VIRTUSHERITAGE



Glen Innes Solar Farm
Tuttles Lane,
Glen Innes, NSW

DUE DILIGENCE ABORIGINAL ARCHAEOLOGICAL ASSESSMENT

FINAL ♦ December2020

Prepared for KDC on Behalf of Providence Asset Group

Version	Date	Prepared by	Approved by	Comments
1a	14.09.2020	Vanessa Hardy Virtus Heritage Pty Ltd	M. Sutton Virtus Heritage Pty Ltd	
2a	21.11.2020	Julian Travaglia Virtus Heritage Pty Ltd	M. Sutton Virtus Heritage Pty Ltd	
3a and 3b	24.11.2020	Elaine Lin Virtus Heritage Pty Ltd	M. Sutton Virtus Heritage Pty Ltd	Reviewed by Providence Asset Group
4a	4.12.2020	M.Sutton Virtus Heritage Pty Ltd	M. Sutton Virtus Heritage Pty Ltd	

Disclaimer

This Report (including any enclosures and attachments) has been prepared by Virtus Heritage for the exclusive use and benefit of KDC and Providence Asset Group for their use regarding the Glen Innes Solar Farm Project and solely for the purpose for which it is provided. Unless we provide express prior written consent, no part of this report should be reproduced, distributed or communicated to any third party. We do not accept any liability if this report is used for an alternative purpose from which it is intended, nor to any third party in respect of this report.

Information contained in the Report is current as at the date of the Report, and may not reflect any event or circumstances which occur after the date of the Report.

All queries related to the content, or to any use of this report must be addressed to Dr Mary-Jean Sutton.

ABN 86 889 757 693
PO Box 101 Pottsville NSW 2489 ♦ Ph: 02 6676 4354 ♦ Mob: 0439 703 886
Email: mj.sutton@virtusheritage.com.au
Website: www.virtusheritage.com.au

EXECUTIVE SUMMARY 5

1. INTRODUCTION 8

1.1 Project Description 8

1.2 Report Aims and Statutory Requirements 8

1.2.1 National Parks and Wildlife Act 1974 8

1.2.2 Heritage Act, 1977 9

1.2.3 Environmental Planning and Assessment Act 1979 10

1.2.4 Native Title legislation 10

1.2.5 Other Acts 10

1.3 Consultation 10

1.4 Limitations 11

1.5 Project Team and Qualifications 11

1.6 Acknowledgements 11

2. ENVIRONMENTAL CONTEXT 14

2.1 Previous Land Use History 14

2.2 Topography, Hydrology and Climate 14

2.3 Geology and Soils 15

2.4 Flora and Fauna 16

2.5 Summary 17

3. ARCHAEOLOGICAL CONTEXT AND ETHNOHISTORY 18

3.1 Ethnohistorical Context 18

3.2 Heritage Register and Database Searches 19

3.2.1 National Native Title Tribunal 20

3.2.2 Aboriginal Heritage Information Management System (AHIMS search) 20

3.2.3 Australian Heritage Database 20

3.2.4 NSW State Heritage Register and NSW State Heritage Inventory 20

3.2.5 Glen Innes Severn Local Environmental Plan (2012) *21*

3.3 Previous Archaeological Research 21

3.4 Regional Character 22

3.5 Summary 23

4. PREDICTIVE MODEL AND ARCHAEOLOGICAL POTENTIAL 26

4.1. Summary 28

5. SITE SURVEY AND RESULTS 29

5.1 Survey Results 29

5.2 Summary of Site Inspection 30

6. RECOMMENDATIONS.....31

7. REFERENCES 32

FIGURES

Figure 1. Locality Plan and Project Area 12

Figure 2. Development Plan 13

Figure 3. Project Area and Known Aboriginal Heritage Sites..... 24

Figure 4. Area of Potential Sensitivity Identified During Site Inspection..... 25

TABLES

Table 1. Soil Landscape Group 15

Table 2. AHIMS Sites Recorded in the Region 21

Table 3. Definitions of Archaeological Potential 27

APPENDICES

Appendix A Comments from Aboriginal Parties

Appendix B National Native Title Tribunal Search results

Appendix C AHIMS Search Results

Appendix D Plates

EXECUTIVE SUMMARY

Virtus Heritage was engaged by KDC on behalf of Providence Asset Group to prepare an Aboriginal archaeological due diligence assessment for the Glen Innes Solar Farm Project. The project is located at Lot Lots 32, 33, 34, 35 and 36 of DP1834 and Lot 1 of DP251457 also known as 208 West Furracabad Road, Glen Innes NSW. It is within the Glen Innes Severn Council Local Government Area (LGA). The proposed solar grid-connected PV farm at Glen Innes will include an approximately 5MWac installation with proposed permanent improved access road via Tuttles Lane, a proposed new 2.3 m high chain link perimeter fence with 3 rows of barbed wire, overhead 11kV power lines, trenching for conduits and cabling, hard stand area and a power conversion station (refer to **Figure 2**).

Consultation

The project area lies within the boundaries of the Glen Innes Local Aboriginal Land Council (LALC). Glen Innes LALC were contacted by email and over the phone over several occasions by Elaine Lin, Senior Archaeologist (Virtus Heritage) to provide a sites officer to assist with identifying Aboriginal sites and objects, and to provide cultural information about the project area. Trevor from Glen Innes LALC informed Elaine that no sites officers were available for the week which the original site inspection was planned, nor the fortnight after. Permission was given by Trevor to inspect the proposed development area with no sites officers in attendance (refer to **Section 5**). A copy of the draft report was provided to the LALC for review and comment on 7 December 2020 (refer to **Appendix A**).

Environmental Context

The project area is connected to a portion of a permanent creekline (Furracabad Creek), which at the location appears to be a fourth order creek (after Strahler 1952), in a temperate to cool climate zone of NSW. It is at an elevation of approximately 1060 metres and is part of the New England Tablelands Bioregion. The bioregional landscape is made up of an expansive plateau, within which the project area is situated.

European land use impacts in the region include mining and vegetation clearing for farming activity, however prior to these impacts the project area and surrounding region would have provided Aboriginal people with diverse resources including stone raw material, and floral and faunal resources including aquatic resources from the rivers, creeks and waterholes. Despite harsh winters in the region these resources were utilised year-round by Aboriginal people. While the immediate area around the proposed site has not been disturbed by large scale mining activities, the area has been stripped of vegetation for sheep and cattle grazing and cultivation. Erosion due to the lack of protective native woodland and thus soil retention may have affected the preservation of Aboriginal sites and material evidence of occupation in this otherwise resource abundant landscape.

Archaeological Context

The results of background archaeological research, including heritage searches and a review of previous archaeological assessments in the region, indicate that the most common site types in the region are artefact sites, followed by grinding grooves and scarred trees. Despite heritage register searches indicating that no sites have been recorded in the project area or immediate vicinity there is a rich and varied archaeological record for the region across different landforms. Site types in the broader region include rock art sites, camp sites, open artefact scatters, scarred or carved trees for ceremonial and utilitarian purposes, grinding grooves for sharpening tools, quarry locations at sources of raw material, ceremonial rings in flat, exposed basalt and granite outcrops, burials, hearth sites, and shell middens in proximity to water sources.

Site Inspection Results

The site inspection was undertaken on the 17 November 2020 within lands in the Glen Innes LALC area. The site inspection was undertaken by Julian Travaglia, Senior Archaeologist, Virtus Heritage. Glen Innes LALC advised that no sites officer were available to undertake field survey, and gave permission for a sites inspection to occur without a LALC sites officer present. The proposal area was surveyed by pedestrian targeted survey. All areas of exposure, mature trees and drainage lines were inspected. No Aboriginal sites or objects were located in the project area during the site inspection (refer to **Section 5**). One area of potential sensitivity was identified in the northwestern portion of the project area and was associated with a creek terrace landform, a known sensitive landform defined as sensitive for Aboriginal occupation within Heritage NSW's *Due Diligence Code of Practice for Proponent's* requirements (refer to **Figure 4**). The remainder of the site is considered to be of low risk for Aboriginal objects based on the results of the site inspection and the assessment.

Recommendations

The following recommendations have been made based on relevant archaeological and environmental background research, and the results of the site inspection.

1) No Aboriginal objects were identified during the site inspection. No Aboriginal places are registered within the project area. One small area of potential sensitivity (sensitive landform; creek terrace) was identified during site inspection but could not be assessed as a Potential Archaeological Deposit due to site constraints (refer to **Figure 4**);

2) It is recommended that project impacts avoid the small area of sensitive landform (creek terrace) in the north west corner of the survey area based on the results of the assessment and known project impacts. PAG have committed to avoidance of this area of sensitivity (refer to **Figure 4**);

3) If project impacts cannot avoid the sensitive landform (creek terrace) in the north west corner of the survey area, further detailed Aboriginal cultural heritage assessment in consultation with registered Aboriginal parties and subsurface testing under *The Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010) would be required as there is potential for Aboriginal objects, below the plough/cultivation zone, triggering further impact assessment. These investigations are regulated to be specific kinds of archaeological test excavation to a methodology specified in the CoP (DECCW 2010, 24-28). If Aboriginal objects are then identified, an Aboriginal Heritage Impact Permit application with a revised Aboriginal Cultural Heritage Assessment will need to be undertaken in consultation with all registered Aboriginal parties and submitted to Heritage NSW for endorsement, prior to works proceeding;

4) All site workers and personnel involved in site impact works associated with the proposal site should be inducted and briefed on the possible identification of Aboriginal sites and objects during construction and their responsibilities according to the provisions of the *NPW Act, 1974,* in case any unknown objects or items are uncovered during excavation.

a. As part of this induction, the contact telephone numbers of the DPC Heritage NSW regional archaeologist and EnviroLine 131 555, the relevant DPIE Environmental Officer responsible for this project should also be given to all site workers and personnel, in case unknown objects or items are uncovered during excavation.

b. Site workers should be made aware of Aboriginal objects and site types and their scientific and cultural significance and their legal obligations in relation to the protection and management of these Aboriginal sites under the NPW Act, 1974 and 2010 ancillary provisions and amendments.

c. As part of this induction, workers should be made aware that in the event that any suspected

human remains are uncovered on site, the area of these suspected remains should be secured and cordoned off and the NSW Police notified. No further works can be undertaken until the NSW Police provide written advice. If these remains are deemed to require archaeological investigation by the NSW Police or NSW Coroner, then OEH, the relevant Aboriginal parties must be notified. A plan of management for the preservation of any identified Aboriginal human remains or for their salvage must be put in place or conducted under a revised AHIP methodology and variation developed in consultation with all relevant Aboriginal parties and the DPIE.

1. INTRODUCTION

Virtus Heritage was engaged by KDC on behalf of Providence Asset Group to prepare an Aboriginal archaeological due diligence assessment for the Glen Innes Solar Farm Project. The project is located at Lot Lots 32, 33, 34, 35 and 36 of DP1834 and Lot 1 of DP251457 adjacent to Tuttles Lane with registered address 208 West Furracabad Road, Glen Innes NSW. It is within the Glen Innes Severn Council Local Government Area (LGA) (refer to **Figure 1**).

1.1 Description

The proposed solar grid-connected PV farm at Glen Innes will include an approximately 5MWac installation with proposed permanent improved access road via Tuttles Lane, a proposed new 2.3 m high chain link perimeter fence with 3 rows of barbed wire, overhead 11kV power lines, trenching for conduits and cabling, hard stand area and a power conversion station (refer to **Figure 2**).

1.2 Report Aims and Statutory Requirements

This report was compiled with reference to the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (DECCW 2010a) and where applicable, the requirements of the *Code of Practice for Archaeological Investigation of Aboriginal Objects, NSW* (hereafter referred to as the 'Code of Practice') (DECCW 2010b). The purpose of this report is to provide advice on Aboriginal archaeological (scientific) values of the project area in relation to the proposed works to guide the client in its decision making process.

In general, the aims of a due diligence assessment are to:

- identify whether or not Aboriginal objects are, or are likely to be, present in the area;
- if objects are present or likely to be present, determine whether the proposed development activities are likely to harm Aboriginal objects; and
- determine whether further assessment or an Aboriginal Heritage Impact Permit (AHIP) is required.

The *National Parks and Wildlife Act 1974* (NPW Act), the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the *Heritage Act, 1977* are the relevant statutory controls protecting Aboriginal heritage within New South Wales.

1.2.1 National Parks and Wildlife Act 1974

Under the provisions of the NPW Act, all Aboriginal objects are protected regardless of their significance or land tenure. Aboriginal objects are defined as '*any deposit, object or material evidence (not being a handicraft made for sale) relating to Aboriginal habitation of the area that comprises NSW, being habitation before or concurrent with the occupation of that area by persons of non-Aboriginal extraction and includes Aboriginal remains'*.

Aboriginal objects are therefore limited to physical evidence and may also be referred to as 'Aboriginal sites', 'relics' or 'cultural material'. Aboriginal objects can include pre-contact features such as scarred trees, middens and artefact scatters, as well as physical evidence of post-contact use of the area such as Aboriginal built fencing or stockyards and missions.

The NPW Act also protects Aboriginal Places, which are defined as *'a place that is or was of special significance to Aboriginal culture. It may or may not contain Aboriginal objects'*. Aboriginal Places can only be declared by the Minister administering the NPW Act. The NPW Act protects Aboriginal objects and

Aboriginal places in NSW. Under the *National Parks and Wildlife Act 1974* (NPW Act), including the 2010 amendments, it is an offence to harm an Aboriginal object:

- Which the person knows is an Aboriginal object (a 'knowing offence')
- Whether or not a person knows it is an Aboriginal object (a 'strict liability offence').

At 1 October 2010, the maximum penalty for a knowing offence is $550,000 for an individual or $1.1 million for a corporation and a 2-year gaol term. The maximum penalty for a strict liability offence is $110,000 for an individual or $220,000 for a corporation (DECCW 2010b:5). A person or organisation who exercises due diligence in determining that their actions would not harm Aboriginal objects has a defence against prosecution for the strict liability offence if they later unknowingly harm an object without an AHIP (DECCW 2010b, 2010:5). The due diligence defence is not available for activities which harm Aboriginal places. The Code of Practice sets out a procedure which, when followed, will satisfy the due diligence requirement. If a person or company can demonstrate that they exercised due diligence and determined that it was unlikely that Aboriginal objects would be harmed, then they have a defence to prosecution under the strict liability offence under Section 86(2) of the NPW Act (DECCW 2010b 2010:5).

Harm includes activities that destroy, deface or damage an Aboriginal object or Aboriginal Place, and in relation to an object; move the object from the land on which it has been situated. Under Section 91 of the Act, the Department of Premier and Cabinet (DPC) Heritage NSW must be informed upon the identification of all Aboriginal Objects. Failure to do this within reasonable time is an offence under the Act. Under Section 90 of the Act, it is an offence for a person to destroy, deface, damage or desecrate an Aboriginal Object or Aboriginal Place without the prior issue of Section 90 consent. Section 90 consents may only be obtained from DPC Heritage NSW. Part 6 of the NPW Act provides specific protection for Aboriginal objects and places by making it an offence to harm them. If harm to Aboriginal objects and places is anticipated an Aboriginal Heritage Impact Permit (AHIP) is required.

The Act also provides for stop-work orders under Section 91A if an action is likely to significantly affect an Aboriginal object or Aboriginal Place. The order may require that an action is to cease or that no action is carried out in the vicinity of the Aboriginal object or Aboriginal Place for a period of up to 40 days.

1.2.2 Heritage Act, 1977

The *Heritage Act, 1977* (as amended in 2009) protects and aims to conserve the environmental heritage of New South Wales. *Environmental heritage* is broadly defined under Section 4 of the *Heritage Act* as consisting of "those places, buildings, works, relics, moveable objects, and precincts, of State or local heritage significance" (Heritage Branch, DoP 2009:4). Aboriginal places or objects that are recognized as having high cultural value (potentially of local and State significance) can be listed on the State Heritage Register and protected under the provisions of the *Heritage Act*.

Amendments to the *Heritage Act* made in 2009 have changed the definition of an archaeological *'relic'* under the Act, so that it is no longer based on age. A relic is now an archaeological deposit, resource or feature that has *heritage significance* at a local or State level. This significance based approach to identifying 'relics' is consistent with the way other heritage items such as buildings, works, precincts or landscapes are identified and managed in NSW (Heritage Branch, DoP 2009:1). Section 4(1) of the *Heritage Act* (as amended 2009) defines 'relic' as follows:

> ***Relic*** *means any deposit, artefact, object or material evidence that:*
> *(a) relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and*
> *(b) is of State or local heritage significance* (Heritage Branch, DoP, 2009:6).

Other relevant State and Commonwealth legislation are discussed below.

1.2.3 Environmental Planning and Assessment Act 1979

The EP&A Act requires that consideration be given to environmental impacts as part of the land use planning process. In NSW, environmental impacts include cultural heritage impacts. Part 3 of the Act relates to planning instruments including those at local and regional levels, Part 4 of the Act controls development assessment processes and Part 5 of the Act refers to approvals by determining authorities.

1.2.4 Native Title legislation

The Native Title Act 1993 (NTA) provides the legislative framework to:

- recognise and protect native title
- establish ways in which future dealings affecting native title may proceed and to set standards for those dealings, including providing certain procedural rights for registered native title claimants and native title holders in relation to acts which affect native title
- establish a mechanism for determining claims to native title
- provide for, or permit, the validation of past acts invalidated because of the existence of native title.

The *NSW Native Title Act 1994* was introduced to make sure the laws of NSW are consistent with the Commonwealth's NTA on future dealings. It validates past and intermediate acts that may have been invalidated because of the existence of native title.

The National Native Title Tribunal has a number of functions under the NTA, including maintaining the Register of Native Title Claims, the National Native Title Register and the Register of Indigenous Land Use Agreements and mediating native title claims.

1.2.5 Other Acts

The Australian Government *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* may be relevant if any item of Aboriginal heritage significance to an Aboriginal community or historical heritage is under threat of injury or desecration and state-based processes are unable to protect it. The *Environment Protection and Biodiversity Conservation Act 1999* is relevant to projects where there are heritage values of national significance present.

1.3 Consultation

Aboriginal people are the primary determinants of their culture and heritage, and cultural values can only be assessed and advised by the relevant Aboriginal parties for the locality. It should be noted that Aboriginal heritage refers both to Aboriginal archaeological sites and sites/places of cultural value to Aboriginal people, protected under the *National Parks and Wildlife Act, 1974* (NPW Act, 1974) as "Aboriginal Objects" and "Aboriginal Places". Sites and places of Aboriginal cultural significance can only be identified by the relevant local Aboriginal people and are likely in many cases (for example, song lines and story places) to not contain any archaeological evidence.

This assessment was conducted by an archaeologist providing advice on the archaeological (scientific) values of the project area. The cultural values of the project area are represented by the Glen Innes Local Aboriginal Land Council (LALC), who could not provide a sites officer to assist on the day of site inspection. Permission was gained from Trevor from Glen Innes LALC to continue with the inspection without a sites officer present. A copy of the draft report was provided to the LALC for review and comment on 7 December 2020 (refer to **Appendix A**).

1.4 Limitations

This report is limited to the assessment of project impacts described in information provided by KDC on behalf of Providence Asset Group and mapped in this report. Virtus Heritage takes no responsibility for errors within Department of Premier and Cabinet, Heritage NSW Aboriginal Heritage Information Management Systems (AHIMS) data, and the heritage register listings and has assumed information provided by Department of Premier and Cabinet is accurate.

The site inspections undertaken were confined to areas of proposed works illustrated in **Figure 1** and **Figure 2**.

1.5 Project Team and Qualifications

This report was compiled by Vanessa Hardy (B.A. Hons. Prehistoric & Historical Archaeology, University of Sydney) with assistance from Julian Travaglia (B.A. Hons. Archaeology, University of Queensland) and Elaine Lin (M.Arch.Sci. Adv. Hons., Australian National University; B.A. Hons. Archaeology, University of Sydney). Quality review was undertaken by Dr Mary-Jean Sutton (Principal Archaeologist, PhD, Archaeology, University of Queensland; B.Arts Hon.s Prehistoric and Historical Archaeology, University of Sydney, MEIANZ). Project information and description of works was provided by KDC and Providence Asset Group.

1.6 Acknowledgements

We would like to acknowledge the assistance of the following individuals for the completion of this report:

- Courtney Sargent (Town Planner), KDC
- Rachel Pettitt (Town Planner), KDC
- Jeremy Every (Solar Program Director), Providence Asset Group

Figure 1
Locality Plan and Project Area

Legend

- Revised Lease Area
- Roads
- Water Courses
- Major Towns & Cities



Source: NSW Spatial Services, KDC
Projection: GDA94

Maps and figures contained within this document may be based on third party data, may not be to scale and are intended for use as a guide only. Virtus Heritage does not warrant the accuracy of such maps or figures.

LEGEND

- TREE
- LOT BOUNDARY
- 400 — MAJOR CONTOUR
- MINOR CONTOUR
- SECURITY FENCE
- FENCE (EXISTING)
- LEASE BOUNDARY (PROPOSED)
- PV TABLE
- O/H 11kV POWERLINE
- O/H 66/132kV POWERLINE
- WATERCOURSE

SYSTEM SUMMARY

ELECTRICAL CONFIGURATION:
- TOTAL PV PLANT CAPACITY (DC): 6.168 MWp
- TOTAL INVERTER CAPACITY (AC): 4.95MVA
- PV PLANT MAXIMUM EXPORT CAPACITY (AC): 4.95MW
- DC:AC RATIO: 1.246
- STRINGS OF 28 PV MODULES.
- 204 PV STRINGS PER INVERTER.
- 408 PV STRINGS TOTAL.

PV MODULES:
- MFR: LONGI SOLAR
- MODEL: LR5-72HPH-540M
- NAMEPLATE: 540Wp
- QUANTITY: 11,424 MODULES

INVERTERS:
- MFR: SUNGROW
- MODEL: SG2475HV-MV
- NAMEPLATE: 2475kVA
- QUANTITY: 2

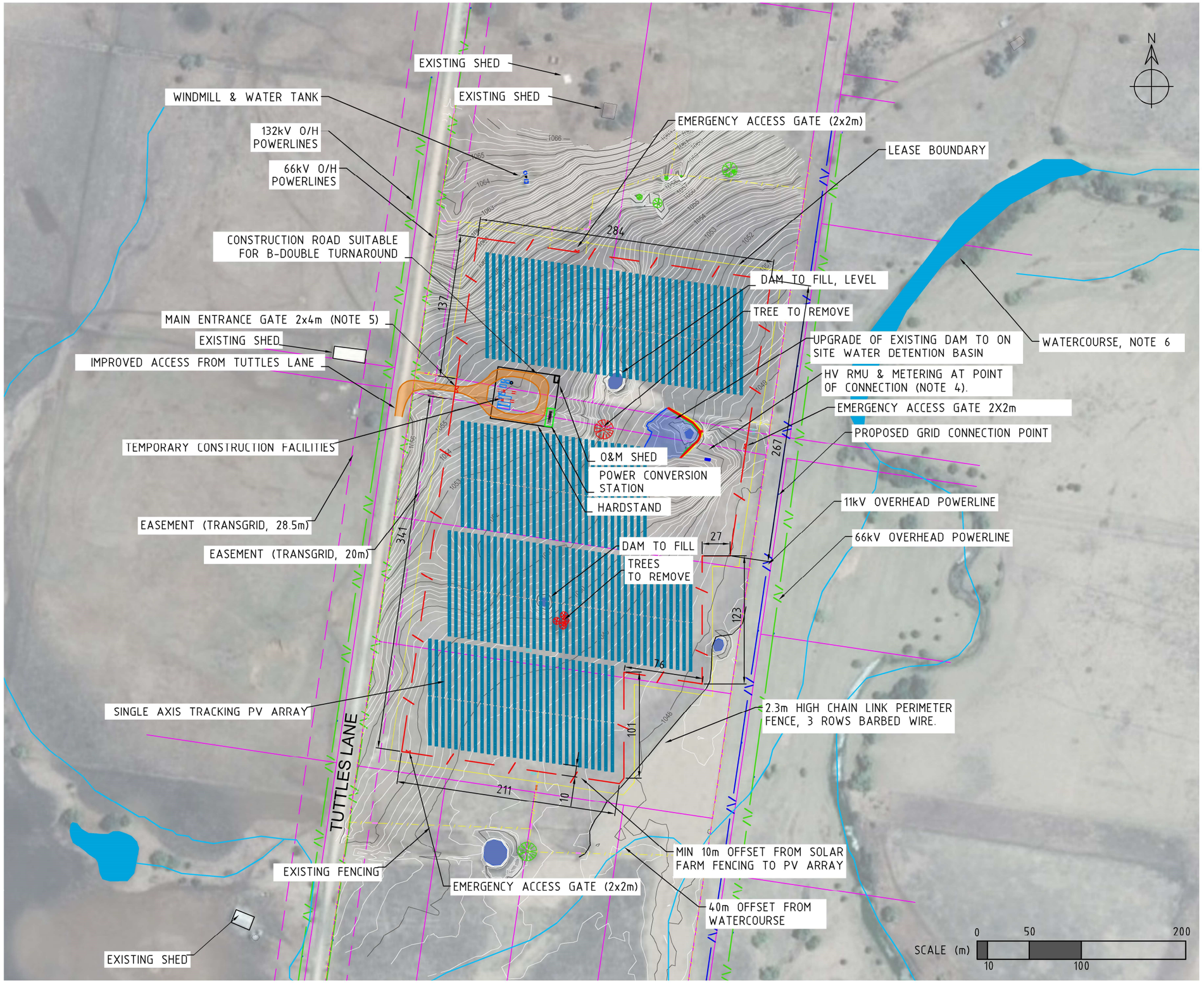
MV POWER STATION:
- MFR: SUNGROW
- MODEL: SG4950HV-MV
- QUANTITY: 1

TRACKER ARRAY:
- TYPE: GROUND MOUNT SINGLE AXIS TRACKING
- CONFIGURATION: INDEPENDENT TYPE
- RANGE OF MOTION: ±60°
- PITCH: 6.25m
- GCR: 36.096%
- QUANTITY: 136 TABLES

FENCED AREA: 133,164 m²
LEASE AREA: 148,238 m²

GENERAL NOTES:

1. SITE ACCESS VIA TUTTLES LANE.
2. DETAIL SHOWN IS PRELIMINARY, MAY CHANGE IN DETAILED DESIGN.
3. CLEARANCE BETWEEN SOLAR TRACKER ARRAY & SITE SECURITY FENCE TYPICALLY 10m
4. HV RMU & METERING (LOCATION AND TYPE TO BE DETERMINED, IS SUBJECT TO ESSENTIAL ENERGY FEEDBACK).
5. FOR SECURITY GATE DETAILS REFER TO DRAWING 10030-C-DET-02-1.
6. WATERCOURSE, WATERBODY DETAIL FROM SIXMAPS, MGA ZONE 56 PROJECTION
7. REFER TO BASIN PLAN DRAWING ×××TBC×××.



PROVIDENCE ASSET GROUP — Balance POWER AND ENERGY

REFERENCES

REV.	DATE	DESCRIPTION	DRWN.	DESIGNED	CHKD.	APPR.
C	2020 12 04	MINOR REVISIONS	JM	JM		
B	2020 11 23	RE-ISSUED WITH CHANGES	JM	JM		
A	2020 11 18	FIRST ISSUE	JM	JM		

THIS DRAWING IS THE PROPERTY OF BALANCE POWER AND ENERGY (BPE) AND IS NOT TO BE COPIED (IN WHOLE OR IN PART) FOR ANY PURPOSE OR DISCLOSED TO OTHER PARTIES WITHOUT THE APPROVAL OF BALANCE POWER AND ENERGY OR AN AUTHORIZED AGENT

TITLE
PROVIDENCE ASSET GROUP
GLEN INNES SOLAR FARM
GENERAL ARRANGEMENT
SYSTEM DETAIL

DWG No. 10030-G-GAD-02-2

SCALE 1:3750
REVISION C
PAPER SIZE A3

4/12/2020 2:48:28 PM

2. ENVIRONMENTAL CONTEXT

This section of the report describes the environmental context of the project area spanning post-contact land-use history, topography and landforms, soils and geology, and fauna and flora. These factors are integral influences of Aboriginal land use, the resultant patterning of archaeological sites, and the survival of sites in the modern landscape.

2.1 Previous Land Use History

The first European exploration of the New England Tablelands was by John Oxley in 1818, who was accompanied by his botanist Alan Cunningham (Oxley 1820). The first pastoral run was set up in 1830 by Henry Dumareq, paving the way for large squatting runs and the mass migration of pastoralists to the locality. The greater New England region continued on this trajectory to widespread intensive agricultural land use, including heavy vegetation clearance for cattle grazing and plant cultivation through to the late 20th century (Benson and Ashby 2000: 755).

Gold was found by Rocky River just southwest of Armidale in 1851, prompting a large migration of workers into the New England region. The town of Glen Innes was first surveyed in 1852 and grew steadily. The Railway came to the town in 1884 (Glen Innes & District Historical Society website).

The mining boom continued throughout the late 1800s, and included mining for other materials subsequently discovered, such as silver, tin, antimony and copper. Mining was largely responsible for the booming populations of towns such as Guyra, Tenterfield, Walcha as well as Glen Innes. By the 20th century, a variety of minerals as well as metals such as bismuth, sapphire, molybdenite, manganese, and coal had been discovered in the region, and were being mined (NSW NPWS 2003: 159 – 160).

The trend for mining and quarrying in the region continues to this day alongside the major agricultural industry of the New England Tablelands. The project area and its immediate surrounds has not been directly affected by mining, however it has been extensively cleared. The land has been used for agriculture and grazing, with intensive oat cultivation and the building of a dam within the project area. Increased erosion is usually associated with these activities. This has resulted in the removal of some topsoils and disturbance and has likely historically contributed to the displacement of any Aboriginal open artefact sites that may have been present.

2.2 Topography, Hydrology and Climate

The proposed project area is situated on the outskirts of Glen Innes approximately three kilometres west of the Glen Innes main street. Glen Innes lies at an elevation of approximately 1060 metres and is part of the New England Tablelands Bioregion, which encompasses towns including: Glen Innes, Armidale, Ebor and Walcha. This region lies between the North Coast and Nandewar Bioregions, and includes parts of the McIntyre, Clarence, Gwydir, Macleay, Namoi and Manning River catchments (NSW NPWS 2003: 157). The landscape is largely made up of a plateau bounded on the east by very rugged country, falling into the very steep valleys of the McIntyre, Gwydir and Namoi Rivers to the west (Bickford *et al.* 1998: 16).

The project area includes a portion of Furracabad Creek, which at this location appears to be at least a fourth order creek (after Strahler 1952). There is a relatively broad (at least one kilometre) flood plain associated with the creek at this location. A portion of creek terrace is contained within the northwestern portion of the project area.

Although not in the immediate vicinity of any of the major rivers in the New England Tableland Bioregion,

the project area contains reliable water. The confluence of Furracabad Creek with Beardy Waters is approximately 2 km to the north and the Severn River approximately 18 km to the north. The Mann River is approximately 12 – 13 km to the east of the project area. In addition, a number of shallow montane lakes/lagoons are within the vicinity. It can be assumed that water was generally accessible in the locality.

The project area lies in the temperate to cool climate zone of NSW, which is characterised by warm summers with uniform rainfall (NSW NPWS 2003: 157). The mean annual temperature in the New England Tableland Bioregion is 9 – 17°C, while the mean annual rainfall is 653 – 1765 mm (NSW DPIE website accessed 9 March 2020). Patches of montane climate occur at higher elevations, and these are characterised by mild summers with no dry season (NSW NPWS 2003: 157).

2.3 Geology and Soils

The project area is situated in the New England Tableland Bioregion, which is characterised by a stepped plateau of hills and plains on Permian sedimentary rocks, intrusive granites and extensive Tertiary basalts. The New England fold belt is composed of sedimentary rocks of Carboniferous and Permian age that were extensively faulted during a period of rapid continental plate movement associated with granite intrusions in the late Carboniferous. A lot of the area is now overlain by Tertiary basalt of to 100 metres (NSW DPIE website, accessed 25 October 2020). Geological mapping for the area (Brunker & Chesnut 1976; Colquhuon *et al.* 2019) suggests that the project area is predominantly within an area of volcanic geology.

The soil types across the region change with changes in topography and bedrock. Common soil types include granite derived siliceous sands, red earths and erosion prone texture contrast soils. In valleys and swampy landscapes soils are increasingly humic and support a variety of woodland and open forest vegetation. In the basalt areas soils vary from shallow stony loams in steep areas, deep loams on flatter slopes and occasional waterlogged soils in valley floors (NSW National Parks and Wildlife Service 2003).

Broad scale state-wide landscape mapping has been undertaken by Mitchell (2002). Mitchell has mapped the study area as being partly within the 'Inverell Plateau Granites' and partly within the 'Glen Innes - Guyra Basalts'. Inverell Plateau Granites are described as having general elevation of between 900 and 1500 metres (with most of the plateau 900 to 1200 metres) with local relief of up to 200 metres. The highest elevations are along the eastern edge above the escarpment. Domed rock outcrop is common with tors. Mitchell notes that soils in general tend to be shallow gritty loam, which thickens downs slope to red or yellow earthy sand and red, red-yellow and yellow texture-contrast soil on lower slopes and valley floors. Elsewhere, wider valleys can contain deep dark clay deposits in 'swampy streamlines' (Mitchell 2002).

Glen Innes – Guyra Basalts are generally undulating to stepped hilly plateau on Tertiary basalt. Ridges are broad with high rounded peaks and valleys shallow and wide. Elevation ranges from 700 to 1,510 metres, with local relief of 300 metres and the average level of the landscape at 1,300 metres. Soils are structured with 'deep dark self-mulching sticky clay on the valley floors' (Mitchell 2002).

The following **Table 1** summarises the primary characteristics of the soils of the project area as described by Mitchell (2002).

Table 1. Soil Landscape Group

MITCHELL LANDSCAPE	TOPOGRAPHY AND GEOLOGY	SOIL TYPES
Ing Inverell Plateau Granites	Widely distributed and defined undulating plateau with domed peaks on	Shallow gritty loam thickens downs lope to red

	Permian New England granites and granodiorites. Several intrusions have distinctive contact ridges of metamorphosed sedimentary rocks. The area includes Permian acid volcanics and pyroclastics and some undifferentiated Permo-Carboniferous mudstone and lithic sandstone. General elevation 900 to 1,500 m, local relief 200 m. The highest elevations are along the eastern edge above the Great escarpment, most of the plateau lies ate 900 to 1,200 m. As mapped this is a large landscape and it might require subdivision on the basis of vegetation. Domed rock outcrop is common with tors.	or yellow earthy sand and red, red-yellow and yellow texture-contrast soil on lower slopes and valley floors. Wide valleys may have deep dark clay deposits in swampy streamlines.
Gsb Glen Innes - Guyra Basalts	Undulating to stepped hilly plateau with broad ridges, wide shallow valleys and high rounded peaks on Tertiary basalt, general elevation 700 to 1510m, local relief 300m, average level of the landscape 1300 m.	Brown structured stony loam and clay loam, on slopes, occasional red structured loam with gradational profiles and deep dark self-mulching sticky clay on the valley floors.

2.4 Flora and Fauna

Prior to European settlement and subsequent intensive agricultural land use, the area would have provided plentiful floral and faunal resources for local Aboriginal people. While this region would have had high levels of biodiversity in the past, the current landscape has since been heavily cleared and extensively cultivated. The flat areas and rolling hills would have been easy to traverse and the waterways and vegetated slopes abundant in resources. It is, however, unlikely that sites relating to resource collection and processing would have remained undisturbed in the heavily cultivated areas.

The vegetation varies with topography, soil, drainage and temperature. The following lists of flora generally available in the region are taken directly from Mitchell (2002) and describe species associated with the landscape types identified within the study area.

In the area of Inverell Plateau Granites vegetation varies. Mitchell describes it as follows:

> In dry areas of open forest: silvertop stringybark (Eucalyptus laevopinea), broad-leaved stringybark (Eucalyptus caliginosa), Blakely's red gum (Eucalyptus blakelyii), narrow-leaved peppermint (Eucalyptus radiata), yellow box (Eucalyptus melliodora), apple box (Eucalyptus bridgesiana), red ironbark (Eucalyptus sideroxylon), Caley's ironbark (Eucalyptus caleyi), rough-barked apple (Angophora floribunda) and black cypress pine (Callitris endlicheri). In moist areas open forest of; New England peppermint (Eucalyptus cinerea), manna gum (Eucalyptus viminalis), mountain gum (Eucalyptus dalrympleana), New England blackbutt (Eucalyptus andrewsii ssp. campanulata), diehard stringybark

(Eucalyptus cameronii), Deane's gum (Eucalyptus deanei), messmate (Eucalyptus obliqua), privet-leaved stringybark (Eucalyptus ligustrina), Youman's stringybark (Eucalyptus youmanii), swamp gum (Eucalyptus camphora), Gibraltar rock blackbutt (Eucalyptus pyrocarpa), tumbledown red gum (Eucalyptus dealbata) and orange gum (Eucalyptus prava) sometimes with closed forest species in the understorey especially in the eastern parts of the landscape. In cold areas: snow gum (Eucalyptus pauciflora), black sallee (Eucalyptus stellulata) woodlands are the norm with manna gum and mountain gum along some streams.

Most granite peaks have specialised joint crevice heath communities typically with about 100 plant genera and almost always containing local endemic species. In this landscape the following communities are recognised: Gonocarpus teucriodes - Isotoma axillaris herbfield with black cypress pine, orange gum, tumbledown red gum, Caley's ironbark, and western New England blackbutt. Babingtonia densifolia - Homoranthus prolixus shrubland with black cypress pine, orange gum, tumbledown red gum, and Acacia neriifolia. New England tea tree - Brachyloma saxicola heath on the escarpment of the Gibraltar Range with New England mallee ash (Eucalyptus approximans), diehard stringybark, apple box, forest oak (Allocasuarina torulosa), black cypress pine and orange gum.

For the Glen Innes [sic]- Guyra Basalts the following is provided:

Open woodland with snow gum (Eucalyptus pauciflora), black sallee (*Eucalyptus stellulata*), manna gum (Eucalyptus viminalis), silvertop stringybark (*Eucalyptus laevopinea*), and New England peppermint (Eucalyptus cinerea) in higher areas grading to woodland of white box (Eucalyptus albens), yellow box (*Eucalyptus melliodora*), roughbarked apple (*Angophora floribunda*) with manna gum (*Eucalyptus viminalis*) along streams in lower areas. Extensive grassy understorey.

As well as plants, various species of animals would have been used by Aboriginal people in the past for food and other uses. Species that would have been likely resources include Eastern grey kangaroo (*Macropus giganteus*), brush-tailed rock wallaby (*Petrogale penicillata*), eastern pigmy possum (*Cercartetus nanus*), spotted-tail quoll (*Dasyurus maculatus*), yellow-bellied glider (*Petaurus australis*), squirrel glider (*Petaurus norfolcensis*), Brush-tailed phascogale (*Phascogale tapoatafa*), Koala (*Phascolarctos cinereus*), Emu (*Dromaius novaehollandiae*) as well as many other birds, fish, reptiles and amphibians. (Atkinson 2013).

2.5 Summary

The project area is situated immediately west of the town of Glen Innes. European land use impacts in the region including mining and vegetation clearance for farming activity, have reduced the likelihood of preservation of Aboriginal sites. However, prior to these impacts the project area and surrounding region would have provided Aboriginal people with diverse resources including stone raw material, a wide variety of floral species and abundant aquatic and terrestrial faunal resources. Despite harsh winters in the region these resources were utilised year-round by Aboriginal people.

The project area itself has been stripped of native vegetation and heavily ploughed in parts, with intensive cultivation of oats in the two northern paddocks. Erosion due to the lack of protective native vegetation will have affected the preservation of Aboriginal sites and material evidence of occupation in this otherwise resource abundant landscape. Despite this there is potential for intact soil profiles and archaeological deposits to occur associated with the local geologies.

3. ARCHAEOLOGICAL CONTEXT AND ETHNOHISTORY

This section presents the ethnohistorical and archaeological context for the evaluation of the project area, specifically known archaeological sites identified by previous archaeological investigations, and the understanding of Aboriginal heritage developed by previous archaeological and heritage studies.

3.1 Ethnohistorical Context

This section provides a description of the Aboriginal heritage context as relevant to the proposal. The Aboriginal heritage context includes a summary of Aboriginal history within the locality and material evidence of Aboriginal land use. This ethno-historical context is drawn from review of accessible sources including:

- Sources identified on the National Library of Australia's *Trove* database,
- Previous archaeological studies
- Regional studies such as *Looking After Country in New South Wales* (Hunt 2010)
- The NSW Department of Planning, Industry and Environment website, accessed October 2020

This section is not meant to be a definitive history of Aboriginal people in the locality of Glen Innes, rather it is provided to give some insight into the historical circumstances that have influenced Aboriginal people connected to the region over time. It also aims to provide an overview of Aboriginal land use and its implications for understanding the survival of Aboriginal sites and potential occupation deposits within the project area.

Language groups and clan boundaries are frequently contested or subject to different versions of recording depending on the sources of information. Our knowledge of the pre-contact social organisation and behavioural patterns of Aboriginal people often comes from early non-Aboriginal historical records. The information is, therefore, subject to the historical and cultural biases of the recorders. It is also important to remember that at the time many of the observations were made, the lifestyles of Aboriginal communities may have already been significantly altered by the presence of non-Aboriginal settlement.

According to Anthropologist Norman Tindale (1974) the project area is within the lands of the Ngarabal people (also Ngarrabul and Ngoorabul). Tindale details that they inhabited a line from west of near Tenterfield to Glen Innes on the 'Beardy River'. He also notes that the neighbouring Jukambal people were east of Glen Innes and were best considered separate. It has been suggested that the Ngarrabul people were located from Glencoe, north to Bolivia then slightly east to the Bundjalung border and west to take in the Beardy plains and the top of the Seven River area. The area around Kingsplains, Wellingrove and Strathbogie stations are also thought to have been part of the lands of Ngarrabul (NSW NPWS 2003).

Other groups in the New England Tablelands included the Anaiwan (in the area around Armidale), the Kwaimbul in the north, and the Banbai in the areas around Ben Lomond and Mt Mitchell at the centre of the region. The plateau was a meeting place for tribal groups from the western slopes and the eastern coastal regions for the exchange of tools, ochres, fibres, shells and other trade goods. The natural resources provided for good nutrition, including grains for grinding into flour and the baking of bread. There would have been a complex society and varied social interactions where information and goods were regularly exchanged. The technology for the boomerang has been attributed to the Banbai people, who were also accomplished doctors and meteorologists (Hunt 2010: 5; McBryde 1974).

A large variety of sites containing physical evidence of past Aboriginal land use remain within the local region. Site types include bora grounds/ceremonial grounds, grinding grooves, burials, cultural places, story places, campsites, artefact scatters, isolated finds, scarred and carved trees.

Aboriginal people in the Tablelands used the landscape as both a natural and cultural resource, with a strong tradition of seasonal movement through the rugged gorge systems around the plateau. The Tablelands were occupied during summer and autumn, with communities moving either to the coast or towards the western river systems and major catchments in the winter (NSW DPIE website, accessed October 2020). It has been suggested that burning of the bush played a large role in management of the landscape, including the burning of the understorey of woodlands to flush out game. This may have also stimulated growth of certain species and helped with easing access in more rugged areas (Benson and Ashby 2000: 754).

Estimations of the Aboriginal population in the nearby Armidale area at the time of European settlement in the New England region are between 600 – 1000 people (Bate 2018: 12). Upon European settlement of the region, abandoned bark huts were recorded, once again suggesting the seasonal use of this resource-rich landscape (Bate 2018: 12).

As well as physical remains of past activity, the memories of local people, oral histories handed down, and early accounts of early non-Aboriginal people coming to the region can help to build up a picture of land use and the range of activities carried out in the past. Aboriginal subsistence activities were likely seasonal and varied based on resource availability and social customs.

From 1883 the Aboriginal Protection Board began establishing Aboriginal stations and missions. The expansion of European settlement in the 1880s after the building of the railway further alienated Aboriginal people, who were forced from their lands onto reserves on the outskirts of towns (High Ground Consulting 2020: 10). During the 1940's and 1950's local Kamilaroi families were living in Aboriginal Reserves in areas such as North Tamworth (Boileau 2007: 15). Despite the hardships, displacement, genocide, murder and dispossession that Aboriginal people suffered as a result of European invasion, the Aboriginal community of the Liverpool Plains region is still strong and vibrant today.

Due to European occupation and subsequent conflicts and disease, the local Aboriginal population declined. As European's took over the region's land for their cattle and sheep, people were displaced along with the resources on which they had depended. The violence of the colonial frontier wars escalated in this period, leading to a number of massacres in the New England Region (Hunt 2010: 6).

While many individuals that survived the European incursion would have left for other areas or been forced onto missions and reserves, some Aboriginal people stayed and worked within the developing industries of the region. By the 1830s, records were already in existence of Aboriginal people working in the pastoral industry, including as stockmen on the various stations around New England (NSW DPIE website, accessed October 2020). These stories are often only glimpsed through brief mentions in historical recollections due to the biases of recordings. We do know, however, that Aboriginal people continue to be connected to the country today. The project area is within the boundaries of the Glen Innes Local Aboriginal Land Council (LALC). Today, the Glen Innes LALC manages around 10,500 hectares of land near Emmaville, including The Willows and the adjoining property Boorabee. In this way the LALC maintains a history of management of significant places that has been continued for tens of thousands of years. The LALC also advises on cultural significance and understanding of significant places.

3.2 Heritage Register and Database Searches

The following heritage registers and database searches were undertaken as part of this preliminary

assessment:

- National Native Title Tribunal (NNTT);
- Aboriginal Heritage Information Management System (AHIMS);
- The Australian Heritage Database (AHD);
- State Heritage Register (SHR) and Inventory (SHI); and
- Glen Innes Severn Shire Local Environmental Plan (2011).

3.2.1 National Native Title Tribunal

A search was undertaken of the National Native Title Register maintained by the National Native Title Tribunal (NNTT) on 28 September 2020. The search identified no Native Title claims, previous or existing, within the project area (refer to **Appendix B**).

3.2.2 Aboriginal Heritage Information Management System (AHIMS search)

A search was conducted of the AHIMS register on 28 September 2020 for any Aboriginal heritage sites recorded within and adjacent to the project area. The search covered the area datum: GDA, Zone: 56, Eastings: 370072 - 380072, Northings: 6705809 - 6715809 (approximate 10 km square centred on the project area). One site and no Aboriginal Places were recorded within this area. The known site is not within the project area (refer to **Appendix C)**.

There are two Aboriginal Places within the Glen Innes Severn LGA. They are within the Washpool National Park and Gibraltar Range National Park. "Sugarloaf" and "Waratah Trig" are culturally sensitive sites, though neither are within or adjacent to the project area.

3.2.3 Australian Heritage Database

The results of the search identified no registered Indigenous heritage items within the project area. A total of 38 places are located within the Glen Innes Severn LGA. Of these, 27 are within Glen Innes, including one Indigenous Place. There is no information to indicate that this Indigenous Place is within or adjacent to the project area.

3.2.4 NSW State Heritage Register and NSW State Heritage Inventory

The State Heritage Register is a heritage database administered by NSW Heritage of the Department of Premier and Cabinet. This database includes heritage listings for State significant heritage items. This database was searched on the 28 September 2020 for items within the Glen Innes Severn LGA.

There are eight items listed within the Glen Innes Severn LGA. Four of these are in the locality of Glen Innes, however none are within or adjacent to the project area. None of the items are Indigenous heritage.

The State Heritage Inventory is a heritage database administered by the NSW Heritage Branch of the Office of Environment and Heritage. This database includes heritage listings from local and regional planning instruments and heritage studies and state significant heritage items. This database was searched on the 28 September 2020.

There are 201 items listed within the Glen Innes Severn LGA. Of these, 182 are within Glen Innes. None are within or adjacent to the project area. None of these sites are Indigenous heritage.

3.2.5 Glen Innes Severn Local Environmental Plan (2012)

The Glen Innes Severn Local Environmental Plan (LEP) is a planning instrument administered by Glen Innes Severn Shire Council, which contains provisions and listings of items of environmental heritage including heritage, conservation areas and archaeological sites within Schedule 5. The LEP was searched on 28 September 2020.

There are 212 items, one Heritage Conservation Area and two Archaeological Sites listed within the Glen Innes Severn LGA. Of these, 150 places and one archaeological site are located in Glen Innes. None are within or adjacent to the project area.

The results of all the searches identified no registered Indigenous heritage items within the project area.

3.3 Previous Archaeological Research

The OEH AHIMS search identified one site and no previous reports for the locality (refer to **Table 2**). The listed site is located approximately 1.5 kilometres from project area to the south east.

Table 2. AHIMS Sites Recorded in the Region

AHIMS Site ID	Site Name	Site Type	Features	Number of Sites	Sites Within Project Area
12-4-0001	Glen Innis (sic) Rock Wells	Open Site	Natural rock pools in a granite boulder formation. Artefacts were recorded in association with the pools.	1	0

It is not precisely known when Aborignal people first came to the study area region. A date of 9,000 BP (before present) was obtained from an excavation of a rockshelter at Graman, approximately 85 kilometres to the northwest of Glen Innes. Evidence of a long period of Aboriginal occupation of the Tablelands exists in the form of a rich and varied archaeological record for the region. The many site types help to build a better understanding of Aboriginal customs, culture and traditional land management practices prior to the arrival of Europeans.

Site types in the region include rock art sites, camp sites, open artefact scatters, scarred or carved trees for ceremonial and utilitarian purposes, grinding grooves for sharpening tools, quarry locations at sources of raw material, ceremonial rings in flat, exposed basalt and granite outcrops, burials associated with scarred trees (e.g. AHIMS site 21-4-0006 at Bora Mountain), hearth sites, and shell middens in proximity to water sources (Knuckey 2019: 17 – 18). It has been suggested that occupation of the region may have commenced around the same time as the development of the "small tool tradition" of artefact manufacture in the mid-Holocene (Byrne 1993).

Aboriginal archaeological work carried out in the region by McBryde starting in the 1960s was part of a regional history of New England and the North Coast (McBryde 1974). The New England Tablelands region was one of the first areas in Australia where attempts were made to create a regional sequence of Aboriginal occupation (Davies 1998). The sites McBryde recorded were mainly Bora grounds (circles of raised earth thought to have been used for initiation ceremonies). Byrne also notes McBryde recorded a burial site and a quarry site in the area around Tenterfield (Byrne 1993: 2).

Following this in the 1970s numerous sites were recorded as part of a project undertaken by the National

Parks and Wildlife Service to record sites of significance to Aboriginal people still living in the area. This resulted in numerous Dreaming and other ceremonial sites being recorded. Byrne notes that sites tended to cluster around communities such as Tabulam and Baryugil. This is due to the tendency of the survey team to work with elders from Aboriginal communities living on former missions or reserves who would have knowledge of these site types and areas (Byrne 1993: 2).

Rich's study of the Glen Innes LGA identified several important Aboriginal sites (all registered), including a Dreaming track which lead from a ceremonial ground at Stonehenge to the Ashford-Graman areas where several important camping places were located near the McIntyre and Severn Rivers (Rich 1985: 24). Other sites recorded included an important camping place at the Severn River junction with Reddestone Creek and Beardy Waters which also contained ochre pits (Rich 1985: 24), and the location of an important access route along the Dreaming Track from Camerons Creek to the properties of "Strathbogie" and "Green Hills" (Rich, 1985: 24). Rich identified four areas within the Glen Innes LGA as having high potential for Aboriginal sites, namely: "granite outcrops above Beardy Waters, Wye Park, Confluence of Red Bank Creek/Beardy Waters and the Bradleys Lane/Blue Hills Road" (Rich 1988: 33).

Further study in 2010 of the Glen Innes LGA by AMBS, supported Rich's findings but also provided additional ethno-historical investigations and Aboriginal consultation to provide more detail about the predicted location of Aboriginal heritage sites within the region. It also provided some information about known massacre sites and taboo cultural sites in the Torrington/Torrington SRA to Haystack Mountain. It identified areas surrounding Emmaville and around Beardy River floodplains and terraces as having high archaeological potential (AMBS 2010: 40 – 46). Beardy River and Beardy Plains are also identified as known Aboriginal massacre site locations (AMBS 2010: 45).

Small scale surveys for impact assessments have increasingly been conducted in the region in recent years (see for example Everick Heritage 2016, Dibden 2018 and other reports cited within these). Most of the surveys have recorded no Aboriginal objects.

3.4 Regional Character

Following on from the early work of McBryde, in the 1990s systematic archaeological surveys began to be undertaken in the New England region. Byrne (1993) undertook survey and analysis to develop a predictive model for the region focusing on areas of State Forest surrounding Tenterfield. As he points out the sort of broad scale understanding of the area shown in McBryde's work is not always useful for predicting sites in a smaller study area. McBryde had suggested that higher altitude sites (above 1000 metres) were mostly ceremonial with occupation centred on lower areas, although this model has been disputed (Byrne 1993). Godwin (1983) recorded habitation sites above 1,000 metres and argued that this does not represent a meaningful habitation boundary. Although he does suggest that different habitation patterns may apply to marginal areas, further work would need to be undertaken to define the limits of such margins.

Byrne's predictive analysis initially proposed a three-part environmental model dividing his study area into riverine, plateau/swamp, and ranges zones. He proposed that the riverine zone would have been predominantly a transitory zone as deeply incised valleys and heavy vegetation were not likely to have been a focus of 'settlement' and therefore not contain large habitation sites. The swamps and plateau would have had rich food resources and therefore artefact scatters would be present on well-drained higher ground adjacent to swamps. His model suggested that the ranges would have been a focus for activity with larger sites present along ridge and spur tops as well as along higher order watercourses.

Some on ground elements did appear to be consistent with his model for example artefact sites were most common within the ranges zone. But it appeared that other environmental variables such as geology,

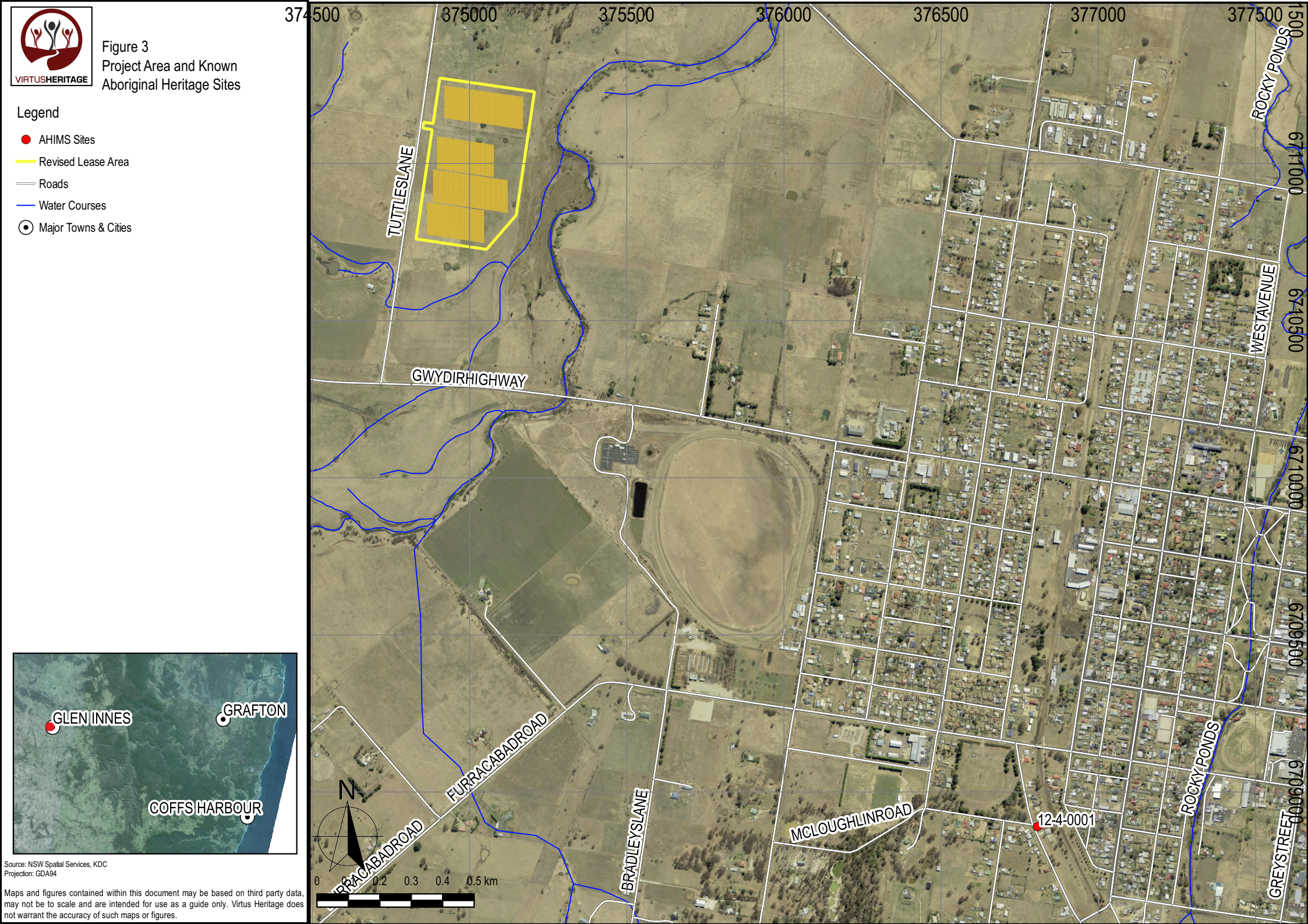
vegetation and climate were of more influence that the initial topographic categories. He suggested a 'sub-zone' of *lower altitude – eastern geology belt – coastal hardwood* as a potential favoured area. Byrne was unable to adequately test riverine zone predictions as his study area did not contain enough of these zones. In addition, the limitations of his sample mean that the conclusions could only be preliminary.

3.5 Summary

The results of the background archaeological research, including heritage searches and a review of previous assessments in the region indicate that the most common site type in the project area vicinity are artefact sites. The archaeological context of the project area indicates that evidence of Aboriginal occupation is most likely to occur in proximity to permanent water sources, dependent on the impacts of previous land use.

Despite heritage register searches indicating that no sites have been recorded in the project area or immediate vicinity there is a rich and varied archaeological record for the broader New England region across a variety of landforms. Site types in the broader region include rock art sites, camp sites, open artefact scatters, scarred or carved trees for ceremonial and utilitarian purposes, grinding grooves for sharpening tools, ceremonial rings in flat, exposed basalt and granite outcrops, burials and hearth sites.

The archaeological context of the project area and the potential for moderate to deep soil profiles indicates that evidence of Aboriginal occupation may occur in the project area, though visibility is dependent on the impacts of previous land use history.



Source: NSW Spatial Services, KDC
Projection: GDA94

Maps and figures contained within this document may be based on third party data, may not be to scale and are intended for use as a guide only. Virtus Heritage does not warrant the accuracy of such maps or figures.

VIRTUSHERITAGE

Figure 4
Project Area and
Area of Potential Sensitivity

Legend

- Area of Potential Sensitivity
- Revised Lease Area
- Proposed Lease Area
- Roads
- Water Courses
- Major Towns & Cities



Source: NSW Spatial Services, KDC
Projection: GDA94

Maps and figures contained within this document may be based on third party data, may not be to scale and are intended for use as a guide only. Virtus Heritage does not warrant the accuracy of such maps or figures.

375000

6711000

TUTTLESLANE

N

0 0.1 0.2 0.3 0.4 0.5 km

4. PREDICTIVE MODEL AND ARCHAEOLOGICAL POTENTIAL

Based on the known archaeological, environmental and landscape context of the locality, a predictive model for evidence of Aboriginal occupation for the project area is presented below:

Aboriginal axe grinding grooves are grooves most often found in sandstone where Aboriginal people have sharpened or manufactured stone axes and other implements and in some cases, ground seed and grains in the sandstone forming 'bowls'. Grinding grooves have also been identified in other rock outcropping such as conglomerate and granite. This site type may occur in the project area if suitable geology is present adjacent to a watercourse.

Scarred trees and **carved trees** contain evidence of scars and carved patterns which can be attributed as having Aboriginal cultural origin. Scarred trees are typically created by the removal of bark from the trunk of the tree (usually with a stone axe) to make shields, canoes, implements and other types of items which leave a wound on the tree trunk. Carved trees contain carved patterns on the tree trunk and are often found in association with ceremonial grounds, burials or cultural sites. Carved trees are a rare site type, with one known example in the region. Scarred trees may be found where areas of mature trees are still present within the project area. the potential for scarred trees to occur in the project area has been greatly reduced by extensive vegetation clearing.

Isolated artefacts and **open campsites (artefact scatters)** are the locations of discarded stone artefacts, often material that has been discarded as part of making stone tools or over frequent episodes of occupation/visitation in an area. This site type can be found on any landform, but the objects are most likely to be found in proximity to major water courses, on low gradient landforms adjacent to water courses, on crests, ridgelines and spurs where the landscape has not been heavily modified.

The elevated landforms associated with Furracabad Creek have potential to contain artefact scatters. Large artefact scatters may also be buried in floodplains and alluvial terraces by alluvial fill since Aboriginal occupation. These sites are not visible during survey and only detectable through excavation.

Higher order streams more commonly contain higher artefact densities, as will areas of proximity to diverse environments, larger waterways, sources of raw materials or known cultural sites such as bora grounds. Sites will also be found preferably on areas with "east, north or west aspects which would receive the most sunlight and be sheltered from southerly winds" (Rich 1988:23).

Middens are the accumulation of debris from fish, crustaceans and shell fish (shells, fish bones) consumed as part of Aboriginal people's diet. Middens also often contain charcoal, stone artefacts, bone and other types of material used by Aboriginal people. Middens often occur within close proximity to freshwater and saltwater sources which have potential to contain mussels, oysters and other types of edible shellfish. Given the extent of clearing and likely subsequent depositional alteration to creek line landforms, this site type is not likely to occur in the project area.

Bora grounds and **ceremonial grounds** have been recorded in the region on flat tablelands. They are often associated with carved or scarred trees or other sites. They will be very rare and difficult to detect in areas previously disturbed or cleared and without detailed Aboriginal consultation. There are known registered and identified bora grounds at Stonehenge, Dirty Creek and Henry River and a corroboree ground at Dundee (Rich 1988: 19, AMBS 2010: 41). It is unlikely additional bora grounds would be identified within the project area.

Burials can be found in many different archaeological contexts, including shelter deposits and often where the ground is soft and sandy. Burials can also be found within middens and carved or scarred trees and ceremonial sites. Burials are difficult to detect unless there are visible eroded evidence of a burial or human remains and therefore, are always a possible site type where these soils exist.

Petroglyphs (also referred to as Rock Engravings) are art sites where marks have been made in stone by Aboriginal people (for example, spirit figures, animals, implements and footprints). **Rock shelter sites with art** consist of rock overhangs used for shelter by Aboriginal people and where smooth surfaces on the walls of the shelter (sandstone surfaces) are painted with ochres and pigments) and **rock shelter sites with occupation deposits** include sediment deposits that potentially retain archaeological material. Rock shelter sites are unlikely to occur in the project area due to a lack of suitable geology, petroglyphs may occur in the project area where suitable outcropping geology occurs.

Potential Archaeological Deposits refers to soil profiles within landforms which are predicted to contain buried evidence of Aboriginal occupation. This buried evidence is most often stone artefact scatters which survive most frequently in the archaeological record. Buried archaeological deposits are nearly always found within the A unit soils (topsoil). Occasionally artefacts are found in the B horizon in cracking clays where artefacts have moved down from the topsoil. Archaeological deposits can also be found within rock shelters as well as level areas near to rivers or creek lines, and in level areas (AMBS 2010). How archaeological potential is defined and to be assessed in this report is provided in **Table 3.**

Table 3. Definitions of Archaeological Potential

ARCHAEOLOGICAL POTENTIAL	DEFINITION
Low to Zero	Landforms that have been totally modified and have low to zero potential for any remaining original soil profile or intact archaeological deposits. This category includes existing roads, quarry areas or any area where the original soil profile (topsoil – A horizon) has been stripped and the landform completely modified. This landform may also include areas where there is no intact A horizon soils due to high levels of erosion.
Low	Landforms that may have been utilised by Aboriginal people in the past, but at a lower intensity relative to all surrounding landforms, resulting in a lower artefact density than all surrounding landforms. This category also includes landscape areas of low terrain integrity, where geomorphic processes or human action may have redistributed artefacts from their deposited locations, such as stripping of soil to create levees or excavation to create culverts, dams or bridges, resulting in site disturbance or destruction.
Moderate	Landforms that are predicted to have been utilised by Aboriginal people in the past, but not intensively or repeatedly. There is therefore potential for artefactual deposition, but at a lower frequency and density than in areas of high archaeological potential. This category may also refer to landforms known to be sensitive for higher levels of Aboriginal occupation but where prior ground surface disturbances has decreased the archaeological integrity and potential of finding evidence of Aboriginal occupation (for example, creek confluences, alluvial terraces where stratigraphic integrity may have decreased due to previous land use).
High	Landscape areas predicted to have been intensively or repeatedly utilised by Aboriginal people in the past, such as creek confluences, Pleistocene terraces, floodplains or

	elevated landforms above major watercourses or floodplains. In these areas, site and artefact density are expected to be higher than the surrounding landscape, and sites in these areas may possibly be more complex. Terrain integrity in these areas may be variable although prior ground surface disturbance should be low or non-existent. An important characteristic of areas of high archaeological potential is the research potential or the capacity of sites to provide valuable information on past Aboriginal land use.

4.1. Summary

Despite heritage register searches indicating that no sites have been recorded in the project area or immediate vicinity there is a rich and varied archaeological record for the region across different landforms. The project area has been stripped of vegetation for cattle grazing and cultivation. Erosion due to the lack of original vegetation and the consequent effects on soil retention may have affected the preservation of Aboriginal sites and material evidence of occupation. However, there is potential for intact archaeological deposits to occur in less disturbed areas of the project area. The most likely site type to occur would be artefact scatters (isolated artefacts or open camp sites).

The archaeological context of the project area indicates that there is potential for evidence of Aboriginal occupation to occur, dependent on the impacts of previous land use, particularly in the elevated landforms associated with Furracabad Creek which have potential to contain artefact scatters. Large artefact scatters may also be buried in floodplains and alluvial terraces by alluvial fill since Aboriginal occupation. These sites are not visible during survey and only detectable through excavation.

5. SITE SURVEY AND RESULTS

The site survey was undertaken on the 17 November 2020 by Julian Travaglia, Senior Archaeologist, Virtus Heritage. The heritage survey area was inspected by pedestrian survey only as no vehicular access was allowed due to the presence of the introduced weed Chilean Needle Grass (Nassella neesiana) (Department of Primary Industries) which was present in abundance over the majority of the project area. All areas of exposure, mature trees and drainage lines where possible were inspected (refer to **Appendix D** for photographs of the site inspection).

5.1 Survey Results

For reporting purposes, the heritage survey area has been divided into four separate paddocks including: the south west paddock, south east paddock, the north west paddock and the north east paddock. **Figure 4** shows areas of sensitivity recorded during the site inspection.

The south west paddock is located on a floodplain landform associated with Furracabad Creek located approximately 270 metres to the east. The landform changes to a very gently inclined lower slope (1-3º) in the north west portion of the paddock. The general ground surface visibility was extremely poor with dense ground surface coverage from Chilean Needle Grass (refer to **Plate 1**). Needle Grass grows in dense tussocks which acted to obscure almost all ground surface visibility. The only ground surface visibility present within this survey quadrant was small scattered erosion scours associated with livestock trampling and cattle tracks, small dams, and small exposures around the bases of large transmission line poles which extend along the western boundary of the survey area. The soils exposed were dark brown with a high clay content with scattered rocks throughout. The only mature tree present was a willow tree which is an introduced species to Australia (introduced around the 1930 – 40s) and therefore any scars on this tree are unlikely to be associated with any Aboriginal cultural action. The south west paddock has been heavily disturbed by European farming practises which include: livestock trampling (cattle and sheep), dam construction (refer to **Plate 2**), vegetation clearing, fencing and cattle yards, water trough and associated subsurface water pipes to feed the trough, ploughing, rock picking, and a series of transmission line poles erected along the western boundary (refer to **Plate 3**). No Aboriginal objects or sensitive landforms were identified within the south west paddock and there is very low potential for intact archaeological deposits to occur due to the landform and prior land use disturbances observed.

The south east paddock is located on a floodplain landform associated with Furracabad Creek located approximately 100 metres to the east. Similar to the adjoining south west paddock, the general ground surface visibility was extremely poor with dense ground surface coverage from the Chilean Needle Grass which acted to obscure almost all ground surface visibility (refer to **Plate 4**). The only ground surface visibility present within this survey quadrant was associated with two small dams. The drainage line which would feed these dams was completely obscured by the dense vegetation coverage. The soils exposed were dark brown with a high clay content with scattered rocks throughout, and piles of previously picked rock. The south east paddock has also been heavily disturbed by European farming practises which included: livestock trampling (cattle and sheep, refer to **Plate 5**), dam construction, vegetation clearing, fencing, ploughing, and rock picking. No Aboriginal objects or sensitive landforms were identified within the south west paddock and there is very low potential for intact archaeological deposits to occur due to the landform and prior land use disturbances observed.

The north west paddock is located on a very gently to gently inclined lower slope landform (1 – 3º) in the southern part of the paddock and a creek terrace in the northern part of the paddock. The creek terrace sits above a small drainage line (obscured by heavy ground surface vegetation coverage) which feeds to

Furracabad Creek approximately 250 metres to the east. The general ground surface visibility was extremely poor with dense ground surface coverage from Oats which had been planted as future feed for the livestock (in some spots up to waist height, refer to **Plate 6** and **7**). The only ground surface visibility present within this survey quadrant was an erosion scour associated with a windmill complex. The windmill complex consisted of a windmill, concrete water tank, a disused water tank stand, and a concrete water trough which is located within the creek terrace landform (refer to **Plate 8**). The north west paddock has had some disturbance by European farming practises such as the windmill complex, vegetation clearing, and boundary fencing; however, the lack of visibility in this location made it difficult to ascertain the level of disturbance. Pers. comm. with landowner (Lyle Perkins) (17 November 2020), indicated that this top paddock had not been ploughed extensively due to the high presence of rocks throughout, in comparison to the lower south west and south east paddocks. Although no Aboriginal objects were identified within this survey paddock, the small area of creek terrace which is located within the very northwest corner of the paddock is a sensitive landform for potential Aboriginal occupation (as identified in Heritage NSW's sensitive landform definitions for Aboriginal cultural heritage), that is, an elevated landform (creek terrace) in proximity to a permanent water source and resource zone (Furracabad Creek).

The north east paddock is located on a very gently inclined lower slope landform (1 – 3º), with a small portion of midslope at the northern boundary. The general ground surface visibility was extremely poor with dense ground surface coverage from Oats planted as a future food source for livestock (refer to **Plate 9**). The only ground surface visibility present within this survey quadrant was small scattered erosion scours associated with livestock trampling and cattle tracks. The soils exposed were dark brown with a high clay content with scattered rocks throughout (refer to **Plate 10**). The only mature trees present were willow trees which are introduced species to Australia (introduced around the 1930 – 40s) and therefore any scars on these trees are unlikely to be associated with any Aboriginal cultural action. The north east paddock has had some disturbance by European farming practises which include: livestock trampling (cattle and sheep), vegetation clearing, and fencing. The landscape is low lying and not considered to be a sensitive landform, with potential Aboriginal occupation more likely to be associated with a creek terrace and ridge crest (Chaffeys Hill) to the north and outside of the heritage survey area. No Aboriginal objects or sensitive landforms were identified within the north east paddock and there is very low potential for intact archaeological deposits to occur due to the landform and prior land use disturbances observed.

5.2 Summary of Site Inspection

There are no previously recorded sites within the project area based on heritage searches and background research of previous archaeological investigations to date. No Aboriginal objects were identified within the survey area during the survey.

One sensitive landform was identified in the north west corner of the survey area, being a creek terrace (elevated landform) in proximity to a permanent water source and resource zone (Furracabad Creek). Due to the dense vegetation coverage on this landform, the level of disturbance across the entire landform was unable to be determined (with the exception of disturbance associated with the windmill complex), and therefore it cannot be presently determined whether this location has intact evidence of Aboriginal occupation below the cultivation zone (as described in **Section 4**).

With the exception of the identified sensitive land form (creek terrace), the remainder of the heritage survey area is considered to have very low potential for intact archaeological deposits to occur due to the landform and/or prior land use disturbances observed. Although we acknowledge that Aboriginal objects are often found in highly modified landscape contexts and cannot be dismissed in any landscape in Australia.

6. RECOMMENDATIONS

The following recommendations have been made based on relevant archaeological and environmental background research, and the results of the site inspection.

1) No Aboriginal objects were identified during the site inspection. No Aboriginal places are registered within the project area. One small area of potential sensitivity (sensitive landform; creek terrace) was identified during site inspection but could not be assessed as a Potential Archaeological Deposit due to site constraints (refer to **Figure 4**);

2) It is recommended that project impacts avoid the small area of sensitive landform (creek terrace) in the north west corner of the survey area based on the results of the assessment and known project impacts. PAG have committed to avoidance of this area of sensitivity (refer to **Figure 4**);

3) If project impacts cannot avoid the sensitive landform (creek terrace) in the north west corner of the survey area, further detailed Aboriginal cultural heritage assessment in consultation with registered Aboriginal parties and subsurface testing under *The Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010) would be required as there is potential for Aboriginal objects below the plough/cultivation zone triggering further impact assessment. These investigations are regulated to be specific kinds of archaeological test excavation to a methodology specified in the CoP (DECCW 2010, 24-28). If Aboriginal objects are then identified, an Aboriginal Heritage Impact Permit application with a revised Aboriginal Cultural Heritage Assessment will need to be undertaken in consultation with all registered Aboriginal parties and submitted to Heritage NSW for endorsement, prior to works proceeding;

4) All site workers and personnel involved in site impact works associated with the proposal site should be inducted and briefed on the possible identification of Aboriginal sites and objects during construction and their responsibilities according to the provisions of the *NPW Act, 1974,* in case any unknown objects or items are uncovered during excavation.

a. As part of this induction, the contact telephone numbers of the DPC Heritage NSW regional archaeologist and EnviroLine 131 555, the relevant DPIE Environmental Officer responsible for this project should also be given to all site workers and personnel, in case unknown objects or items are uncovered during excavation.

b. Site workers should be made aware of Aboriginal objects and site types and their scientific and cultural significance and their legal obligations in relation to the protection and management of these Aboriginal sites under the NPW Act, 1974 and 2010 ancillary provisions and amendments.

c. As part of this induction, workers should be made aware that in the event that any suspected human remains are uncovered on site, the area of these suspected remains should be secured and cordoned off and the NSW Police notified. No further works can be undertaken until the NSW Police provide written advice. If these remains are deemed to require archaeological investigation by the NSW Police or NSW Coroner, then OEH, the relevant Aboriginal parties must be notified. A plan of management for the preservation of any identified Aboriginal human remains or for their salvage must be put in place or conducted under a revised AHIP methodology and variation developed in consultation with all relevant Aboriginal parties and the DPIE.

7. REFERENCES

AMBS, 2010. *Glen Innes Severn LGA Aboriginal Heritage Study*. A report prepared for Glen Innes Severn Council.

Atkinson, A. 2013 *Aboriginal Archaeological Assessment Preferred Route Options Report for the New England Highway Upgrade at Bolivia Hill*. Unpublished report by Niche Environment and Heritage to Cardno and Roads and Maritime Services. Australian Heritage Database.

http://www.environment.gov.au/cgi-bin/ahdb/search.pl Accessed on 28 September 2020.

Bate, J. 2018. *Armidale Secondary College Upgrade – Aboriginal Archaeological Assessment*. Report prepared by Apex Archaeology for NBRS Architecture on behalf of The Department of Education, Armidale Regional Council LGA.

Beck, W. & Appleton, J. 1990. *A report of the archaeological survey of the proposed site at Cooks Road/Tilbuster Ponds, Armidale, NSW*. Report prepared for TJ Stewart Pty Ltd.

Bickford *et al.* 1998. *Thematic Forest History and Heritage Assessment (Non-Indigenous) UNE/LNE CRA Regions*. Report undertaken for the NSW CRA/RFA Steering Committee project number NA 29/EH. Resource and Conservation Division, Department of Urban Affairs and Planning: Sydney.

Brunker R.L. and Chesnut W.S. 1976. *Grafton 1:250 000 Geological Sheet SH/56-06*, 1st edition. Geological Survey of New South Wales, Sydney

Byrne, D. 1993. *An Investigation of the Aborignal Archaeological Record in the Tenterfield EIS Area*. A Report to The Forestry Commission of New South Wales.

Colquhuon, G. *et al.* 2019. New South Wales Seamless Geology dataset, version 1.1 [Digital Dataset]. Geological Survey of New South Wales. NSW Department of Planning and Environment: Maitland.

Davies, S. J. 1998. *A Cultural Heritage Assessment of the Location of Telstra Optic Fibre Cable Routes and Scads in the Vicinity of Tenterfield and Inverell, Northern Tablelands, New South Wales*. Unpublished Report Prepared for Telstra.

DECCW. 2010a. *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW and Archaeological Investigation of Aboriginal Objects Code of Practice*.

DECCW. 2010b. *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW*.

DECCW. 2010c. *Aboriginal heritage consultation requirements for proponents 2010*.

Dibden, J. 2018. *Sapphire Solar Farm Kings Plains via Inverell, NSW Aboriginal Cultural Heritage Assessment Report*. Unpublished report to CWP Solar.

Everick Heritage. 2016. *EV.456 Wattle Vale Quarry Aboriginal Cultural Heritage Assessment*. Report Prepared for Glen Innes Severn Council

Glen Innes & District Historical Society website http://www.beardieshistoryhouse.info accessed October 2020.

Godwin, L. 1983. Archaeological Site Surveys on the Eastern Margin of the New England Tablelands. *Australian Archaeology* 17:38-47.

Hunt, J. 2010. *Looking After Country in New South Wales: Two Case Studies of Socioeconomic Benefits for Aboriginal People*, in CAEPR Working Paper 75. The Centre for Aboriginal Economic Policy Research, Australian National University: Canberra.

ICOMOS Burra Charter 2013. The Burra Charter.

Knuckey, G. 2019. *An Aboriginal Cultural Heritage Assessment – Wright Block Project at the University of New England, Armidale*. Prepared by Remnant Archaeology for Facilities Management Services, University of New England.

MacPherson, J. 1905. Ngarrabul and other Aboriginal tribes. *Proceedings of the Linnean Society*, 29, 677-684

McBryde, I. 1974. *Aboriginal prehistory in New England: an archaeological survey of northeastern New South Wales*. Sydney University Press: Sydney.

Mitchell, P. 2002. *Descriptions for NSW (Mitchell) Landscapes*. Report prepared for NSW National Parks and Wildlife Surface.

NSW Department of Planning, Industry and Environment Website https://www.environment.nsw.gov.au/bioregions/NewEnglandTableland-RegionalHistory.htm , accessed October 2020

NSW Department of Planning, Industry and Environment Website https://www.environment.nsw.gov.au/bioregions/NewEnglandTableland-Landform.htm, accessed October 2020

NSW National Parks and Wildlife Service 2003. The Bioregions of NSW: their biodiversity, conservation and history. NSW National Parks and Wildlife Service: Hurstville.

NSW Department of Primary Industries https://weeds.dpi.nsw.gov.au/Weeds/Details/36 Accessed on 21 November 2020.

Oxley, J. 1820. *Journals of two expeditions into the interior of New South Wales 1817 – 18*. J. Murray: London.

Rich, E, 1988. *Aboriginal Heritage in the Glen Innes Municipality*, A report prepared for Robert Moore Architects and Conservation Planners and Glen Innes Municipal Council.

Strahler, R. L. 1952. Hypsometric (Area-Altitude) Analysis of Erosional Topography. *Geological Society of America Bulletin* 63:1117-1142.

APPENDIX A

COMMENTS FROM ABORIGINAL PARTIES

Gmail **Virtus Consultation <consultation@virtusheritage.com.au>**

218 - Glen Innes Proposed Solar Development Due Diligence Assessment - Receipt of Comments

1 message

Virtus Consultation <consultation@virtusheritage.com.au> Mon, Dec 14, 2020 at 9:37 AM
To: gilalc@northnet.com.au, bids3236@bigpond.net.au
Cc: Mary-Jean Sutton <mj.sutton@virtusheritage.com.au>, Kelly Kent <administration@virtusheritage.com.au>

Dear Trevor,

Thank you for your conversation over the phone today. I can confirm that we have received your comments and that you are satisfied with the results of the due diligence assessment. I also note that you wish the clients to commit to completely avoiding the area of sensitivity recorded and mapped during the site inspection. We appreciate your time and look forward to working with you again in the future.

Warm Regards,

Elaine Lin
Senior Archaeologist

VIRTUSHERITAGE
Email: consultation@virtusheritage.com.au
Web: www.virtusheritage.com.au

Think before you print.

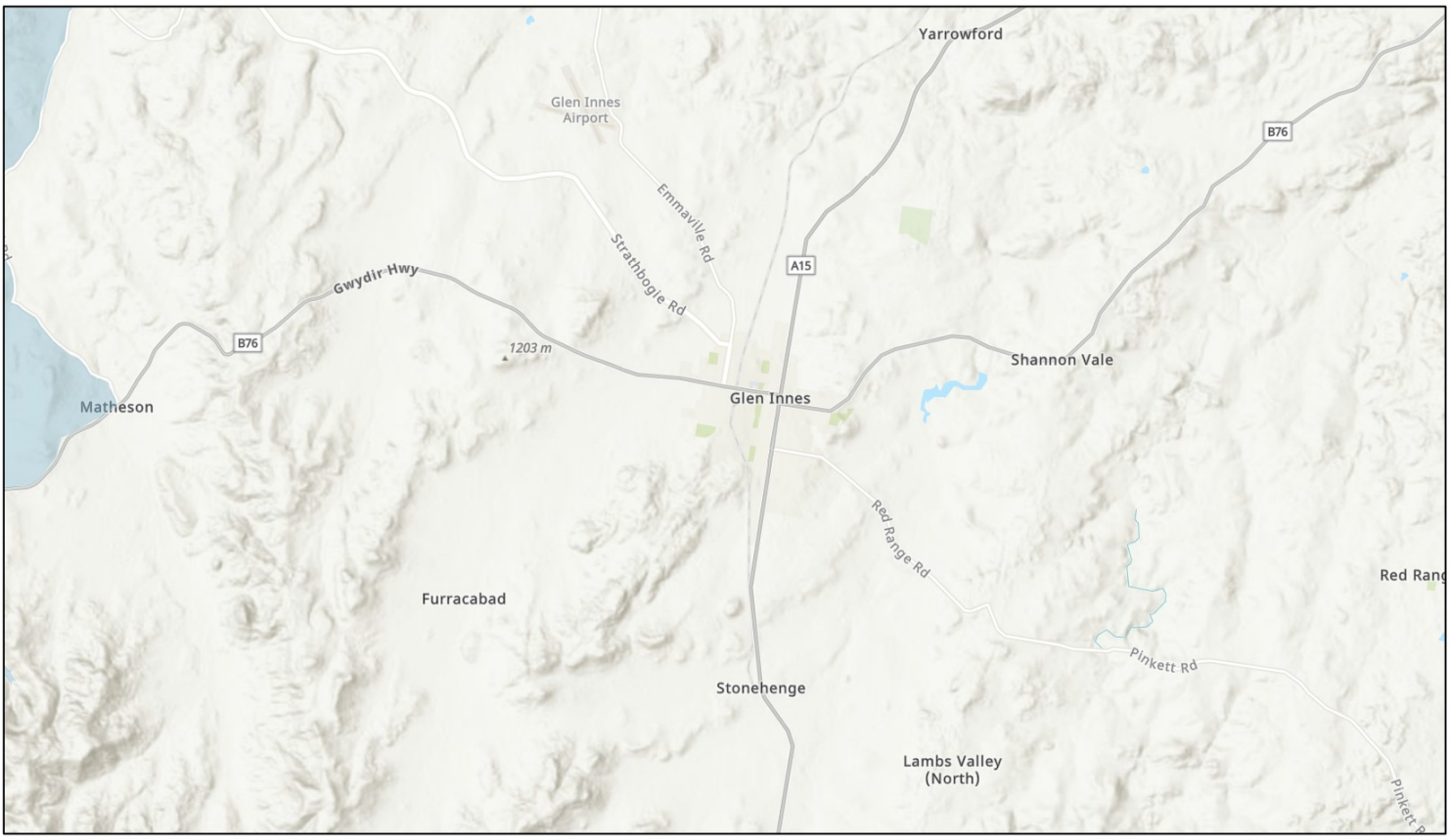
Acknowledgement of Country
Virtus Heritage is committed to the spirit of reconciliation and acknowledges Aboriginal and Torres Strait Islander peoples as the First Australians and the Traditional Custodians of the states and territories of Australia. We recognise the Traditional Owners of the lands we work within. We pay our respect to Elders past, present and emerging in maintaining the culture, country and their spiritual and historical connections to the lands and waters.

Breach of Confidentiality
This email and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. If you have received this email in error please notify the sender. This message contains confidential information and is intended only for the individual named. If you are not the named addressee you should not disseminate, distribute or copy this e-mail. Please notify the sender immediately by e-mail if you have received this e-mail by mistake and delete this e-mail from your system. If you are not the intended recipient you are notified that disclosing, copying, distributing or taking any action in reliance on the contents of this information is strictly prohibited. *Although the company has taken reasonable precautions to ensure no viruses are present in this email, the company cannot accept responsibility for any loss or damage arising from the use of this email or attachments.*

APPENDIX B

NATIONAL NATIVE TITLE TRIBUNAL SEARCH

218 - NT Search Area



9/28/2020, 1:50:18 PM

Applications (Schedule)

1:144,448

0 1 2 4 mi

0 1.75 3.5 7 km

Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Native TitleVision

Esri, USGS | Esri, HERE, Garmin, FAO, METI/NASA, USGS |

APPENDIX C

AHIMS SEARCH

AHIMS Web Services (AWS)
Search Result

Purchase Order/Reference : 218 - GlenInnes SolarFarm

Client Service ID : 538676

Elaine Lin

17/469-475 Parramatta Road
Leichhardt New South Wales 2040

Attention: Elaine Lin

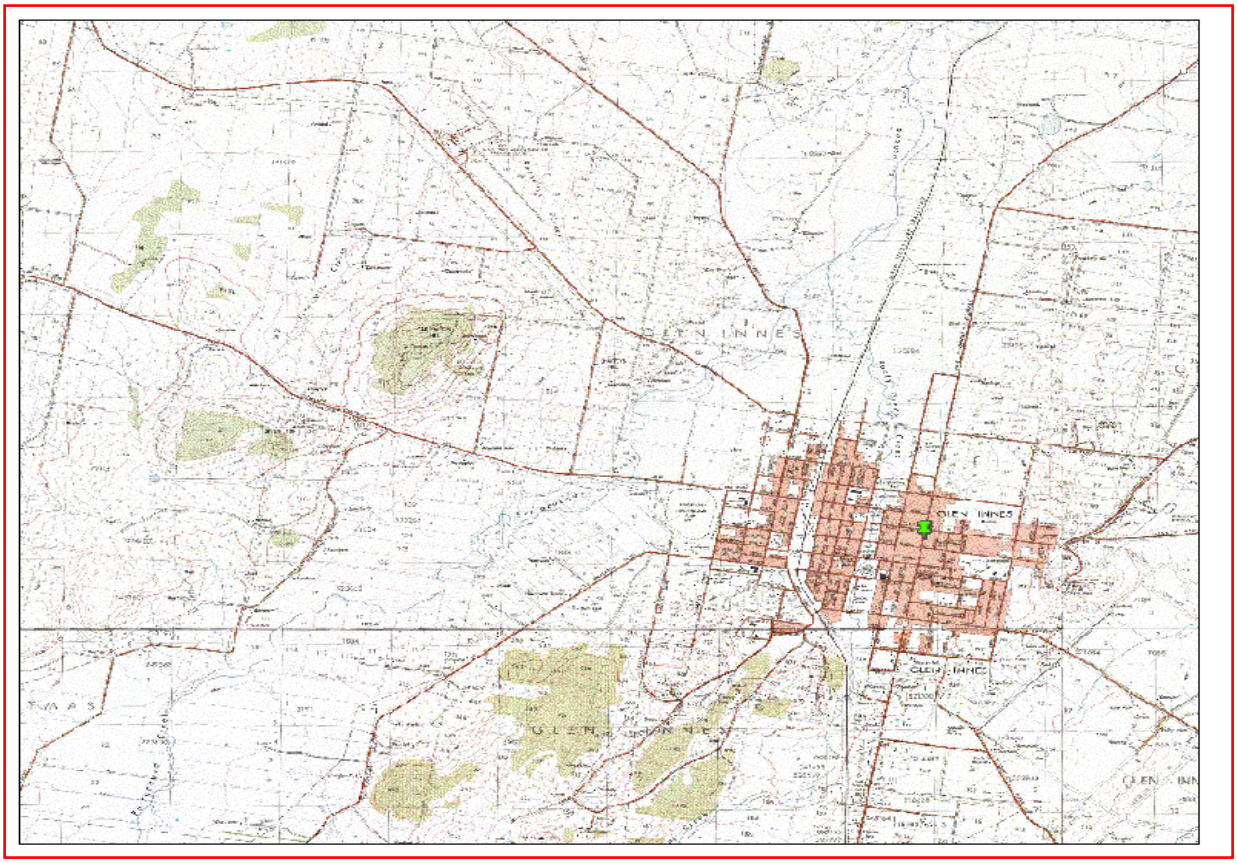
Email: e.lin@virtusheritage.com.au

Date: 28 September 2020

Dear Sir or Madam:

AHIMS Web Service search for the following area at Datum :GDA, Zone : 56, Eastings : 370072 - 380072, Northings : 6705809 - 6715809 with a Buffer of 0 meters. Additional Info : Survey and relocation of sites, conducted by Elaine Lin on 28 September 2020.

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:

1	**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.

3 Marist Place, Parramatta NSW 2150
Locked Bag 5020 Parramatta NSW 2220
Tel: (02) 9585 6380 Fax: (02) 9873 8599

ABN 30 841 387 271
Email: ahims@environment.nsw.gov.au
Web: www.environment.nsw.gov.au

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 218 - GlenInnes SolarFarm

Client Service ID : 538676

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
12-4-0001	Glen Innis;Glen Innis Rock Wells;	AGD	56	376700	6708700	Open site	Valid	Aboriginal Ceremony and Dreaming : -	Natural Mythological (Ritual)	

Contact **Recorders** Harry Creamer,Mr.Richard Kelly **Permits**

Report generated by AHIMS Web Service on 28/09/2020 for Elaine Lin for the following area at Datum :GDA, Zone : 56, Eastings : 370072 - 380072, Northings : 6705809 - 6715809 with a Buffer of 0 meters. Additional Info : Survey and relocation of sites. Number of Aboriginal sites and Aboriginal objects found is 1

This information is not guaranteed to be free from error omission. Office of Environment and Heritage (NSW) and its employees disclaim liability for any act done or omission made on the information and consequences of such acts or omission.

APPENDIX D

PLATES

Glen Innes Solar Heritage Survey



Plate 1. Area of potential sensitivity identified during site inspection in north west paddock.

South West Paddock



Plate 2. South west paddock, dense Needle Grass ground surface coverage, view to east.



Plate 3. South west paddock, European disturbance (dam) with mature Willow tree in background, view to east.



Plate 4. South west paddock, European disturbance (transmission line poles) and erosion scour, view to south south west.

South East Paddock



Plate 5. South east paddock, dense Needle Grass ground surface coverage, view to east.



Plate 6. South east paddock, erosion scour from livestock, ground surface visibility.

North West Paddock



Plate 7. North west paddock, dense vegetation cover (oats) and view from creek terrace landform over floodplain (Furracabad Creek to the left of photo), view to south.



Plate 8. North west paddock, dense vegetation cover (oats) and view from creek terrace landform over floodplain (Furracabad Creek to the left of photo), view to south south west.



Plate 9. North west paddock, windmill complex on creek terrace landform, view to west.

North East Paddock



Plate 10. North east paddock, dense vegetation cover (oats), view to west.



Plate 11. North east paddock, example of scattered rock.

KLEINFELDER
Bright People. Right Solutions.

Flora and Fauna Assessment Report



KDC Pty Ltd

Glen Innes Solar Farm

Tuttles Lane, Glen Innes 2370 NSW

14 December 2020

Flora and Fauna Assessment Report

Glen Innes Solar Farm

Tuttles Lane, Glen Innes 2370 NSW

Kleinfelder Document Number: NCA20R119254
File Name: NCA20R119254_GlenInnesFFAR_20201214
Project No: 20212718
All Rights Reserved

Prepared for:

KDC PTY LTD

Only KDC Pty Ltd, its designated representatives or relevant statutory authorities may use this document and only for the specific project for which this report was prepared. It should not be otherwise referenced without permission.

Document Control:

Version	Description	Date	Author	Peer Reviewer
1.0	Draft for Client Review	09 December 2020	C. Whyte	G. Whyte
2.0	Final	14 December 2020	C. Whyte	G. Whyte

Copyright 2020 Kleinfelder

Contents

1. INTRODUCTION 1
   - 1.1 PROJECT BACKGROUND 1
   - 1.2 SITE DESCRIPTION 1
   - 1.3 PROPOSED DEVELOPMENT 2
   - 1.4 REPORT OBJECTIVES 2
2. LEGISLATIVE CONTEXT 6
   - 2.1 COMMONWEALTH LEGISLATION 6
     - 2.1.1 Environment Protection & Biodiversity Conservation Act 1999 6
   - 2.2 STATE LEGISLATION 7
     - 2.2.1 Environmental Planning and Assessment Act 1979 7
     - 2.2.2 Biodiversity Conservation Act 2016 7
     - 2.2.3 Biosecurity Act 2015 8
     - 2.2.4 National Parks and Wildlife Act 1974 9
     - 2.2.5 Water Management Act 2000 9
     - 2.2.6 State Environmental Planning Policy (Koala Habitat Protection) 2019 9
   - 2.3 LOCAL PLANNING INSTRUMENTS 10
     - 2.3.1 Glen Innes Severn Local Environmental Plan 2012 10
     - 2.3.2 Glen Innes Severn Development Control Plan 2014 11
3. METHODOLOGY 12
   - 3.1 DESKTOP ASSESSMENT 12
   - 3.2 FIELD SURVEY 12
     - 3.2.1 Vegetation Assessment 12
     - 3.2.2 Fauna Habitat Assessment 13
   - 3.3 SURVEY LIMITATIONS 14
4. RESULTS 16
   - 4.1 PLANT DIVERSITY 16
   - 4.2 WEEDS 16
   - 4.3 PLANT COMMUNITY TYPES 16
   - 4.4 THREATENED ECOLOGICAL COMMUNITIES 17
   - 4.5 THREATENED FLORA SPECIES 17
   - 4.6 FAUNA HABITAT 17
   - 4.7 FAUNA SPECIES 18
   - 4.8 THREATENED FAUNA SPECIES 18
   - 4.9 KOALA HABITAT 19

Copyright 2020 Kleinfelder

4.10 EPBC ACT PROTECTED MATTERS 19

5. DISCUSSION 21

5.1 IMPACT ASSESSMENT 21
5.1.1 Removal of Native Vegetation 21
5.1.2 Impacts to Fauna 21
5.1.3 Impacts to Threatened Species 21
5.1.4 Impacts to Threatened Ecological Communities 21
5.1.5 Impacts to Aquatic Habitat 22
5.1.6 Cumulative Impacts 22
5.2 IMPACT AMELIORATION 22
5.2.1 Avoidance Measures 22
5.2.2 Erosion Control 22
5.2.3 Dust Control 23
5.2.4 Chemical Spills 23
5.2.5 Weed Management 23
5.2.6 Offset Provisions 24
5.3 CONCLUSION 24

REFERENCES 25

Tables

Table 1: Flora list 29
Table 2: Likelihood of occurrence 32

Figures

Figure 1: Locality 3
Figure 2: Study area and subject site 4
Figure 3: Proposed site layout 5
Figure 4: Survey effort 15
Figure 5: Vegetation and paddock trees 20

Plates

Plate 1: Exotic grassland (improved pasture) within the subject site 27
Plate 2: Isolated paddock trees (Weeping Willow *Salix Babylonica* and Poplar *Populus sp.*) 27
Plate 3: Constructed Dam within the subject site 28
Plate 4: Constructed Dam within the subject site 28

Copyright 2020 Kleinfelder

Appendices

Appendix 1: Site photographs
Appendix 2: Flora Species List
Appendix 3: Threatened Species ‘Likelihood of occurrence’
Appendix 4: EPBC Act Protected Matters Search Report
Appendix 5: Licenses and Permits

Copyright 2020 Kleinfelder

1. INTRODUCTION

1.1 PROJECT BACKGROUND

Kleinfelder has been engaged by KDC Pty Ltd (KDC) on behalf of Providence Asset Group to prepare a Flora and Fauna Assessment Report for a proposed solar farm located at Lot 1 DP 251457, Lots 32, 33, 34, 35, 36 DP 1834 Tuttles Lane, Glen Innes 2370 (**Figure 1**). The project will be assessed under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) with Glen Innes Severn Shire Council as the determining authority.

The following terms are used throughout this report to describe geographical areas:

- Study area – Lot 1 DP 251457, Lots 32, 33, 34, 35, 36 DP 1834 (28.11 ha).
- Subject site (development footprint) – areas of the study area that have been leased for the proposed development (14.8 ha) as shown in **Figure 2** and **Figure 3.**
- Locality – land within a 5 km radius of the study area.

This report identifies flora, fauna and threatened species present, or likely to occur within the study area based on species and/or habitats detected during field surveys and threatened flora and fauna records from the locality. An assessment of the likely impacts on identified threatened species, habitat features, wildlife corridors and vegetation communities as a result of the proposed development has also been undertaken.

1.2 SITE DESCRIPTION

The study area is located in the suburb of Glen Innes, approximately 1.5 km west of the township, within the Glen Innes Severn Shire Council Local Government Area (LGA). The study area is zoned 'RU1 – Primary Production under the *Glen Innes Severn Local Environmental Plan 2012* (LEP) (Glen Innes Severn LEP, 2010).

Access to the study area is achieved via Tuttles Lane, which borders the study areas western boundary. The study area is surrounded on all sides by agricultural land and rural dwellings. Furracabad Creek runs adjacent to the study areas eastern boundary through the neighbouring properties and a tributary of the creek is located to the south east of the study area. There are four constructed dams throughout the study area (Lot 1, Lot 33 and two in Lot 35) and a vacant

Copyright 2020 Kleinfelder

rural dwelling located in the north (Lot 36). The study area has a relatively flat topography, with an elevation ranging from 154 m in the south west to 300 m in the north east. The study area has previously been cleared of native vegetation for agricultural purposes. Remaining native vegetation consists of exotic grassland and isolated planted paddock trees. Site photographs are provided in **Appendix 1.**

1.3 PROPOSED DEVELOPMENT

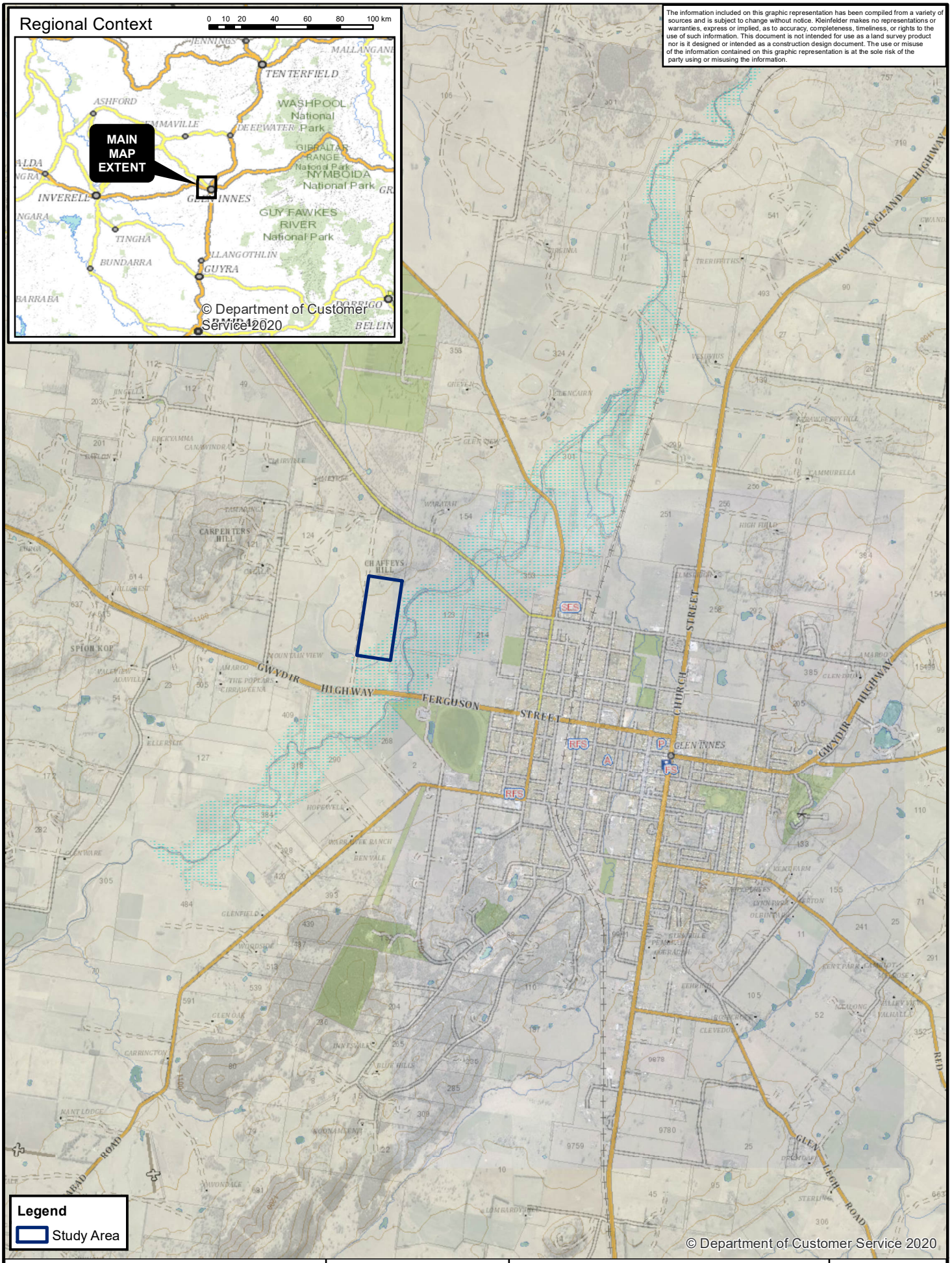
The Glen Innes Solar Farm project will include a 5 MW grid-connected solar PV installation. The proposed project layout is approximately 14.8 ha in area and is provided in **Figure 3**. The location of the proposed solar farm is situated in the centre of the study area. Access to the site and connection to the grid will be achieved via an existing powerline easement to the east of the study area.

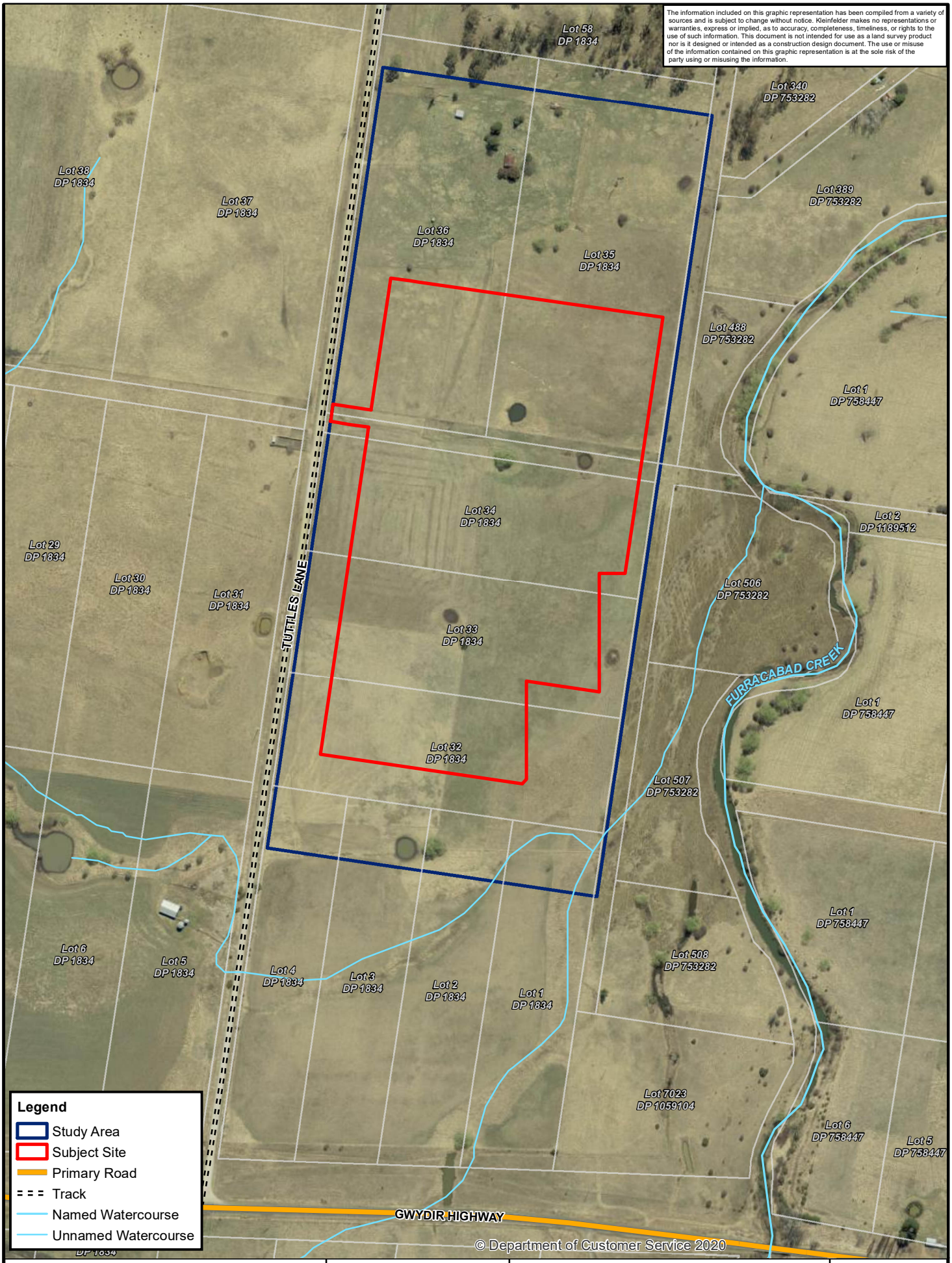
1.4 REPORT OBJECTIVES

The objectives of the Flora and Fauna Assessment Report include:

- Describe the flora and fauna (and their habitats) present on, or likely to occur on the subject site.
- Assess the relevance and value of the subject site for threatened species and ecological communities (and their habitats) listed under the NSW *Biodiversity Conservation Act 2016* (BC Act).
- Assess the potential impacts of the proposed development on threatened species and ecological communities, pursuant to Section 7.3 of the BC Act (5-part test).
- Comment on the likely occurrence and relevance of matters of national environmental significance listed under the Commonwealth *Environment Planning and Biodiversity Conservation Act 1999* (EPBC Act).
- Describe steps to avoid and mitigate any identified impacts on flora and fauna and to protect the natural environment of the subject site.

Copyright 2020 Kleinfelder


Regional Context
0 10 20 40 60 80 100 km
MAIN MAP EXTENT
TENTERFIELD
ASHFORD
WASHPOOL National Park
DEEPWATER
GIBRALTAR RANGE National Park
NYMBOIDA National Park
INVERELL
GLEN INNES
GUY FAWKES RIVER National Park
TINGHA
BUNDARRA
GUYRA
BARRABA
BELLIN
© Department of Customer Service 2020
The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.
NEW ENGLAND HIGHWAY
CHURCH STREET
GWYDIR HIGHWAY
FERGUSON STREET
CHAFFEYS HILL
CARPENTERS HILL
SPION KOP
GLEN INNES
SES
RFS
P
A
FS
GLEN LEIGH ROAD
Legend
Study Area
© Department of Customer Service 2020
km
0 0.25 0.5 1 1.5 2 2.5
N
KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com
PROJECT REFERENCE: 20212647
DATE DRAWN: 2020/12/04 12:35 Version 1
DRAWN BY: GJoyce
DATA SOURCE:
NSW DFSI - 2020
KDC - 2020
Locality
Flora and Fauna Assessment Report
Glen Innes Solar Farm
Tuttles Lane
Glen Innes NSW
FIGURE:
1
L:\GIS FOLDER\00 CLIENT FILES\130060_KDC_PtyLtd\20212647_FFAR_GlenInnes_Warral_Boggabri\GlenInnes\Mapping\20212647_Fig1_Locality.mxd



The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.

© Department of Customer Service 2020

Metres
0 25 50 100 150 200 250

N

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT REFERENCE: 20212647

DATE DRAWN: 2020/12/04 12:40 Version 1

DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2020
KDC - 2020

Study Area and Subject Site

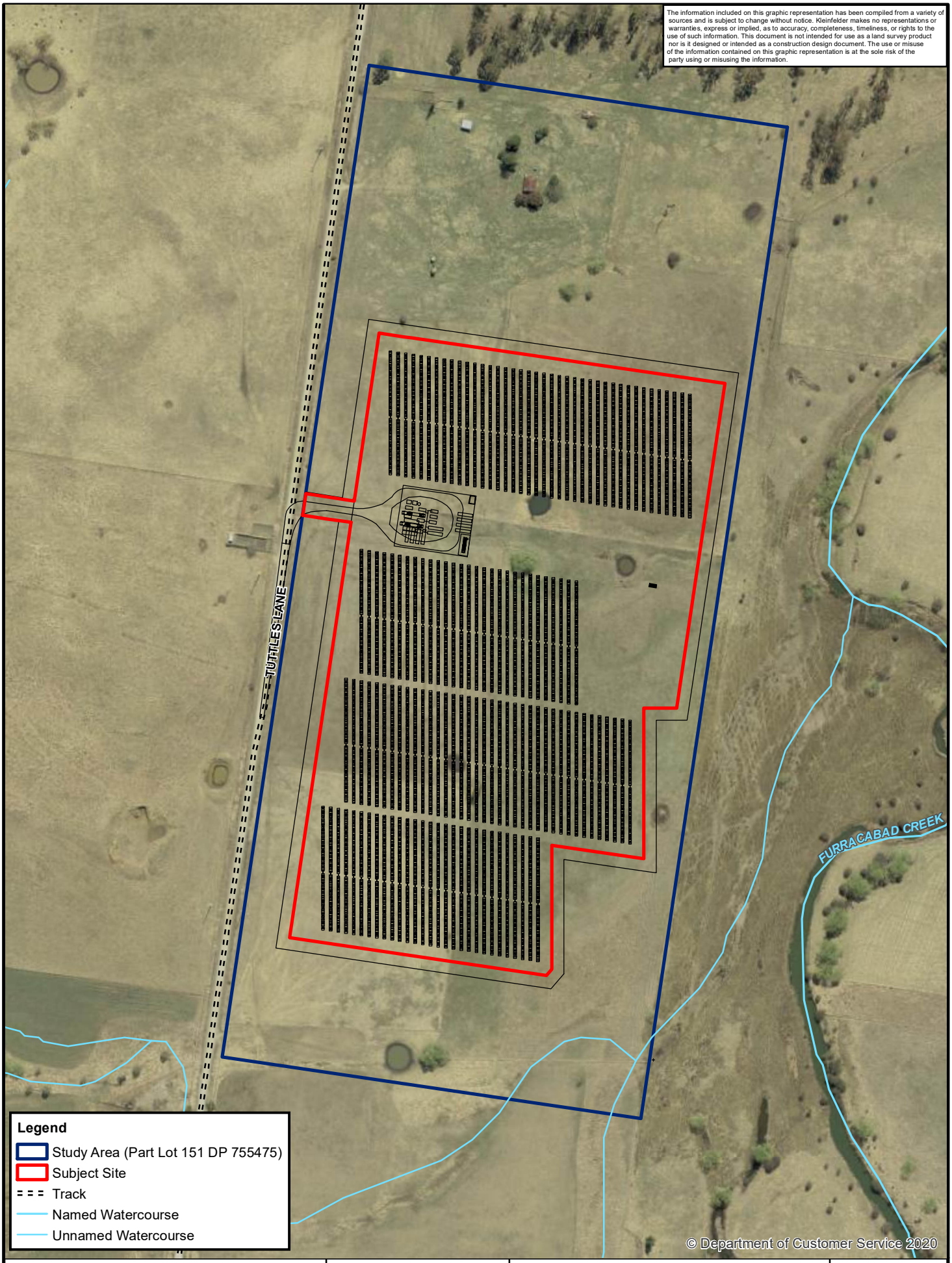
Flora and Fauna Assessment Report
Glen Innes Solar Farm
Tuttles Lane
Glen Innes NSW

FIGURE:

2

L:\GIS FOLDER\00 CLIENT FILES\130060_KDC_PtyLtd\20212647_FFAR_GlenInnes_Warral_Boggabri\GlenInnes\Mapping\20212647_Fig2_StudyArea_SubjectSite.mxd

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.



Metres
0 25 50 100 150 200

N

PROJECT REFERENCE: 20212647

DATE DRAWN: 2020/12/04 12:31 Version 1

DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2020
KDC - 2020

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

Proposed Site Layout

Flora and Fauna Assessment Report
Glen Innes Solar Farm
Tuttles Lane
Glen Innes NSW

FIGURE:

3

L:\GIS FOLDER\00 CLIENT FILES\130060_KDC_PtyLtd\20212647_FFAR_GlenInnes_Warral_Boggabri\GlenInnes\Mapping\20212647_Fig3_ProposedSiteLayout.mxd

2. LEGISLATIVE CONTEXT

2.1 COMMONWEALTH LEGISLATION

2.1.1 Environment Protection & Biodiversity Conservation Act 1999

The purpose of the EPBC Act is to ensure that actions likely to cause a significant impact on 'matters of national environmental significance' undergo an assessment and approval process. Under the EPBC Act, an action includes a proposal, a development, an undertaking, an activity or a series of activities, or an alteration of any of these things. An action that 'has, will have or is likely to have a significant impact on a Matter of National Environmental Significance (MNES) is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Australian Minister for the Environment.

The EPBC Act identifies nine MNES:

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

As part of the current assessment, MNES that are predicted to occur within the locality (applying a 5 km buffer) were obtained from the on-line Protected Matters Search Tool (DoEE, 2020a). These records are discussed in **Section 4**. The EPBC Act has been further addressed in this assessment through:

- Field surveys for EPBC Act listed threatened biota and migratory species.
- Assessment of potential impacts on EPBC Act listed threatened species and migratory biota.

Copyright 2020 Kleinfelder

- Identification of suitable impact mitigation and environmental management measures for EPBC Act listed threatened species and migratory biota.

2.2 STATE LEGISLATION

2.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act forms the legal and policy platform for proposal assessment and approval in NSW and aims to '*encourage the proper management, development and conservation of natural and artificial resources'*. All development in NSW is assessed in accordance with the provisions of the EP&A Act and the EP&A Regulation 2000.

Development activities that require consent are assessed and determined in accordance with Part 4 of the EP&A Act. The determining authority for the project is Glen Innes Severn Shire Council.

2.2.2 Biodiversity Conservation Act 2016

The NSW BC Act, the NSW *Biodiversity Conservation Regulation 2017* (NSW BC Regulation) and amendments to the NSW *Local Land Services Act 2013* (LLS Act) commenced on 25 August 2017. The legislation aims to deliver "a strategic approach to conservation in NSW while supporting improved farm productivity and sustainable development". The NSW BC Act repeals several pre-existing Acts, most notably the NSW *Threatened Species Conservation Act 1995,* the NSW *Nature Conservation Trust Act 2001* and the *NSW Native Vegetation Act 2003*.

In accordance with the NSW BC Act, entry into the Biodiversity Offsets Scheme (BOS) is not required for the proposed development due to the following:

- The proposed development is not deemed to be 'State Significant' under the NSW EP&A Act.
- The proposed development will not impact an Area of Outstanding Biodiversity Value (AOBV) as listed under Part 3 of the NSW BC Act.
- The proposed development is unlikely to cause a significant impact on a threatened species, population or ecological community, as listed under Schedules 1 and 2 of the

Copyright 2020 Kleinfelder

NSW BC Act, as determined by application of a five-part-test of significance under Section 7.3 of the NSW BC Act.

- The proposed development will not impact areas mapped as having 'high biodiversity value' as indicated by the NSW Biodiversity Values Map (BV Map).
- The proposed development will not result in the removal of native vegetation (further discussed in **Section 5.1.1**) therefore, the project will not involve clearing of native vegetation that exceeds the BOS threshold for the site (1 ha threshold for a minimum lot size of 40 ha) as determined by the NSW *Biodiversity Conservation Regulation 2017*.

In consideration of the criteria listed above, a Biodiversity Development Assessment Report (BDAR) is not required for the proposed development. As part of the current assessment, threatened species and ecological communities as listed under the NSW BC Act that have previously been recorded within the locality (applying a 5 km buffer) were obtained from the on-line BioNet Atlas of NSW Wildlife (DPIE, 2020a). These records are discussed in **Section 4** of this report. The NSW BC Act has been further addressed in this assessment through:

- Field surveys to assess the presence of threatened species, populations and ecological communities, as listed under Schedules 1 and 2 of the NSW BC Act, within the subject site.
- Assessment of potential impacts threatened species, populations and ecological communities, as listed under Schedules 1 and 2 of the NSW BC Act, as determined by application of a five-part-test of significance under Section 7.3 of the NSW BC Act.
- Identification of suitable impact mitigation and environmental management measures.

2.2.3 Biosecurity Act 2015

The NSW *Biosecurity Act 2015* provides a streamlined statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds. The primary objective of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Copyright 2020 Kleinfelder

Weed species recorded within the subject site during the current investigation are discussed in **Section 4**.

2.2.4 National Parks and Wildlife Act 1974

The NSW *National Parks and Wildlife Act 1979* (NPWS Act) aims to conserve nature, objects, places or features (including biological diversity) of cultural value within the landscape. The Act also aims to foster public appreciation, understanding and enjoyment of nature and cultural heritage, and provides for the preservation and management of national parks, historic sites and certain other areas identified under the Act.

No areas of National Park estate occur within or adjacent to the subject site.

2.2.5 Water Management Act 2000

Controlled activities carried out in, on or under waterfront land are regulated by the NSW WM Act. The NSW Natural Resource Asset Regulator (NRAR) administers the WM Act and is required to assess the impact of any proposed controlled activity to ensure that no more than minimal harm will be done to 'waterfront land' as a consequence of carrying out the controlled activity. Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 m of the highest bank of the river, lake or estuary (NRAR, 2018). This means that a controlled activity approval must be obtained from the NRAR before commencing the activity.

Furracabad Creek runs adjacent to the study area and is between 58 m to 210 m away from the eastern boundary. A tributary of the creek is located to the south east of Lot 32. No major wetlands or streams are mapped within the proposed subject site. The study area does not constitute 'waterfront land' as defined in the WM Act. No vegetation clearing or disruption to the creek is likely to occur as a result of the construction of the solar array. Notwithstanding, an assessment of indirect impacts of the proposed development on aquatic habitat and downstream aquatic habitats is provided in **Section 5.1**.

2.2.6 State Environmental Planning Policy (Koala Habitat Protection) 2019

State Environmental Planning Policy (Koala Habitat Protection) aims to encourage the conservation and management of areas of natural vegetation that provide habitat for Koalas

Copyright 2020 Kleinfelder

to support a permanent free-living population over their present range and reverse the current trend of Koala population decline.

The study area lies within the Koala Management Area of the Northern Tablelands. A Koala Plan of Management (KPoM) has not been prepared for the study area; therefore, provisions of Clause 9 of the SEPP (Koala Habitat Protection) is applicable to the proposed development. As such, Council must take into account the requirements of the Koala Habitat Assessment Guideline (DPIE, 2020b), or information prepared by a suitably qualified and experienced person in accordance with the guideline to determine if the land is classified as Highly Suitable Koala Habitat or Core Koala Habitat.

See **Section 4.9** for a summary of the Koala habitat assessment.

2.3 LOCAL PLANNING INSTRUMENTS

2.3.1 Glen Innes Severn Local Environmental Plan 2012

The study area is located within the Glen Innes Severn Shire Council LGA. The *Glen Innes Severn LEP 2012* (Glen Innes Severn LEP, 2012) controls development within the study area through zoning and development controls. The particular aims of this Plan are as follows:

- To encourage the proper management, development and conservation of natural and human resources in Glen Innes Severn by protecting, enhancing and conserving the following:
  - Land of significance to agricultural production.
  - Timber, minerals, soil, water and other natural resources.
  - Areas of significance for nature conservation.
  - Areas of high scenic or recreational value.
  - Landscapes, places and buildings of archaeological or heritage significance, including aboriginal relics and places.
  - Communities and settlements.
  - To facilitate growth and development that minimises the cost to the community of fragmented and isolated development of rural land and facilitates the efficient and effective delivery of amenities and services.
- To facilitate growth and development that:

Copyright 2020 Kleinfelder

- Minimises the cost to the community of fragmented and isolated development of rural land.
- Facilitates the efficient and effective delivery of amenities and services.
- Facilitates stimulation of demand for a range of residential, enterprise and employment opportunities and promotes agricultural diversity.
- Maximises the efficient use of existing infrastructure.
- Facilitates stimulation of demand for a range of residential, enterprise and employment opportunities and promotes agricultural diversity.
- Maximises the efficient use of existing infrastructure.

2.3.2 Glen Innes Severn Development Control Plan 2014

The *Glen Innes Severn Development Control Plan 2014* (DCP) (Glen Innes Severn DCP 2014) supports the Glen Innes Severn LEP by providing additional detail and guidance on addressing environmental considerations associated with development. In the event of any conflict between the DCP and the LEP, the LEP takes precedence.

Copyright 2020 Kleinfelder

3. METHODOLOGY

3.1 DESKTOP ASSESSMENT

Existing information on the flora and fauna of the subject site and the locality, including relevant threatened biota was obtained from:

- Regional vegetation mapping: *SVTM_VM_4467_BorderRiversNamoiGwydir_PCT_V2* (OEH 2015).
- The BioNet Atlas of NSW Wildlife (DPIE, 2020a) for previous records of threatened species, populations and ecological communities (as listed under the BC Act) within a 5 km radius of the subject site (data retrieved 02/12/2020).
- The Department of the Environment and Energy (DoEE, 2020a) Protected Matters Search Tool, which involved a search for matters of national environmental significance within a 5 km radius of the subject site (conducted on 02/12/2020).
- Relevant published literature on threatened biota (see **References**).

The results of the database searches were used to compile a list of threatened species, populations and communities, as listed under the BC Act and EPBC Act that could potentially occur on the subject site, and their likelihood of occurrence.

3.2 FIELD SURVEY

3.2.1 Vegetation Assessment

A diurnal inspection of the subject site and surrounds was undertaken on 12 November 2020 to provide specific observations for this report.

Native vegetation types were identified based on dominant flora species present within each structural layer (i.e. canopy, shrub and ground layers). Exotic or highly modified native vegetation was defined based on structure and species composition. Boundaries of vegetation types and communities were marked with a hand-held GPS and mapped using geographical information system (GIS) software.

Copyright 2020 Kleinfelder

Vegetation types were assessed against identification criteria for State and Commonwealth listed threatened ecological communities (DoEE, 2020b; DPIE, 2020d). Vegetation and habitats were compared with descriptions provided in the BioNet Vegetation Classification to identify Plant Community Types (PCTs). The locations of the floristic plot/ transects are presented in **Figure 4**.

Three 400 m² floristic plot/transects were sampled in accordance with Section 5.3.4 of the NSW Biodiversity Assessment Method (BAM) (OEH, 2017). Percentage cover and relative abundance was recorded for all plant species within each plot/transect. Plot/ transects were positioned to sample areas that were most representative of the floristic characteristics of each PCT.

Plant identification and nomenclature were based on species descriptions presented within The Flora of New South Wales Volumes 1 to 4 (Harden, 1993) and with reference to taxonomic updates in PlantNET - The Plant Information Network System of Botanic Gardens Trust, Sydney, Australia (Botanic Gardens Trust, 2020).

3.2.2 Fauna Habitat Assessment

The locations of any important habitat features, such as microbat roosting habitat, hollow-bearing trees, terrestrial refugia and nests/burrows were captured with a handheld GPS device and photographed where appropriate.

Searches for potential habitat for threatened fauna species included but were not limited to:

- Koala feed trees.
- Foraging trees for threatened birds.
- Hollow-bearing trees.
- Potential roosts for microbats.
- Vegetated ponds, riparian vegetation and drainage lines for frogs and waterbirds.
- Woody debris, leaf litter and bush rock.

Diurnal opportunistic observations of fauna species and fauna activity such as scats, tracks, burrows or other traces were recorded during survey.

Copyright 2020 Kleinfelder

3.3 SURVEY LIMITATIONS

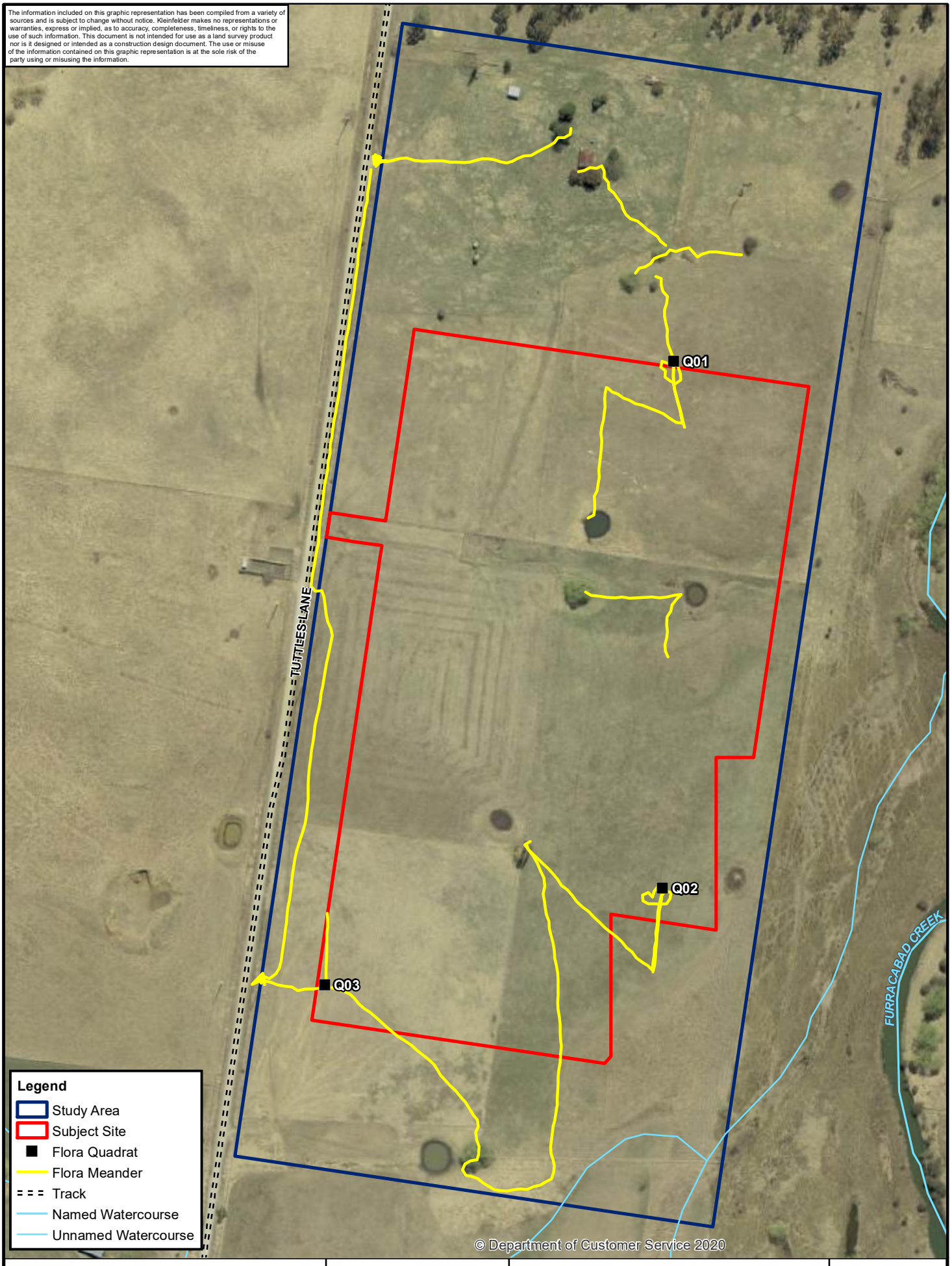
The survey techniques and survey effort applied for this study were commensurate with the nature and condition of the subject site. Due to these limitations, priority was given to habitat assessment for relevant threatened biota. A 'likelihood of occurrence' assessment was applied to all species previously recorded or predicted to occur within the locality based on State and Commonwealth information sources.

The field survey was undertaken during an eight-hour survey period by one ecologist. While a moderate diversity of native and exotic flora species was recorded, a longer survey duration or multiple seasonal surveys would likely result in the detection of a greater diversity of species. The majority of the subject site is considered to be degraded and unsuitable for most threatened plant species known to occur in the locality; therefore, the survey effort that is recommended in *The NSW Guide to Surveying Threatened Plants* (OEH, 2016) is not considered to be applicable.

No targeted fauna surveys, microchiropteran bat surveys (i.e. Anabat), fauna trapping or targeted surveys for cryptic fauna species was undertaken, as the proposed development will avoid the creek and will not clear any habitat features. No 'call playback' for arboreal fauna, large forest owl species were conducted. Given the limited availability of native vegetation within the subject site and the lack of hollow bearing trees, the survey effort was considered adequate to detect the fauna species most likely to be present.

Copyright 2020 Kleinfelder

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.



Metres
0 25 50 100 150 200
N

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT REFERENCE: 20212647
DATE DRAWN: 2020/12/04 12:50 Version 1
DRAWN BY: GJoyce
DATA SOURCE:
NSW DFSI - 2020
KDC - 2020

Survey Effort

Flora and Fauna Assessment Report
Glen Innes Solar Farm
Tuttles Lane
Glen Innes NSW

FIGURE:
4

L:\GIS FOLDER\00 CLIENT FILES\130060_KDC_PtyLtd\20212647_FFAR_GlenInnes_Warral_Boggabri\GlenInnes\Mapping\20212647_Fig4_SurveyEffort.mxd

4. RESULTS

4.1 PLANT DIVERSITY

A total of 33 plant species were identified during the assessment. These were comprised of 28 exotics and five native species (herbs and grasses). A complete list of flora species is presented in **Appendix 2**. The majority of the exotic plant species were comprised of annual herbs and grasses associated with the exotic grasslands (improved pasture).

4.2 WEEDS

Saffron Thistle *Carthamus lanatus* and Chilean Needle Grass *Nassella neesiana* are Priority listed weeds (DPI, 2020), which were identified in some areas such as near fence lines and along access tracks. Chilean Needle Grass is a Weeds of National Significance (DoEE, 2020c). Mitigation measures to prevent the spread of weeds are presented in **Section 5.2.**

4.3 PLANT COMMUNITY TYPES

The regional vegetation mapping is extremely broad (landscape level) and indicates that the study area and surrounds is vegetated mostly with non-native vegetation with a small patch of PCT 84 *River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion* in the south eastern corner. This PCT is dominated by *Casuarina cunninghamiana* (River Oak) and *Angophora floribunda* (Rough-barked Apple).

The assessment revealed that the entirety of the subject site is comprised of exotic grassland vegetation (improved pasture). This vegetation does not represent any of the PCT's which occur in the locality (**Figure 5**). The vegetation is dominated by exotic grass species such as Common Oat *Avena sativa,* Brome Grass *Bromus catharticus,* Great Brome *Bromus diandrus,* Bulbous Canary Grass *Phalaris aquatica* and Rigid Ryegrass *Lolium rigidum.* All of these species occur in high abundance. The vegetation can be described as improved pasture. Native species are limited to the occurrence of occasional native herb and grass species.

Copyright 2020 Kleinfelder

Isolated trees include planted species such as Weeping Willow *Salix babylonica,* Radiata Pine *Pinus radiata,* Hawthorn *Crataegus monogyna* and Poplar species *Populus* sp. No native tree species occur within the subject site. No native tree species were detected.

4.4 THREATENED ECOLOGICAL COMMUNITIES

The grasslands within the subject site are dominated by exotic species and do not represent any TEC's.

4.5 THREATENED FLORA SPECIES

No threatened flora species were identified within the subject site during the assessment.

A search of the BioNet Atlas of NSW Wildlife (DPIE, 2020a) returned three records of a threatened flora species within a 5 km radius of the subject site:

- Narrow-leaved Black Peppermint *Eucalyptus nicholii*.
- Bluegrass *Dichanthium setosum*.
- Austral Toadflax *Thesium australe*.

A "likelihood of occurrence' assessment determined that habitat is not present within the subject site for any State listed flora species (**Appendix 3**).

4.6 FAUNA HABITAT

The subject site was found to lack vegetation with a complex structure, shrubs and midstorey species were generally absent. The habitat is likely to support a low diversity of native fauna, including birds and mammal species common within agricultural landscapes. In summary, the fauna habitat assessment determined the following:

- The isolated trees within the subject site are planted species. They may provide marginal foraging and nesting habitat for common native bird species.
- The grasslands may provide foraging habitat for a range of native birds and terrestrial mammals such as macropods (Kangaroos and Wallabies).

Copyright 2020 Kleinfelder

- The grasslands may provide hunting habitat for native predatory birds, such as Falcons, Kestrels and Large Forest Owls.
- No hollow-bearing trees, nests, woody debris or rocky outcrops were identified within the subject site.
- The constructed dams do not contain aquatic or emergent vegetation and are unlikely to support an aquatic ecosystem containing a high diversity of aquatic species.

4.7 FAUNA SPECIES

Opportunistic fauna observations included sightings of common bird species. No threatened or migratory fauna were observed.

4.8 THREATENED FAUNA SPECIES

No threatened fauna species were detected within the subject site. A search of the BioNet Atlas of NSW Wildlife (DPIE, 2020a) returned a list of seven threatened fauna species that have previously been recorded within 5 km of the subject site:

- Black-necked Stork *Ephippiorhynchus asiaticus*.
- Little Eagle *Hieraaetus morphnoides*.
- Spotted-tailed Quoll *Dasyurus maculatus*.
- Koala *Phascolarctos cinereus*.
- Grey-headed Flying-fox *Pteropus poliocephalus*.
- Eastern False Pipistrelle *Falsistrellus tasmaniensis*.
- Narrow-leaved Black Peppermint *Eucalyptus nicholii*.
- Bluegrass *Dichanthium setosum*.
- Austral Toadflax *Thesium australe*.
- Large Bent-winged Bat *Miniopterus orianae oceanensis*.

A “likelihood of occurrence” assessment determined that the habitat is too degraded and does not contain suitable habitat to support populations of any of these species (**Appendix 3**).

Copyright 2020 Kleinfelder

4.9 KOALA HABITAT

The majority of the subject site has been previously developed for agriculture. Isolated trees are introduced and are not listed as a preferred Koala food tree species under Schedule 2 of the SEPP for Koala Habitat Protection (2019).

An assessment of Koala habitat within the subject site determined that no Highly Suitable Koala Habitat, or Core Koala Habitat is present. This is based on the following:

- No Koala feed trees within the subject site.
- No evidence of a resident population of Koalas was detected during the assessment (i.e. No Koala individuals, scats or scratch marks were identified).

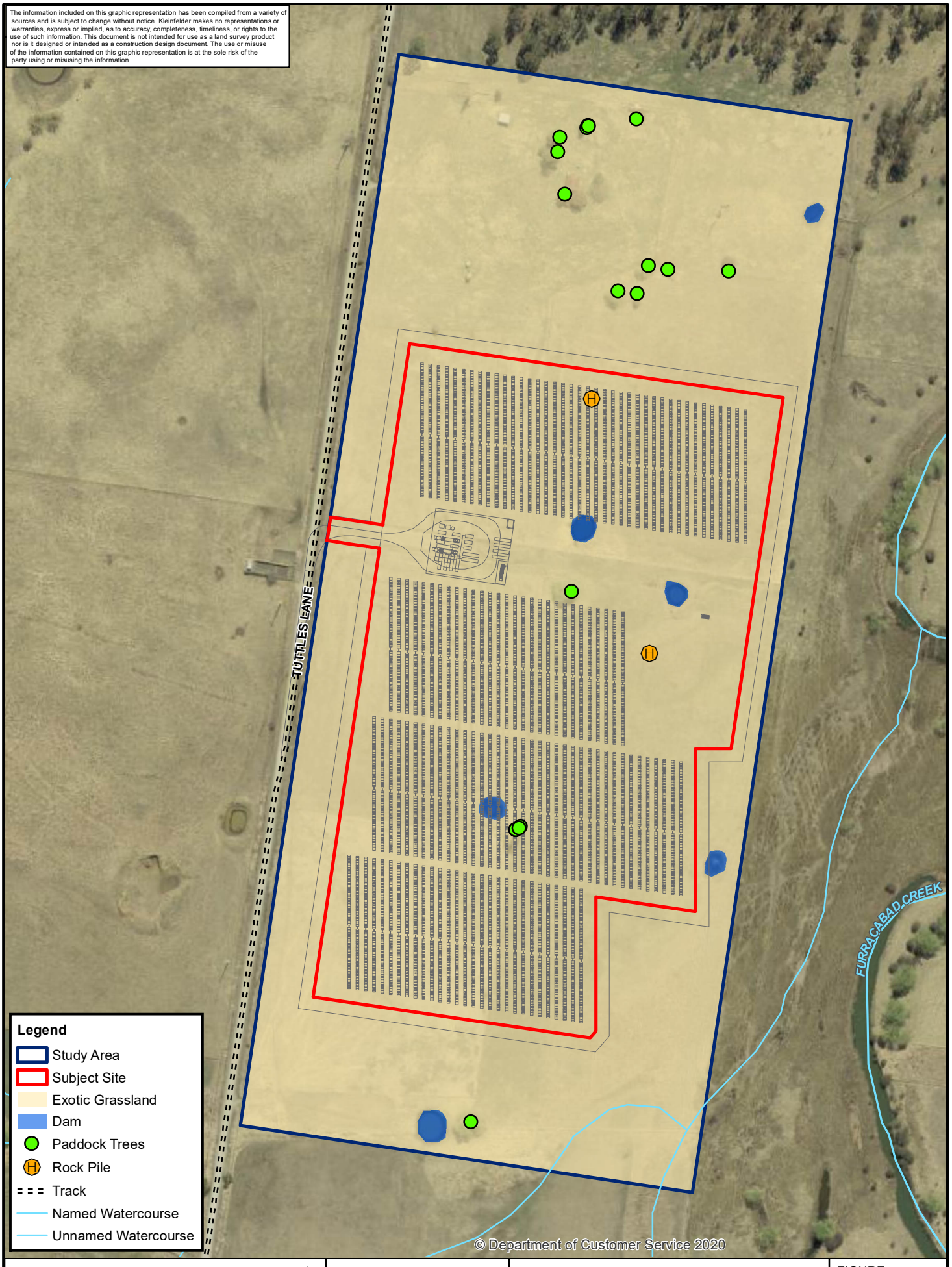
4.10 EPBC ACT PROTECTED MATTERS

A 'likelihood of occurrence' assessment was conducted for all threatened species and migratory species returned by the EPBC Protected Matters Search (**Appendix 3**).

The habitats present within the subject site is considered to be too degraded for all species, with the exception of the White-throated Needletail *Hirundapus caudacutus,* which may aerially forage over a very wide range of habitats including vegetated and non-vegetated areas. The proposed development will not remove habitat features considered to be important to these species. The extent of foraging habitat is likely to be unaffected.

Copyright 2020 Kleinfelder

The information included on this graphic representation has been compiled from a variety of sources and is subject to change without notice. Kleinfelder makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information. This document is not intended for use as a land survey product nor is it designed or intended as a construction design document. The use or misuse of the information contained on this graphic representation is at the sole risk of the party using or misusing the information.



Metres
0 25 50 100 150 200
N

KLEINFELDER
Bright People. Right Solutions.
www.kleinfelder.com

PROJECT REFERENCE: 20212647

DATE DRAWN: 2020/12/04 16:11 Version 1

DRAWN BY: GJoyce

DATA SOURCE:
NSW DFSI - 2020
KDC - 2020

Vegetation Mapping and Habitat Trees

Flora and Fauna Assessment Report
Glen Innes Solar Farm
Tuttles Lane
Glen Innes NSW

FIGURE:

5

L:\GIS FOLDER\00 CLIENT FILES\130060_KDC_PtyLtd\20212647_FFAR_GlenInnes_Warral_Boggabri\GlenInnes\Mapping\20212647_Fig5_Vegetation_HabitatTrees.mxd

5. DISCUSSION

5.1 IMPACT ASSESSMENT

5.1.1 Removal of Native Vegetation

Vegetation to be removed consists of exotic grasslands and planted non-native paddock trees, negligible amounts of native groundcover will be removed.

5.1.2 Impacts to Fauna

Potential indirect impacts of the proposed development on resident fauna populations include the following:

- Noise and lighting during the construction phase may cause minor disturbance to resident fauna within the locality and disrupt their natural behaviour.
- Pollution such as chemical spills from construction machinery may have adverse effects on the water quality of downstream aquatic habitat.
- Ground disturbance by machinery during the construction phase may create dust and facilitate the movement of sediment. Sedimentation could adversely affect the water quality within the constructed dams.

Management measures are presented in **Section 5.2** to reduce the potential for these impacts.

5.1.3 Impacts to Threatened Species

No threatened species were identified during the assessment. A “likelihood of occurrence” assessment determined that habitat does not occur within the subject site as it the subject site is too degraded.

5.1.4 Impacts to Threatened Ecological Communities

No TECs were identified within the subject site.

Copyright 2020 Kleinfelder

Noise Assessment

Glen Innes Solar Farm
Glen Innes, NSW

Prepared for: Providence Asset Group
December 2020
MAC201186-01RP1

Muller Acoustic Consulting

Document Information

Noise Assessment

Glen Innes Solar Farm

Glen Innes, NSW

Prepared for: Providence Asset Group

704/99 Bathurst Street

Sydney NSW 2000

Prepared by: Muller Acoustic Consulting Pty Ltd

PO Box 262, Newcastle NSW 2300

ABN: 36 602 225 132

P: +61 2 4920 1833

www.mulleracoustic.com

DOCUMENT ID	STATUS	DATE	PREPARED	SIGNED	REVIEWED	SIGNED
MAC201186-01RP1	Final	14 December 2020	Rod Linnett		Oliver Muller	

DISCLAIMER

All documents produced by Muller Acoustic Consulting Pty Ltd (MAC) are prepared for a particular client's requirements and are based on a specific scope, circumstances and limitations derived between MAC and the client. Information and/or report(s) prepared by MAC may not be suitable for uses other than the original intended objective. No parties other than the client should use or reproduce any information and/or report(s) without obtaining permission from MAC. Any information and/or documents prepared by MAC is not to be reproduced, presented or reviewed except in full.

CONTENTS

1 INTRODUCTION 5

1.1 PURPOSE AND OBJECTIVES 5

1.2 SCOPE OF THE ASSESSMENT 5

2 PROJECT DESCRIPTION 7

2.1 BACKGROUND 7

2.2 DESCRIPTION OF PROPOSED CONSTRUCTION WORKS 7

2.3 DESCRIPTION OF PROPOSED OPERATION 8

2.3.1 RECEIVER REVIEW 8

3 NOISE POLICY AND GUIDELINES 11

3.1 INTERIM CONSTRUCTION NOISE GUIDELINE 11

3.1.1 STANDARD HOURS FOR CONSTRUCTION 11

3.1.2 OUT OF HOURS CONSTRUCTION 12

3.1.3 CONSTRUCTION NOISE MANAGEMENT LEVELS 13

3.1.4 CONSTRUCTION SLEEP DISTURBANCE 14

3.2 NOISE POLICY FOR INDUSTRY 15

3.2.1 PROJECT NOISE TRIGGER LEVELS (PNTL) 16

3.2.2 RATING BACKGROUND LEVEL (RBL) 16

3.2.3 PROJECT INTRUSIVENESS NOISE LEVEL (PINL) 16

3.2.4 PROJECT AMENITY NOISE LEVEL (PANL) 16

3.2.5 MAXIMUM NOISE ASSESSMENT TRIGGER LEVELS 19

3.3

4 NOISE ASSESSMENT CRITERIA 21

4.1

4.2

4.3

4.3.1 PROJECT INTRUSIVENESS NOISE LEVELS 22

4.3.2 PROJECT AMENITY NOISE LEVELS 23

4.3.3 PROJECT NOISE TRIGGER LEVELS 24

4.4 MAXIMUM NOISE ASSESSMENT TRIGGER LEVELS 24

4.5 ROAD TRAFFIC NOISE CRITERIA 24
5 MODELLING METHODOLOGY 27
5.1 CONSTRUCTION ASSESSMENT METHODOLOGY 27
5.2 OPERATIONAL ASSESSMENT METHODOLOGY 29
5.2.1 METEOROLOGICAL ANALYSIS 29
5.3 ROAD TRAFFIC NOISE ASSESSMENT METHODOLOGY 30
6 NOISE ASSESSMENT RESULTS 31
6.1 CONSTRUCTION NOISE ASSESSMENT 31
6.2 OPERATIONAL NOISE ASSESSMENT 32
6.3 MAXIMUM NOISE LEVEL ASSESSMENT 34
6.4 ROAD TRAFFIC NOISE ASSESSMENT 34
7 DISCUSSION AND CONCLUSION 35
APPENDIX A – GLOSSARY OF TERMS

1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Providence Asset Group (PAG) to prepare a Noise Assessment (NA) for the proposed Glen Innes Solar Farm near Glen Innes, NSW (the 'project'). This report presents the methodology and findings of the NA for the construction and operation of the project.

1.1 Purpose and Objectives

A NA is required as part of the environmental assessment to be submitted to Glen Innes Severn Shire Council as part of the Development Application (DA). The purpose of the NA is to quantify potential environmental noise emissions associated with the construction and operation of the project. Where impacts are identified, the assessment includes recommendations for potential noise mitigation and management measures.

1.2 Scope of the Assessment

The NA includes the following key tasks:

- review construction and operating activities to identify key noise generating plant, equipment, machinery or activities proposed to be undertaken as part of the project;
- identify the closest and/or potentially most affected receivers situated within the area of influence to the project;
- determine project-specific construction Noise Management Levels (NMLs), and operational noise criteria;
- undertake 3D noise modelling to predict levels that may occur as a result of the construction and operation of the project at the closest and/or potentially most affected receivers;
- provide a comparison of predicted noise levels against relevant construction and operational criteria;
- assess the potential noise impacts associated with construction and operational aspects of the project
- assess the potential noise impacts associated with road traffic noise during construction; and
- provide feasible and reasonable noise mitigation and management measures, and monitoring options, where criteria may be exceeded.

The assessment has been undertaken in accordance with the following documents:

- NSW Department of Environment and Climate Change (DECCW) – NSW Interim Construction Noise Guideline (ICNG), July 2009;
- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI) 2017;
- NSW Department of Environment, Climate Change and Water (DECCW) – NSW Road Noise Policy (RNP), March 2011;
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise - General Procedures; and
- International Standard ISO 9613:1993 - Acoustics - Attenuation of sound during propagation outdoors.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

2 Project Description

2.1 Background

PAG propose to construct and operate a 5 Megawatt (MW) solar farm using photovoltaic (PV) technology at Tuttles Lane, Glen Innes, NSW approximately 1km west of Glen Innes, NSW.

2.2 Description of Proposed Construction Works

The project includes installation of groups of north facing PV modules on mounting structures of 1.3m to 1.5m in height. Approximately 11,000 PV panels will be installed using a single axis tracking system, tilting along the north-south axis. The PV mounting structure would comprise steel posts driven into the ground using a small pile driver. Additional support structures would be attached to the piles, which would then support the PV panels.

Where cabling of each PV array/module to inverters is required to be underground, earthworks will primarily involve trenching. Other minor earthworks would be completed for the preparation of the site and in most cases a concrete slab would be required to support the ancillary infrastructure. Most of the infrastructure would be pre-fabricated off-site, delivered and assembled on-site.

It is anticipated that the solar farm would be constructed in stages, with two to three stages in construction at any one time over a six month period during standard construction hours.

All vehicles would access the project via Tuttles Lane from the Gwydir Highway during construction and operational phases.

During construction, traffic generated by the project would include employee and delivery vehicles. During the peak construction period, the daily traffic volume is expected to be up to four heavy vehicles (semi-trailers or B-doubles) per hour and 20 light commercial vehicles or equivalent for worker transport during the morning and afternoon peaks.

2.3 Description of Proposed Operation

PV infrastructure on site will comprise of groups of PV panels installed in rows running north to south. The PV modules will be on a single axis tracker system which will follow the sun and move in an east to west direction. Electrical cabling would be attached beneath the modules and would connect the individual PV modules to each other. Inverters will be located centrally and connected by underground cables. The project will be contained solely within the site as shown in .

The project would operate 24 hours a day, 7 days a week, with no permanent staff on site. During operation, the PV panels would generate electricity which would be fed into the power grid via the adjacent existing powerline. Key noise emissions from the operation of the project are associated with the inverter and transformer(s). It is noted that emissions from these sources are anticipated to be acoustically insignificant compared to ambient background noise levels at assessed receivers.

When required, maintenance activities will occur during standard working hours (except for emergencies) and are expected to include:

- panel cleaning;
- repairs or replacement of infrastructure, as required; and
- land management including mowing to control vegetation as required.

Typical noise sources associated with maintenance activities would include light vehicle movements on site and maintenance of equipment.

2.3.1 Receiver Review

Using aerial photography, geospatial information and other project design information, MAC has identified the following potentially sensitive receivers that may be affected by noise from operation or construction activities and project related road traffic. **Table 1** presents a summary of receiver identification, type, address and coordinates. These are reproduced visually in **Figure 1**.

Table 1 Receiver Locations				
Receiver	Description	Receiver Type	Coordinates (GDA94/MGA56)	
			Easting	Northing
IND1	Glen Innes Zone Substation	Industrial	375472	6710094
R01	185 Strathbogie Road	Residential	375266	6711889
R02	123 Strathbogie Road	Residential	375653	6711647
R03	134 Strathbogie Road	Residential	375739	6711847
R04	154 Strathbogie Road	Residential	375704	6712146
R05	176 Tuttles Lane	Residential	374831	6712036
R06	257 Strathbogie Road	Residential	374360	6712408
R07	168 Abbotts Road	Residential	374143	6712343
R08	189 Abbotts Road	Residential	373873	6712218
R09	137 Abbotts Road	Residential	373842	6711943
R10	123 Abbotts Road	Residential	373897	6711768
R11	124 Abbotts Road	Residential	374055	6711761
R12	121 Abbotts Road	Residential	373816	6711579
R13	65 Abbotts Road	Residential	373613	6711234
R14	Corner Abbotts Road/Gwydir Highway	Residential	373875	6710612
R15	505 Gwydir Highway	Residential	373203	6710473
R16	485 Gwydir Highway	Residential	373388	6710476
R17	477 Gwydir Highway	Residential	373402	6710330
R18	449 Gwydir Highway	Residential	373708	6710466
R19	437 Gwydir Highway	Residential	373854	6710430
R20	425 Gwydir Highway	Residential	373969	6710406
R21	409 Gwydir Highway	Residential	374173	6710303
R22	268 Furracabad Road	Residential	375049	6709632
R23	2 Bradleys Lane	Residential	375433	6709462
R24	2 Wellingrove Street	Residential	375753	6710527
R25	1 Wellingrove Street	Residential	375722	6710423
R26	48 Ferguson Street	Residential	375839	6710317
R27	50 Ferguson Street	Residential	375868	6710203
R28	60 Ferguson Street	Residential	376006	6710182
R29	200 Dumaresq Street	Residential	376168	6710401
R30	214 Dumaresq Street	Residential	376191	6710649
R31	154 Derby Street	Residential	376463	6710890
R32	4 Grafton Street	Residential	376639	6711117
R33	19 Ferguson Street	Residential	376192	6710046
R34	1 Meade Street	Residential	376166	6709898


FIGURE 1
Project Layout
MAC201186-01
Glen Innes Solar Farm
KEY
Receivers
Access Route
Panel Array
Project Boundary
0
200
400
600
800 m
N
MAC
Muller Acoustic Consulting
R01
R02
R03
R04
R05
R06
R07
R08
R09
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R31
R32
R33
R34
IND1
STRATHBOGIE ROAD
EMMAVILLE ROAD
MARTIN STREET
TUTTLES LANE
ABBOTTS ROAD
GWYDIR HIGHWAY
WEST FURRACABAD ROAD
FURRACABAD ROAD
BRADLEYS LANE
FERGUSON STREET
TAYLOR STREET
DERBY STREET
WRIGLEY LANE
CORONATION AVENUE
DUMARESQ STREET
BOURKE STREET
LEWIS STREET
UTZ LANE
WENTWORTH STREET
RAILWAY STREET
DIGBY STREET
LANG STREET
DUNN AVENUE
ABBOTT ST

3 Noise Policy and Guidelines

3.1 Interim Construction Noise Guideline

The ICNG sets out procedures to identify and address the impacts of construction noise on residences and other sensitive land uses. This section provides a summary of noise objectives that are applicable to the assessment. The ICNG provides two methodologies for the assessment of construction noise emissions:

- Quantitative, which is suited to major construction projects with typical durations of more than three weeks; and
- Qualitative, which is suited to short term infrastructure maintenance (< three weeks).

The qualitative assessment methodology is a more simplified approach that relies on noise management strategies. This study has adopted a quantitative assessment approach which is summarised in **Figure 2.** The quantitative approach includes identification of potentially affected receivers, derivation of the construction noise management levels, quantification of potential noise impact at receivers via predictive modelling and, provides management and mitigation recommendations.

3.1.1 Standard Hours for Construction

Table 2 summaries the ICNG recommended standard hours for construction works

Table 2 Recommended Standard Hours for Construction

Daytime	Construction Hours
Monday to Friday	7am to 6pm
Saturdays	8am to 1pm
Sundays or Public Holidays	No construction

These recommended hours do not apply in the event of direction from police, or other relevant authorities, for safety reasons or where required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

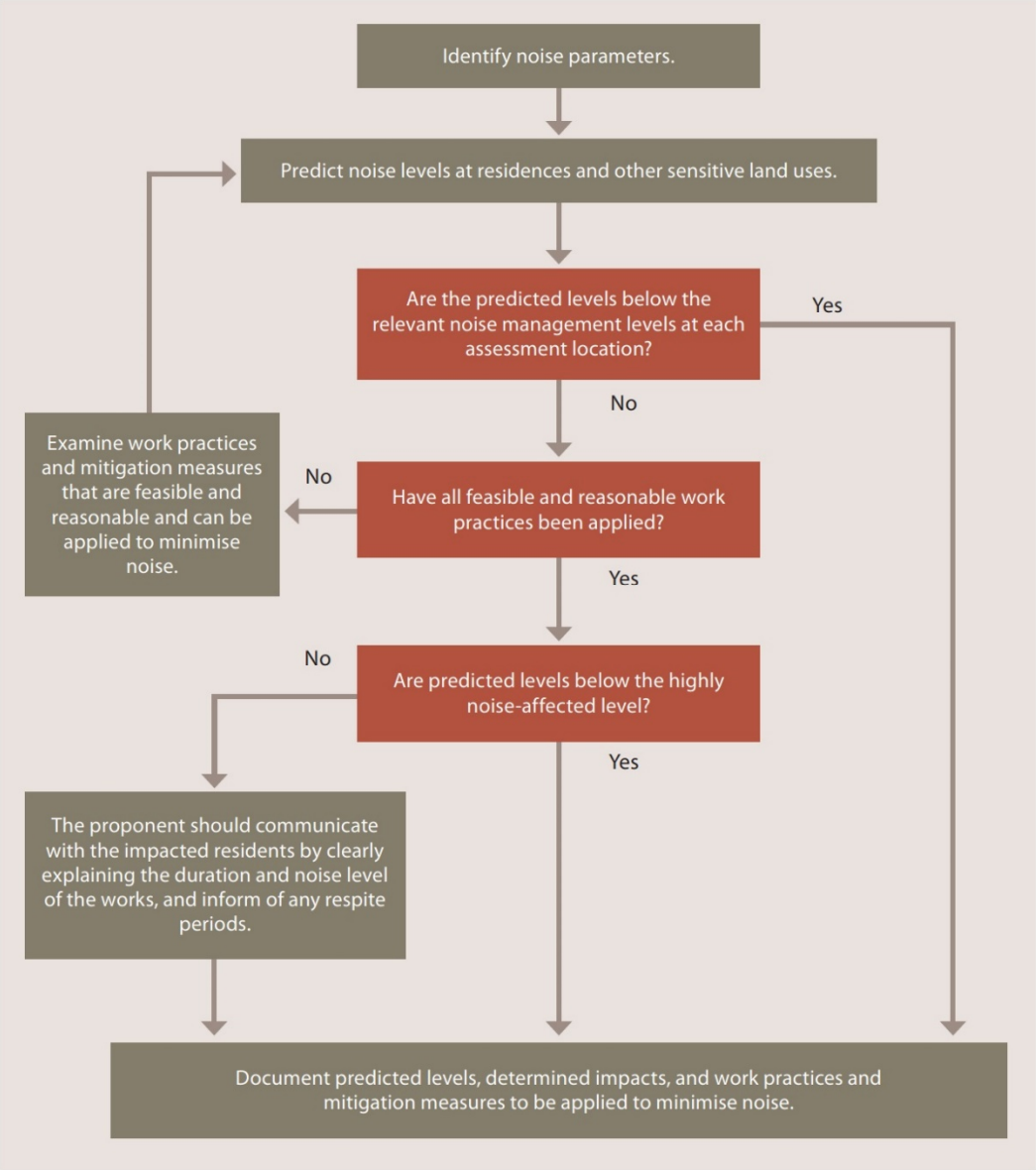
Construction activities are anticipated to be undertaken during standard construction hours.

3.1.2 Out of Hours Construction

Works conducted outside of recommended standard hours are considered out of hours work (OOH). The ICNG suggests that any request to vary the hours of construction activities as identified above shall be:

- considered on a case by case basis or activity-specific basis;
- accompanied by details of the nature and need for activities to be undertaken during the varied construction hours; and
- accompanied by written evidence that activities undertaken during the varied construction hours are strongly justified; appropriate consultation with potentially affected receivers and notification of the relevant regulatory authorities has occurred; and all practicable and reasonable mitigation measures will be put in place.

Figure 2 Quantitative Assessment Processes for Assessing and Managing Construction Noise



Source: Department of Environment and Climate Change, 2009.

3.1.3 Construction Noise Management Levels

Section 4 of the ICNG (DECC, 2009) details the quantitative assessment method involving predicting noise levels and comparing them with the Noise Management Level (NML) and are important indicators of the potential level of construction noise impact. **Table 3** reproduces the ICNG Noise Management Level (NML) for residential receivers. The NML is determined by adding 10dB (standard hours) or 5dB (OOH) to the Rating Background Level (RBL) for each specific assessment period.

Table 3 Noise Management Levels		
Time of Day	Management Level LAeq(15min)[1]	How to Apply
Recommended standard hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or public holidays.	Noise affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured LAeq(15min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of work to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dBA	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 work near schools, or mid-morning or mid-afternoon for work near residences; and 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 strong justification would typically be required for work 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 5dBA above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2.

Note 1: The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the construction noise management levels for noise assessment purposes and is the median of the ABL's.

3.1.4 Construction Sleep Disturbance

Section 4.3 of the ICNG (DECC, 2009) states that a sleep disturbance assessment is required where construction activities are planned to occur for more than two consecutive nights. Given that construction activities are anticipated to occur during standard construction hours, sleep disturbance has not been considered in this assessment.

3.2 Noise Policy for Industry

The EPA released the Noise Policy for Industry (NPI) in October 2017 which provides a process for establishing noise criteria for consents and licenses enabling the EPA to regulate noise emissions from scheduled premises under the Protection of the Environment Operations Act 1997.

The objectives of the NPI are to:

- provide noise criteria that is used to assess the change in both short term and long-term noise levels;
- provide a clear and consistent framework for assessing environmental noise impacts from industrial premises and industrial development proposals;
- promote the use of best-practice noise mitigation measures that are feasible and reasonable where potential impacts have been identified; and
- support a process to guide the determination of achievable noise limits for planning approvals and/or licences, considering the matters that must be considered under the relevant legislation (such as the economic and social benefits and impacts of industrial development).

The policy sets out a process for industrial noise management involving the following key steps:

1. Determine the Project Noise Trigger Levels (PNTLs) (ie criteria) for a development. These are the levels (criteria), above which noise management measures are required to be considered. They are derived by considering two factors: shorter-term intrusiveness due to changes in the noise environment; and maintaining the noise amenity of an area.
2. Predict or measure the noise levels produced by the development with regard to the presence of annoying noise characteristics and meteorological effects such as temperature inversions and wind.
3. Compare the predicted or measured noise level with the PNTL, assessing impacts and the need for noise mitigation and management measures.
4. Consider residual noise impacts - that is, where noise levels exceed the PNTLs after the application of feasible and reasonable noise mitigation measures. This may involve balancing economic, social and environmental costs and benefits from the proposed development against the noise impacts, including consultation with the affected community where impacts are expected to be significant.

5. Set statutory compliance levels that reflect the best achievable and agreed noise limits for the development.

6. Monitor and report environmental noise levels from the development.

3.2.1 Project Noise Trigger Levels (PNTL)

The policy sets out the procedure to determine the PNTLs relevant to an industrial development. The PNTL is the lower (ie, the more stringent) of the **Project Intrusiveness Noise Level** (PINL) and **Project Amenity Noise Level** (PANL) determined in accordance with Section 2.3 and Section 2.4 of the NPI.

3.2.2 Rating Background Level (RBL)

The Rating Background Level (RBL) is a determined parameter from noise monitoring and is used for assessment purposes. As per the NPI, the RBL is an overall single figure background level representing each assessment period (day, evening and night) over the noise monitoring period.

3.2.3 Project Intrusiveness Noise Level (PINL)

The PINL ($LA_{eq(15min)}$) is the RBL + 5dB and seeks to limit the degree of change a new noise source introduces to an existing environment. Hence, when assessing intrusiveness, background noise levels need to be measured.

3.2.4 Project Amenity Noise Level (PANL)

The PANL is relevant to a specific land use or locality. To limit continuing increases in intrusiveness levels, the ambient noise level within an area from all combined industrial sources should remain below the recommended amenity noise levels specified in Table 2.2 (of the NPI). The NPI defines two categories of amenity noise levels:

- **Amenity Noise Levels (ANL)** – are determined considering all current and future industrial noise within a receiver area; and
- **Project Amenity Noise Level (PANL)** – is the recommended level for a receiver area, specifically focusing the project being assessed.

Additionally, Section 2.4 of the NPI states: “to ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows”:

PANL for new industrial developments = recommended **ANL** minus 5dBA.

The following exceptions apply when deriving the PANL:

- areas with high traffic noise levels;
- proposed developments in major industrial clusters;
- existing industrial noise and cumulative industrial noise effects; and
- greenfield sites.

Where relevant this assessment has considered influences of traffic with respect to amenity noise levels (ie areas where existing traffic noise levels are 10dB greater than the recommended amenity noise level).

The recommended amenity noise levels as per Table 2.2 of the NPI are reproduced in **Table 4**.

Table 4 Amenity Criteria			
Receiver Type	Noise Amenity Area	Time of day	Recommended amenity noise level dB LAeq(period)
Residential	Rural	Day	50
		Evening	45
		Night	40
	Suburban	Day	55
		Evening	45
		Night	40
	Urban	Day	60
		Evening	50
		Night	45
Hotels, motels, caretakers' quarters, holiday accommodation, permanent resident caravan parks.	See column 4	See column 4	5dB above the recommended amenity noise level for a residence for the relevant noise amenity area and time of day
School Classroom	All	Noisiest 1-hour period when in use	35 (internal) 45 (external)
Hospital ward			
- internal	All	Noisiest 1-hour	35
- external	All	Noisiest 1-hour	50
Place of worship - internal	All	When in use	40
Passive Recreation	All	When in use	50
Active Recreation	All	When in use	55
Commercial premises	All	When in use	65
Industrial	All	When in use	70

Notes: The recommended amenity noise levels refer only to noise from industrial noise sources. However, they refer to noise from all such sources at the receiver location, and not only noise due to a specific project under consideration. The levels represent outdoor levels except where otherwise stated.

Types of receivers are defined as rural residential; suburban residential; urban residential; industrial interface; commercial; industrial – see Table 2.3 and Section 2.7 of the NPI.

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

3.2.5 Maximum Noise Assessment Trigger Levels

The potential for sleep disturbance from maximum noise level events from a project during the night-time period needs to be considered. The NPI considers sleep disturbance to be both awakenings and disturbance to sleep stages.

Where night-time noise levels from a development/premises at a residential location exceed the following criteria, a detailed maximum noise level event assessment should be undertaken:

- $L_{Aeq(15min)}$ 40dB or the prevailing RBL plus 5dBA, whichever is the greater, and/or
- L_{Amax} 52dB or the prevailing RBL plus 15dBA, whichever is the greater.

A detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

Other factors that may be important in assessing the impacts on sleep disturbance include:

- how often the events would occur;
- the distribution of likely events across the night-time period and the existing ambient maximum events in the absence of the development;
- whether there are times of day when there is a clear change in the noise environment (such as during early morning shoulder periods); and
- current understanding of effects of maximum noise level events at night.

3.3 Road Noise Policy

The road traffic noise criteria are provided in the Department of Environment, Climate Change and Water NSW (DECCW), Road Noise Policy (RNP), 2011. The policy sets out noise criteria applicable to different road classifications for the purpose of quantifying traffic noise impacts. Road noise criteria relevant to this assessment are presented in detail in Section 4.5.

This page has been intentionally left blank

4 Noise Assessment Criteria

Background noise monitoring has not been conducted for this project and hence, the minimum applicable Rating Background Levels (RBL) of 35dBA for the daytime period and 30dBA for the evening and night time periods have been adopted in accordance with NPI methodology.

4.1 Construction Noise Criteria

The relevant Noise Management Levels (NMLs) for standard construction hours are presented in Table 5.

Table 5 Construction Noise Management Levels

Receiver Type	Assessment Period	Adopted RBL dB LA_{90}	NML dB $LA_{eq(15min)}$
Urban Residential	Standard Hours	35	45 (RBL+10dBA)
Suburban Residential	Standard Hours	35	45 (RBL+10dBA)
Rural Residential	Standard Hours	35	45 (RBL+10dBA)
Educational	When in use	N/A	45 (internal) 60 (external)[1]
Hospital Wards	When in use	N/A	45 (internal) 60 (external)[1]
Place of Worship	When in use	N/A	45 (internal) 60 (external)[1]
Active Recreation Areas	When in use	N/A	65 (external)
Passive Recreation Areas	When in use	N/A	60 (external)
Industrial Premises	When in use	N/A	75 (external)
Community Centres	When in use	N/A	Refer to AS2107 for maximum internal levels and specific use
Commercial Premises	When in use	N/A	70 (external)

Note 1: External level based on 15dB loss through partially open window.

4.2 Construction Vibration

Department of Environment and Conservation (DEC) 2006, *Assessing Vibration: A Technical Guideline* (the 'Guideline') provides guidance on determining effects of vibration on buildings occupants. The guideline does not address vibration induced damage to structures, blast induced vibration effects or structure borne noise effects.

The Construction Noise & Vibration Strategy (CNVS, V4.1 Transport for NSW, 2019) sets out safe working distances to achieve the human response criteria for vibration. The key vibration generating source proposed to be used is small pile driver used to drive the piles into the ground on which the PV mounting structures are mounted and vibratory roller for road construction. The CNVS sets a safe working distance of 50m for a hammer piling rig and 100m for a large vibratory roller to achieve the residential human response criteria for continuous vibration. Therefore, as the nearest non project related receivers to the project are greater than 100m from the project boundary, human exposure to vibration is anticipated to be minimal. Furthermore, where the human response criteria are satisfied, the structural or cosmetic criteria for sensitive receivers will be achieved. Therefore, vibration impacts are not considered to be a significant issue and have not been considered further in this assessment.

4.3 Operational Noise Criteria

4.3.1 Project Intrusiveness Noise Levels

The PINLs for the project are presented in **Table 6** and have been determined based on the RBLs +5dBA.

Table 6 Project Intrusiveness Noise Levels

Receiver	Period[1]	Adopted RBL dB LA90(period)	PINL dB LAeq(15min)
All Residential Receivers	Day	35	40
	Evening	30	35
	Night	30	35

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.3.2 Project Amenity Noise Levels

The PANL for residential receivers and other receiver types (ie non-residential) potentially affected by the project are presented in **Table 7.**

Table 7 Amenity Noise Levels and Project Amenity Noise Levels

Receiver Type	Noise Amenity Area	Assessment Period[1]	Recommended ANL dB $LA_{eq(period)}$	ANL dB $LA_{eq(period)}$[2]	PANL dB $LA_{eq(15min)}$[3]
Residential	Rural	Day	50	45	48
		Evening	45	40	43
		Night	40	35	38
Residential	Suburban	Day	55	50	53
		Evening	45	40	43
		Night	40	35	38
Residential	Urban	Day	60	55	58
		Evening	50	45	48
		Night	45	40	43
Hotels Motels	Rural/Urban/ Suburban	Day	ANL +5dB	ANL +5dB	ANL +5dB
		Evening	ANL +5dB	ANL +5dB	ANL +5dB
		Night	ANL +5dB	ANL +5dB	ANL +5dB
Educational		When in use	35 (internal 1 hr)	30 (internal 1 hr)	33 (internal 1 hr) 48 (external 1 hr)[4]
Hospital Wards		When in use	35 (internal 1 hr) 50 (external 1 hr)	30 (internal 1 hr) 45 (external 1 hr)	33 (internal 1 hr) 48 (external 1 hr)
Place of worship		When in use	40 (internal)	35 (internal 1 hr)	38 (internal 1 hr) 53 (external 1 hr)[4]
Passive Recreation		When in use	50	45	48
Active Recreation		When in use	55	50	53
Commercial		When in use	65	60	63
Industrial		When in use	70	65	68
Industrial Interface		When in use	ANL +5dB	ANL +5dB	ANL +5dB

Note 1: Monday – Saturday, Day 7am to 6pm; Evening 6pm to 10pm; Night 10pm to 7am. On Sundays and Public Holidays, Day 8am to 6pm; Evening 6pm to 10pm; Night 10pm to 8am.
Note 2: Project Amenity Noise Level equals the Amenity Noise Level as there is no other industry in the area.
Note 3: Includes a +3dB adjustment to the amenity period level to convert to a 15-minute assessment period as per Section 2.2 of the NPI.
Note 4: External level based on 15dB loss through partially open window.

4.3.3 Project Noise Trigger Levels

The PNTLs are the lower of either the PINLs or the PANLs. **Table 8** presents the derivation of the PNTLs in accordance with the methodologies outlined in the NPI. For this assessment the night time PNTL of 35dB $L_{Aeq(15min)}$ is the limiting criteria for residential receivers.

Table 8 Project Noise Trigger Levels

Catchment	Assessment Period[1]	PINL dB $L_{Aeq(15min)}$	PANL dB $L_{Aeq(15min)}$	PNTL dB $L_{Aeq(15min)}$
Residential Receivers (Rural)	Day	40	53	40
	Evening	35	48	35
	Night	35	43	35
Industrial	When in use	--	68	68

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

4.4 Maximum Noise Assessment Trigger Levels

The maximum noise trigger levels shown in **Table 9** are based on night time RBLs and trigger levels as per Section 2.5 of the NPI. The trigger levels will be applied to transient noise events that have the potential to cause sleep disturbance.

Table 9 Maximum Noise Trigger Level

L1 Rural Residential Receivers	
52dB L_{Amax} or RBL + 15dB	
Trigger	52
RBL 30+15dB	45
Highest	**52**

Note: Monday to Saturday; Night 10pm to 7am. On Sundays and Public Holidays Night 10pm to 8am.
Note: NPI identifies that maximum of the two values is to be adopted which is shown in bold font.

4.5 Road Traffic Noise Criteria

The road traffic noise criteria are provided in the RNP. For this assessment, the 'sub arterial road' category for Tuttles Lane has been adopted. It is acknowledged that the functional classification of Tuttles Lane is a 'Collector Road' in accordance with the Roads and Maritime Noise Criteria Guideline (April 2015). However, the Road Noise Policy does not provide separate noise criteria for Collector Roads but applies the sub-arterial category to all roads that are not classified as local roads. The relevant road traffic noise criteria are provided in the RNP and are presented in **Table 10** for residential receivers.

Table 10 Road Traffic Noise Assessment Criteria			
Road category	Type of project/development	Assessment Criteria – dBA	
		Day (7am to 10pm)	Night (10pm to 7am)
Freeways/arterial/ sub-arterial Roads	Existing residences affected by additional traffic on freeways/arterial/sub-arterial roads generated by land use developments	60dB LAeq(15hr)	55dB LAeq(9hr)
Local roads	Existing residences affected by additional traffic on local roads generated by land use developments	55dB LAeq(1hr)	50dB LAeq(1hr)
School Classrooms	Proposed road projects and traffic generating developments	40dB LAeq(1hr) (internal) when in use	N/A
Hospital Wards		35dB LAeq(1hr) (internal)	35dB LAeq(1hr) (internal)
Places of Worship		40dB LAeq(1hr) (internal)	40dB LAeq(1hr) (internal)
Open Space (active use)		60dB LAeq(1hr)	N/A
Open Space (passive use)		55dB LAeq(1hr)	N/A
Isolated residences in commercial or industrial zones		Refer to AS2107 for internal levels	
Mixed Use development		Each component to be considered separately	
Childcare Facilities		Sleeping rooms 35dB LAeq(1hr) (internal) Indoor play areas 40dB LAeq(1hr) (internal) Outdoor play areas 55dB LAeq(1hr) (external)	

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2dBA, which is generally accepted as the threshold of perceptibility to a change in noise level.

This page has been intentionally left blank

5 Modelling Methodology

A computer model was developed to quantify project noise emissions to neighbouring receivers for typical construction activities and operations. DGMR (iNoise, Version 2020.0) noise modelling software was used to quantify noise emissions from typical construction activities and operations. iNoise is a new intuitive and quality assured software for industrial noise calculations in the environment. 3D noise modelling is considered industry best practice for assessing noise emissions from projects.

The model incorporated a three-dimensional digital terrain map giving all relevant topographic information used in the modelling process. Additionally, the model uses relevant noise source data, ground type, attenuation from barrier or buildings and atmospheric information to predict noise levels at the nearest potentially affected receivers. Where relevant, modifying factors in accordance with Fact Sheet C of the NPI have been applied to calculations.

The model calculation method used to predict noise levels was in accordance with ISO 9613-1 'Acoustics - Attenuation of sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere' and ISO 9613-2 'Acoustics - Attenuation of sound during propagation outdoors. Part 2: General method of calculation' including corrections for meteorological conditions using CONCAWE[1]. The ISO 9613 standard from 1996 is the most used noise prediction method worldwide. Many countries refer to ISO 9613 in their noise legislation. However, the ISO 9613 standard does not contain guidelines for quality assured software implementation, which leads to differences between applications in calculated results. In 2015 this changed with the release of ISO/TR 17534-3. This quality standard gives clear recommendations for interpreting the ISO 9613 method. iNoise fully supports these recommendations. The models and results for the 19 test cases are included in the software.

5.1 Construction Assessment Methodology

Construction activities are proposed to be progressive (trenching, piling and assembly) and will occur at several locations simultaneously. Noise emissions were modelled for the following four scenarios:

- earthworks for internal roads and compound construction including the stripping of topsoil and unsuitable soil and the placement and compaction of road base for internal roads;
- earthworks involving trenching for cabling;
- piling of panel supports; and
- assembly of the panels.

[1] Report no. 4/18, "the propagation of noise from petroleum and petrochemical complexes to neighbouring communities", Prepared by C.J. Manning, M.Sc., M.I.O.A. Acoustic Technology Limited (Ref.AT 931), CONCAWE, Den Haag May 1981

It is envisaged that all four construction scenarios have the potential to occur simultaneously at up to two key locations across the site. Noise emission data and assumptions used in this assessment are summarised in **Table 11**. All significant noise generating construction activities will be limited to standard construction hours. Where low intensity construction activities are required to be undertaken outside standard construction hours, such as cabling, minor assembly, use of hand tools etc, they will be managed such that they are not audible at any residential receivers.

Table 11 Construction Equipment Sound Power Levels, Lw dBA (re 10^{-12} W)

Noise Source/Item	Utilisation %	Quantity	Lw/Item	Total Lw
Trenching & Earthworks				
Backhoe	80	1	104	103
Light vehicle	25	2	76	73
Total – Trenching & Earthworks				**105**
Piling				
Piling Rig (hydraulic)	80	1	113	112
Tele-handler	75	1	106	105
Light vehicle	25	2	76	73
Total – Piling				**113**
Assembly				
Mobile Crane/HIAB	75	1	104	103
Tele-handler	75	1	106	105
Light vehicle	25	2	76	73
Hand tools/Power tools	50	1	102	99
Welder	50	1	105	102
Total – Assembly				**109**
Transport (on site)				
Heavy vehicle	40	1	104	101
Tele-handler	50	1	106	103
Total – Transport				**105**

5.2 Operational Assessment Methodology

For this assessment, noise predictions were modelled for a typical worst-case operational scenario over a 15-minute assessment period based on the assumptions and sound power levels in **Table 12.** Plant noise emission data used in modelling for this assessment were obtained from manufacturers data or the MAC database. Where relevant, modifying factors in accordance with Section 3.3 and Fact Sheet D of the NPI have been applied to calculations.

Table 12 Operational Equipment Sound Power Levels, Lw dBA (re 10^{-12} W)

Noise Source/Item	Activity	Quantity	Lw/Item	Total Lw
PV Panel Tracking Motor[1, 2]	All tracking motors in operation 1 minute per 15-minute period	136	78	83
2.5MW Inverter[2]	Constant	2	81	84
5MVA Transformer[2]	Constant	1	77	77

Note 1: Tracking motor is situated underneath the PV panel, -5dB attenuation applied to account for shielding provided by the panel.

Note 2: Modifying factor penalty of +5dB added for low frequency and +5dB added for tonality.

5.2.1 Meteorological Analysis

Noise emissions can be influenced by prevailing weather conditions. Light stable winds (<3m/s) and temperature inversions have the potential to increase noise at a receiver.

Fact Sheet D of the NPI provides two options when considering meteorological effects:

- adopt the noise enhancing conditions for all assessment periods without an assessment of how often the conditions occur – a conservative approach that considers a source to receiver winds for all receivers and F class temperature inversions with wind speeds up to 2m/s at night; or
- determine the significance of noise enhancing conditions. This requires assessing the significance of temperature inversions (F and G Class stability categories) for the night time period and the significance of light winds up to 3m/s for all assessment periods during stability categories other than E, F or G.

Standard meteorological conditions and noise-enhancing meteorological conditions as defined in Table D1of the NPI are reproduced in **Table 13**.

Table 13 Standard and Noise-Enhancing Meteorological Conditions	
Meteorological Conditions	Meteorological Parameters
Standard Meteorological Conditions	Day/evening/night: stability categories A–D with wind speed up to 0.5m/s at 10m AGL.
Noise Enhancing Meteorological Conditions	Daytime/evening: stability categories A–D with light winds (up to 3 m/s at 10m AGL). Night-time: stability categories A–D with light winds (up to 3m/s at 10m AGL) and/or stability category F with winds up to 2m/s at 10 m AGL.

A detailed analysis of the significance of noise enhancing conditions has not been undertaken and hence, the (worst case) NPI noise enhancing meteorological conditions have been applied to the noise modelling assessment are presented in **Table 14**.

Table 14 Modelled Meteorological Parameters				
Assessment Condition[1]	Temperature	Wind Speed[2]/ Direction	Relative Humidity	Stability Class[2]
Day	20°C	3m/s all directions	50%	D
Evening	10°C	3m/s all directions	50%	D
Night	10°C	2m/s all directions	50%	F

Note 1: Day 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening 6pm to 10pm; Night - the remaining periods.

Note 2: Implemented using CONCAWE meteorological corrections.

5.3 Road Traffic Noise Assessment Methodology

Due to the low traffic volume generated by the project over a typical day during the construction phase, road traffic noise calculation methods such as Calculation of Road Traffic Noise (CRTN - ISBN 0 11 550847 3) by Department of Transport (UK) 1988 or Traffic Noise Model (TNM) by the United States Department of Transport, Federal Highway Administration are not considered appropriate as they are primarily intended to calculate noise emissions from motorways and highways. Whilst each method has a low volume correction, the project traffic volume is out of the scope of these methods. Therefore, road traffic noise has been modelled using iNoise modelling software using ISO 9613-1 and ISO 9613-2 calculation methods, representing the road traffic as “moving sources” along the transport route using the parameters presented in **Table 15.**

Table 15 Road Traffic Noise Modelling Parameters				
Noise Source/Item	Lw dBA re 10^{-12} W	Movements/hr	Speed, km/h	Source Height, m[1]
Heavy vehicle (rigid, semi trailer or b-double)	104	8	50	1.5
Light Vehicle	96	20	50	0.75

Note 1: Height above ground level.

6 Noise Assessment Results

6.1 Construction Noise Assessment

Noise levels were predicted at all identified receivers at 1.5m above ground level for typical construction activities for standard construction hours. **Table 16** summarises the predicted noise level range and maximum predicted noise level for each of the construction scenarios (trenching, piling and assembly) at identified receivers. Noise levels are expected to satisfy the NMLs at all receivers.

Table 16 Predicted Construction Noise Levels

Receiver ID	Description/Address	Predicted Noise Level Range dB $L_{Aeq(15min)}$[1]	Highest Predicted Noise Level dB $L_{Aeq(15min)}$	NML Standard Hours dB $L_{Aeq(15min)}$	Compliance Achieved
IND1	Glen Innes Zone Substation	<30-43	43	70	✓
R01	185 Strathbogie Road	<30-39	39	45	✓
R02	123 Strathbogie Road	<30-41	41	45	✓
R03	134 Strathbogie Road	<30-38	38	45	✓
R04	154 Strathbogie Road	<30-36	36	45	✓
R05	176 Tuttles Lane	<30-39	39	45	✓
R06	257 Strathbogie Road	<30-34	34	45	✓
R07	168 Abbotts Road	<30-34	34	45	✓
R08	189 Abbotts Road	<30-34	34	45	✓
R09	137 Abbotts Road	<30-36	36	45	✓
R10	123 Abbotts Road	<30-36	36	45	✓
R11	124 Abbotts Road	<30-37	37	45	✓
R12	121 Abbotts Road	<30-37	37	45	✓
R13	65 Abbotts Road	<30-36	36	45	✓
R14	Corner Abbotts Road/Gwydir Highway	<30-39	39	45	✓
R15	505 Gwydir Highway	<30-32	32	45	✓
R16	485 Gwydir Highway	<30-34	34	45	✓
R17	477 Gwydir Highway	<30-33	33	45	✓
R18	449 Gwydir Highway	<30-37	37	45	✓
R19	437 Gwydir Highway	<30-38	38	45	✓
R20	425 Gwydir Highway	<30-39	39	45	✓
R21	409 Gwydir Highway	<30-41	41	45	✓

Table 16 Predicted Construction Noise Levels					
Receiver ID	Description/Address	Predicted Noise Level Range dB $L_{Aeq(15min)}$[1]	Highest Predicted Noise Level dB $L_{Aeq(15min)}$	NML Standard Hours dB $L_{Aeq(15min)}$	Compliance Achieved
R22	268 Furracabad Road	<30-39	39	45	✓
R23	2 Bradleys Lane	<30-36	36	45	✓
R24	2 Wellingrove Street	<30-45	45	45	✓
R25	1 Wellingrove Street	<30-44	44	45	✓
R26	48 Ferguson Street	<30-42	42	45	✓
R27	50 Ferguson Street	<30-41	41	45	✓
R28	60 Ferguson Street	<30-39	39	45	✓
R29	200 Dumaresq Street	<30-39	39	45	✓
R30	214 Dumaresq Street	<30-40	40	45	✓
R31	154 Derby Street	<30-35	35	45	✓
R32	4 Grafton Street	<30-34	34	45	✓
R33	19 Ferguson Street	<30-37	37	45	✓
R34	1 Meade Street	<30-36	36	45	✓

Note 1: Noise levels from construction activities vary due to their position across the project site with respect to surrounding receivers.

6.2 Operational Noise Assessment

Noise levels were predicted at all identified receivers at 1.5m above ground level for all operational sources and are presented in **Table 17**. Noise levels are expected to satisfy the PNTLs at all receivers.

Table 17 Predicted Operational Noise Levels				
Receiver ID	Description/Address	Predicted Noise Level dB $L_{Aeq(15min)}$	PNTL dB $L_{Aeq(15min)}$ Day/Eve/Night[1]	Compliance Achieved
IND1	Glen Innes Zone Substation	<30	68	✓
R01	185 Strathbogie Road	<30	40/35/35	✓
R02	123 Strathbogie Road	<30	40/35/35	✓
R03	134 Strathbogie Road	<30	40/35/35	✓
R04	154 Strathbogie Road	<30	40/35/35	✓
R05	176 Tuttles Lane	<30	40/35/35	✓
R06	257 Strathbogie Road	<30	40/35/35	✓
R07	168 Abbotts Road	<30	40/35/35	✓
R08	189 Abbotts Road	<30	40/35/35	✓
R09	137 Abbotts Road	<30	40/35/35	✓
R10	123 Abbotts Road	<30	40/35/35	✓

Table 17 Predicted Operational Noise Levels				
Receiver ID	Description/Address	Predicted Noise Level dB LAeq(15min)	PNTL dB LAeq(15min) Day/Eve/Night[1]	Compliance Achieved
R11	124 Abbotts Road	<30	40/35/35	✓
R12	121 Abbotts Road	<30	40/35/35	✓
R13	65 Abbotts Road	<30	40/35/35	✓
R14	Corner Abbotts Road/Gwydir Highway	<30	40/35/35	✓
R15	505 Gwydir Highway	<30	40/35/35	✓
R16	485 Gwydir Highway	<30	40/35/35	✓
R17	477 Gwydir Highway	<30	40/35/35	✓
R18	449 Gwydir Highway	<30	40/35/35	✓
R19	437 Gwydir Highway	<30	40/35/35	✓
R20	425 Gwydir Highway	<30	40/35/35	✓
R21	409 Gwydir Highway	<30	40/35/35	✓
R22	268 Furracabad Road	<30	40/35/35	✓
R23	2 Bradleys Lane	<30	40/35/35	✓
R24	2 Wellingrove Street	<30	40/35/35	✓
R25	1 Wellingrove Street	<30	40/35/35	✓
R26	48 Ferguson Street	<30	40/35/35	✓
R27	50 Ferguson Street	<30	40/35/35	✓
R28	60 Ferguson Street	<30	40/35/35	✓
R29	200 Dumaresq Street	<30	40/35/35	✓
R30	214 Dumaresq Street	<30	40/35/35	✓
R31	154 Derby Street	<30	40/35/35	✓
R32	4 Grafton Street	<30	40/35/35	✓
R33	19 Ferguson Street	<30	40/35/35	✓
R34	1 Meade Street	<30	40/35/35	✓

Note 1: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods.

6.3 Maximum Noise Level Assessment

A detailed maximum noise level assessment is not required as predicted noise levels for night time operations do not exceed the maximum noise level screening criterion of 40dB $LA_{eq(15min)}$ and there are no operational noise sources that generate significant maximum noise events.

6.4 Road Traffic Noise Assessment

The major transport route for all vehicles to the access the project site is via Tuttles Lane from the Gwydir Highway. During construction, traffic generated by the project include employee/subcontractor and delivery vehicles. The traffic volume over a typical day for standard construction hours is expected to be up to four heavy vehicles (semi-trailers or B-doubles) per hour and 20 light commercial vehicles or equivalent mini buses for worker transport during the morning and afternoon peak hour periods.

Predicted noise levels from project related construction traffic at the closest receivers (R27, R28) on the Gwydir Highway, 25m from the road centre has been completed using the methodology described in **Section 5.3** and the parameters presented in **Table 15**. The results presented in **Table 18** show the calculated $LA_{eq(1hr)}$ noise level and the adjusted $LA_{eq(15hr)}$ noise level to align with RNP assessment periods.

Table 18 Predicted Construction Road Traffic Noise Levels

Road Name	Offset Distance to Receiver	Predicted Noise Level		RTN Criteria	Compliance Achieved
Gwydir Highway	25m	45dB LAeq(1hr)	43dB LAeq(15hr)	60dB LAeq(15hr)	✓

Results demonstrate that project construction traffic noise levels would comply with the relevant RNP criteria.

Existing road traffic flows on the Gwydir Highway are approximately 1,299 vehicles per day (TfNSW Traffic Volume Viewer, Station ID 6134, 2020). The project proposes to add an additional 40 light vehicles and up to six heavy vehicles per day (four times the average of 100 heavy vehicles over a six month construction period) as a possible daily worst case scenario. For other receivers along the Gwydir Highway, based on a total of 46 vehicle movements occurring during the daytime period, the project would increase traffic noise levels by less than 0.1dB based on a simple calculation relating to the percentage change in traffic flows, ie 10 x log(future flow/existing flow).

Therefore, it is concluded that project related road traffic noise levels would satisfy the relevant RNP criteria at any residential receiver along the proposed transport routes and not increase existing noise levels by more than 2dB.

7 Discussion and Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Assessment for a proposed Solar Farm near Glen Innes, NSW.

The results of the Noise Assessment demonstrate that emissions from the project would satisfy the relevant construction NMLs and operational PNTLs at all identified receivers.

The results of the Noise Assessment demonstrate that emissions from the project would satisfy the operational PNTLs at all identified receivers.

Furthermore, sleep disturbance is not anticipated, as there are no operational noise sources that generate significant maximum noise events and noise emissions from the project are predicted to satisfy the EPA maximum noise criteria.

Road noise emissions associated with the project are anticipated to satisfy the relevant RNP criteria at all receivers along the proposed transportation route.

A qualitative assessment of potential vibration impacts has been completed. Due to the nature of the works proposed and distances to potential vibration sensitive receivers, vibration impacts from the project would be negligible.

Based on the Noise Assessment results, there are no noise related issues which would prevent approval of the proposed project.

This page has been intentionally left blank

Appendix A – Glossary of Terms

A number of technical terms have been used in this report and are explained in **Table A1**.

Table A1 Glossary of Acoustical Terms

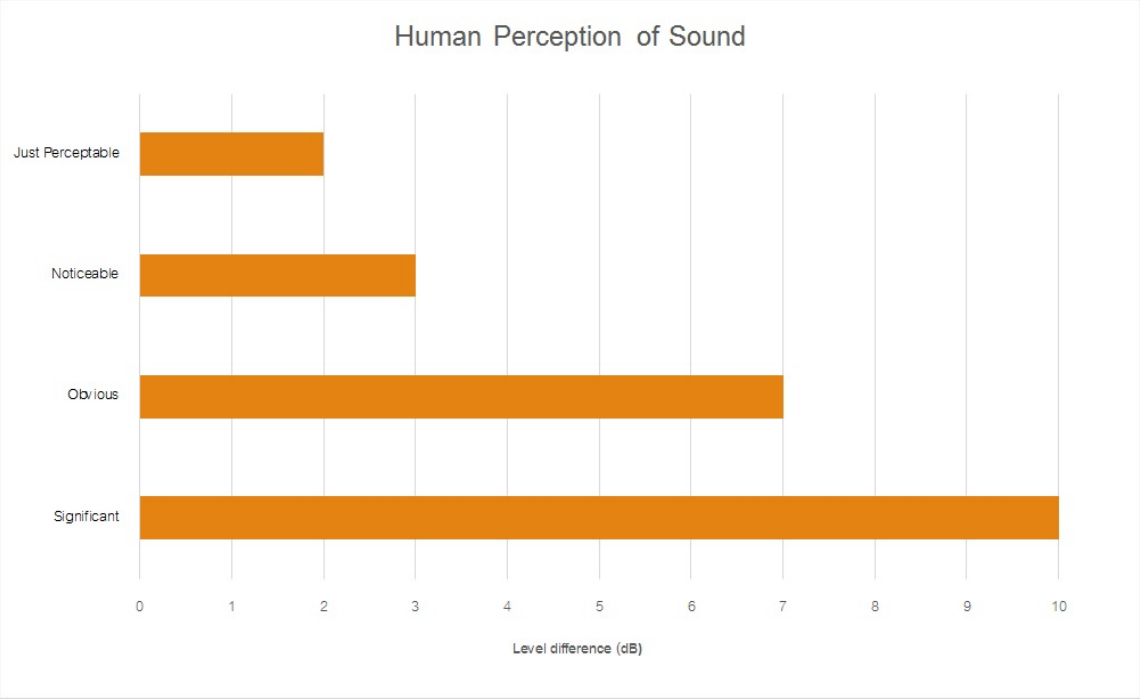
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L90 statistical noise levels.
Ambient Noise	The total noise associated with a given environment. Typically, a composite of sounds from all sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to sound.
Background Noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is usually represented by the LA90 descriptor
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Z-weighted or decibels Linear (unweighted).
Extraneous Noise	Sound resulting from activities that are not typical of the area.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A sound level which is exceeded 10% of the time.
LA90	Commonly referred to as the background noise, this is the level exceeded 90% of the time.
LAeq	Represents the average noise energy or equivalent sound pressure level over a given period.
LAmax	The maximum sound pressure level received at the microphone during a measuring interval.
Masking	The phenomenon of one sound interfering with the perception of another sound. For example, the interference of traffic noise with use of a public telephone on a busy street.
RBL	The Rating Background Level (RBL) as defined in the NPI, is an overall single figure representing the background level for each assessment period over the whole monitoring period. The RBL, as defined is the median of ABL values over the whole monitoring period.
Sound power level (Lw or SWL)	This is a measure of the total power radiated by a source in the form of sound and is given by 10.log10 (W/Wo). Where W is the sound power in watts to the reference level of 10^{-12} watts.
Sound pressure level (Lp or SPL)	the level of sound pressure; as measured at a distance by a standard sound level meter. This differs from Lw in that it is the sound level at a receiver position as opposed to the sound 'intensity' of the source.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Pressure Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



Muller Acoustic Consulting Pty Ltd
PO Box 262, Newcastle NSW 2300
ABN: 36 602 225 132
P: +61 2 4920 1833
www.mulleracoustic.com

MAC
Muller Acoustic Consulting



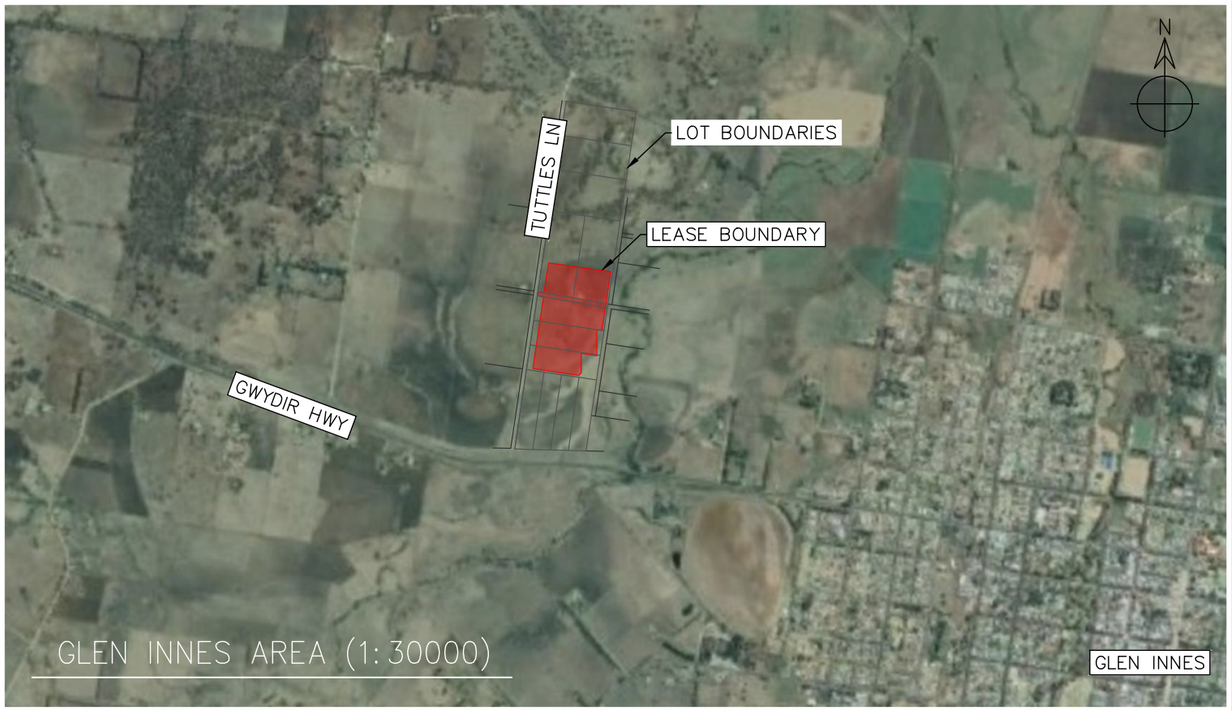
GLEN INNES AREA (1:44000)

ADDRESS
LOT 32, DP1834
LOT 33, DP1834
LOT 34, DP1834
LOT 35, DP1834
LOT 36, DP1834
LOT 1, DP251457
TUTTLES LANE,
GLEN INNES
NSW 2370

COORDINATES
-29.725343°, 151.707628°



NSW STATE MAP



GLEN INNES AREA (1:30000)

PROVIDENCE ASSET GROUP
Balance

REFERENCES

REVISIONS

REV.	DATE	DESCRIPTION	DRWN.	DESIGNED	CHKD.	APPR.
C	2020.12.07	MINOR REVISIONS	JM	JM	SS	JM
B	2020.12.03	MINOR REVISIONS	JM	JM	SS	JM
A	2020.10.16	FIRST ISSUE	JM	JM	SS	JM

THIS DRAWING IS THE PROPERTY OF PROVIDENCE ASSET GROUP AND IS NOT TO BE COPIED (IN WHOLE OR IN PART) FOR ANY PURPOSE OR DISCLOSED TO OTHER PARTIES WITHOUT THE APPROVAL OF PROVIDENCE ASSET GROUP OR AN AUTHORIZED AGENT.

TITLE
PROVIDENCE ASSET GROUP
GLEN INNES
LOCATION DETAIL

DWG No. 10030-G-GAD-01-1

SCALE
AS SHOWN

REVISION
C

PAPER SIZE
A3

9/12/2020 11:42:00 AM

GDA 2020/MGA ZONE 56
374912.07m E,
6711525.71m S

EXISTING SHED
EXISTING SHED
WINDMILL & WATER TANK
132kV O/H POWERLINES
66kV O/H POWERLINES
EXISTING SHED
MAIN ENTRANCE GATE
SINGLE AXIS TRACKING PV ARRAY
WATERBODY (NOTE 3)
WATERBODY (NOTE 3)
EXISTING SHED
WATERBODY (NOTE 3)
UPGRADE OF EXISTING DAM TO ON SITE WATER DETENTION BASIN
PROPOSED GRID CONNECTION POINT
66kV O/H POWERLINES
11kV O/H POWERLINES

Lot 58 DP1834
Lot 36 DP 1834
Lot 35 DP 1834
Lot 37 DP 1834
Lot 389 DP753282
Furracabad Creek
Lot 488 DP753282
Lot 1 DP 251457
Lot 34 DP 1834
Lot 33 DP 1834
Lot 32 DP 1834
Lot 31 DP 1834
Lot 506 DP753282
Furracabad Creek
Lot 507 DP753282
Lot 508 DP753282
Furracabad Creek
TUTTLES LANE
Lot 5 DP 1834
Lot 4 DP 1834
Lot 3 DP 1834
Lot 2 DP 1834
Lot 1 DP 1834
Lot 7023 DP 1059104

SCALE (m) 0 50 200 / 10 100

GENERAL NOTES

1. THIS DRAWING IS INTENDED TO BE PRINTED IN COLOUR.
2. BACKGROUND SATELLITE IMAGERY IS INDICATIVE ONLY.
3. WATERCOURSE, WATERBODY DETAIL SHOWN IS OBTAINED FROM SIXMAPS, PROJECTION MGA ZONE 56.
4. SOLAR FARM DETAIL SHOWN IS PRELIMINARY, MAY CHANGE IN DETAILED DESIGN.

LEGEND

- TREE
- LOT BOUNDARY
- 400 MAJOR CONTOUR
- MINOR CONTOUR
- SECURITY FENCE
- LEASE BOUNDARY (PROPOSED)
- FENCE (EXISTING)
- ACCESS ROAD
- O/H 11kV POWERLINE
- O/H 66/132kV POWERLINE
- WATERCOURSE

PROVIDENCE ASSET GROUP
Balance

REFERENCES

REV.	DATE	DESCRIPTION	DRWN.	DESIGNED	CHKD.	APPR.
D	2020.12.07	MINOR REVISIONS	JM	JM	SS	JM
C	2020.12.04	MINOR REVISIONS	JM	JM	SS	JM
B	2020.11.23	RE-ISSUED WITH CHANGES	JM	JM	SS	JM
A	2020.11.18	FIRST ISSUE	JM	JM	SS	JM

THIS DRAWING IS THE PROPERTY OF PROVIDENCE ASSET GROUP AND IS NOT TO BE COPIED (IN WHOLE OR IN PART) FOR ANY PURPOSE OR DISCLOSED TO OTHER PARTIES WITHOUT THE APPROVAL OF PROVIDENCE ASSET GROUP OR AN AUTHORIZED AGENT.

TITLE
PROVIDENCE ASSET GROUP
GLEN INNES SOLAR FARM
GENERAL ARRANGEMENT
OVERVIEW

DWG No. 10030-G-GAD-02-1

SCALE 1:5000
REVISION D
PAPER SIZE A3

9/12/2020 11:42:45 AM

LEGEND

- TREE
- LOT BOUNDARY
- 400 — MAJOR CONTOUR
- MINOR CONTOUR
- SECURITY FENCE
- FENCE (EXISTING)
- LEASE BOUNDARY (PROPOSED)
- PV TABLE
- O/H 11kV POWERLINE
- O/H 66/132kV POWERLINE
- WATERCOURSE

SYSTEM SUMMARY

ELECTRICAL CONFIGURATION:
- TOTAL PV PLANT CAPACITY (DC): 6.168 MWp
- TOTAL INVERTER CAPACITY (AC): 4.95MVA
- PV PLANT MAXIMUM EXPORT CAPACITY (AC): 4.95MW
- DC:AC RATIO: 1.246
- STRINGS OF 28 PV MODULES.
- 204 PV STRINGS PER INVERTER.
- 408 PV STRINGS TOTAL.

PV MODULES:
- MFR: LONGI SOLAR
- MODEL: LR5-72HPH-540M
- NAMEPLATE: 540Wp
- QUANTITY: 11,424 MODULES

INVERTERS:
- MFR: SUNGROW
- MODEL: SG2475HV-MV
- NAMEPLATE: 2475kVA
- QUANTITY: 2

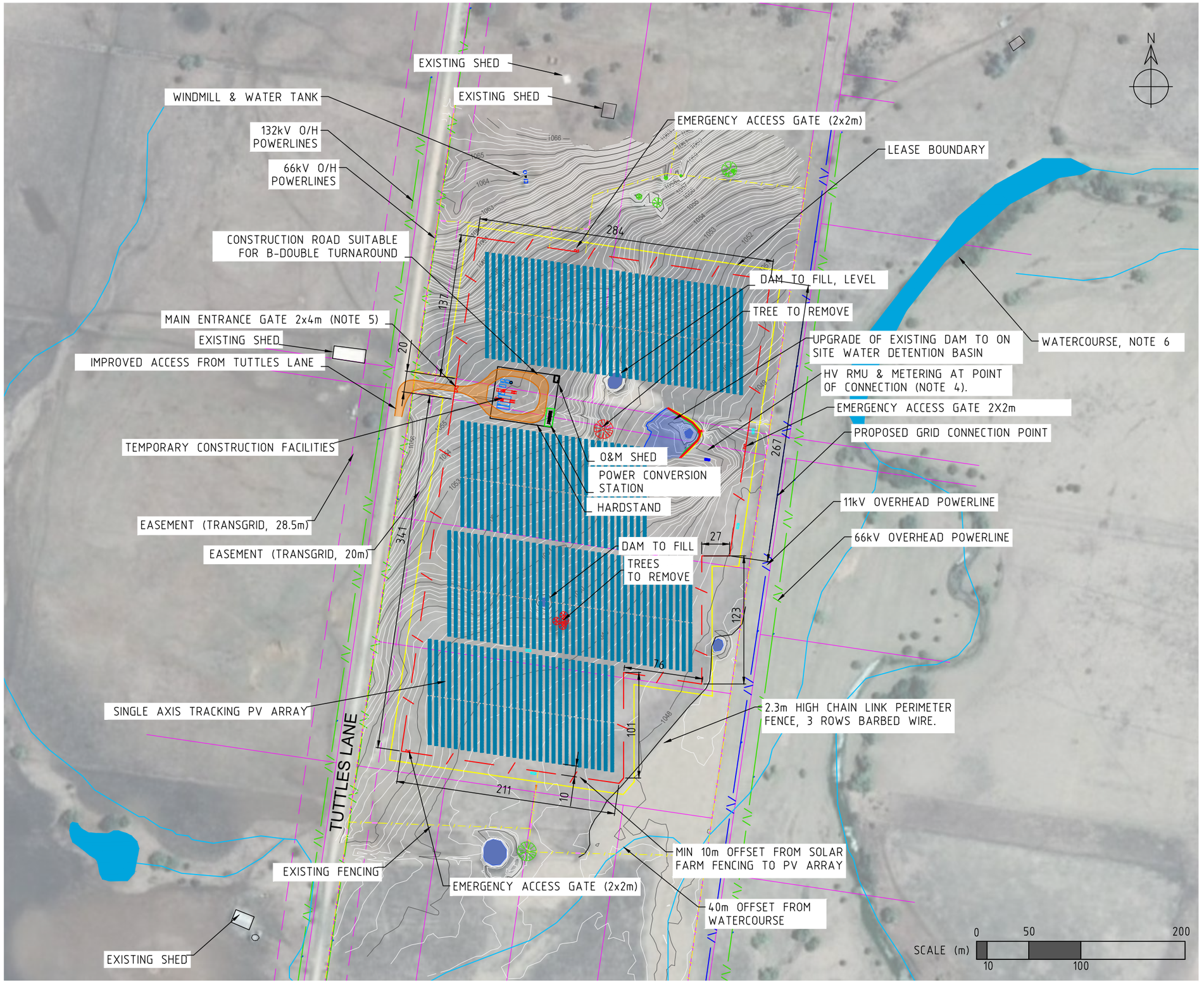
MV POWER STATION:
- MFR: SUNGROW
- MODEL: SG4950HV-MV
- QUANTITY: 1

TRACKER ARRAY:
- TYPE: GROUND MOUNT SINGLE AXIS TRACKING
- CONFIGURATION: INDEPENDENT TYPE
- RANGE OF MOTION: ±60°
- PITCH: 6.25m
- GCR: 36.096%
- QUANTITY: 136 TABLES

FENCED AREA: 133,164 m²
LEASE AREA: 148,238 m²

GENERAL NOTES:

1. SITE ACCESS VIA TUTTLES LANE.
2. DETAIL SHOWN IS PRELIMINARY, MAY CHANGE IN DETAILED DESIGN.
3. CLEARANCE BETWEEN SOLAR TRACKER ARRAY & SITE SECURITY FENCE TYPICALLY 10m
4. HV RMU & METERING (LOCATION AND TYPE TO BE DETERMINED, IS SUBJECT TO ESSENTIAL ENERGY FEEDBACK).
5. FOR SECURITY GATE DETAILS REFER TO DRAWING 10030-C-DET-02-1.
6. WATERCOURSE, WATERBODY DETAIL FROM SIXMAPS, MGA ZONE 56 PROJECTION
7. REFER TO BASIN PLAN DRAWING ×××TBC×××.



PROVIDENCE ASSET GROUP
Balance GOODS AND EXCHANGE

REFERENCES

REV.	DATE	DESCRIPTION	DRWN.	DESIGNED	CHKD.	APPR.
D	2020.12.07	MINOR REVISIONS	JM	JM	SS	JM
C	2020.12.04	MINOR REVISIONS	JM	JM	SS	JM
B	2020.11.23	RE-ISSUED WITH CHANGES	JM	JM	SS	JM
A	2020.11.18	FIRST ISSUE	JM	JM	SS	JM

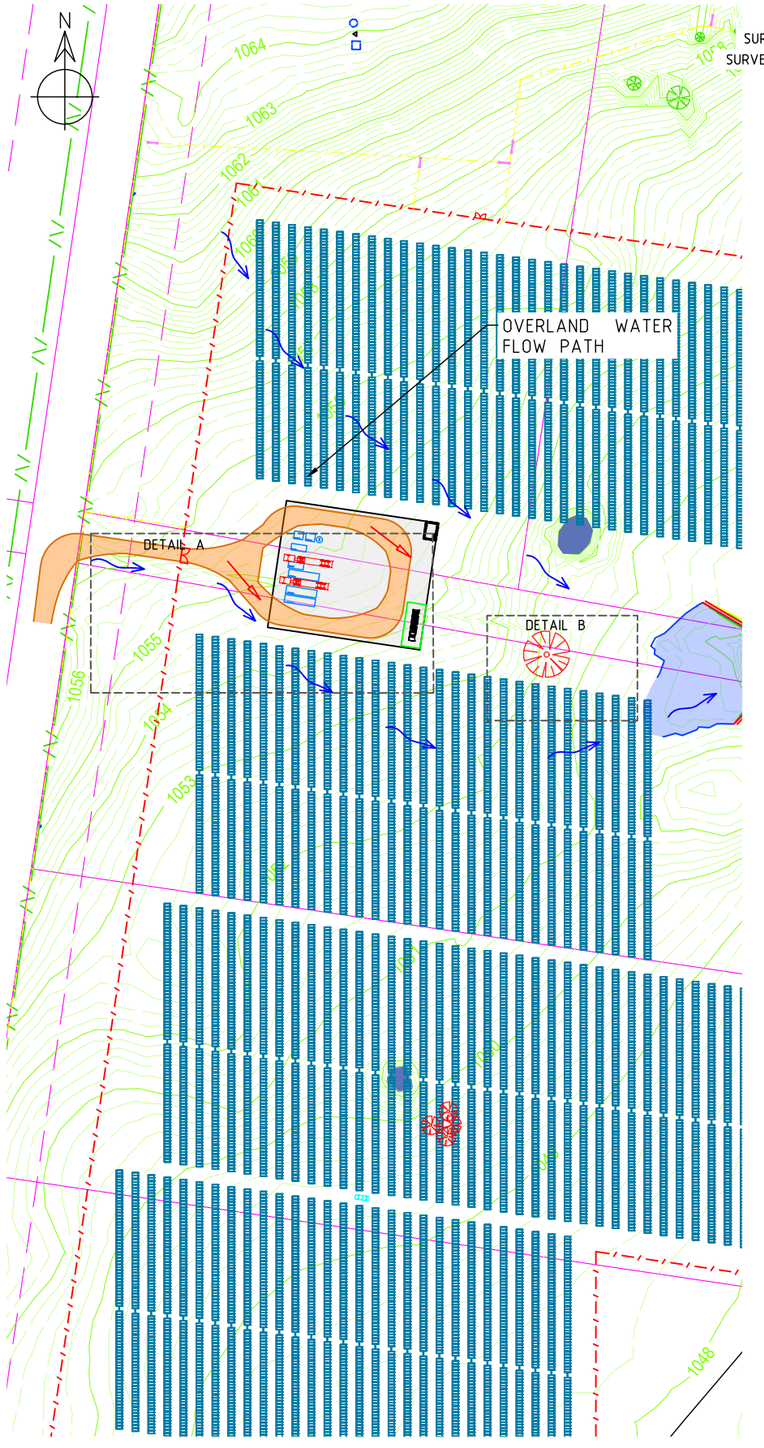
THIS DRAWING IS THE PROPERTY OF PROVIDENCE ASSET GROUP AND IS NOT TO BE COPIED (IN WHOLE OR IN PART) FOR ANY PURPOSE OR DISCLOSED TO OTHER PARTIES WITHOUT THE APPROVAL OF PROVIDENCE ASSET GROUP OR AN AUTHORIZED AGENT.

TITLE
PROVIDENCE ASSET GROUP
GLEN INNES SOLAR FARM
GENERAL ARRANGEMENT
SYSTEM DETAIL

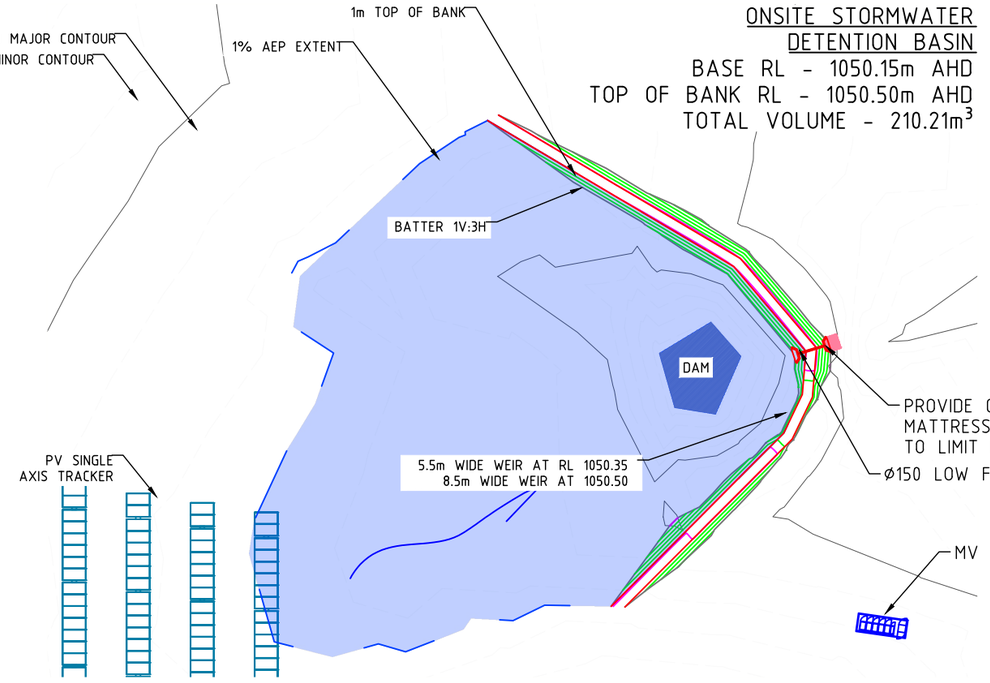
DWG No. 10030-G-GAD-02-2

SCALE 1:3750
REVISION D
PAPER SIZE A3

9/12/2020 11:43:36 AM



PLAN VIEW (1:2400)

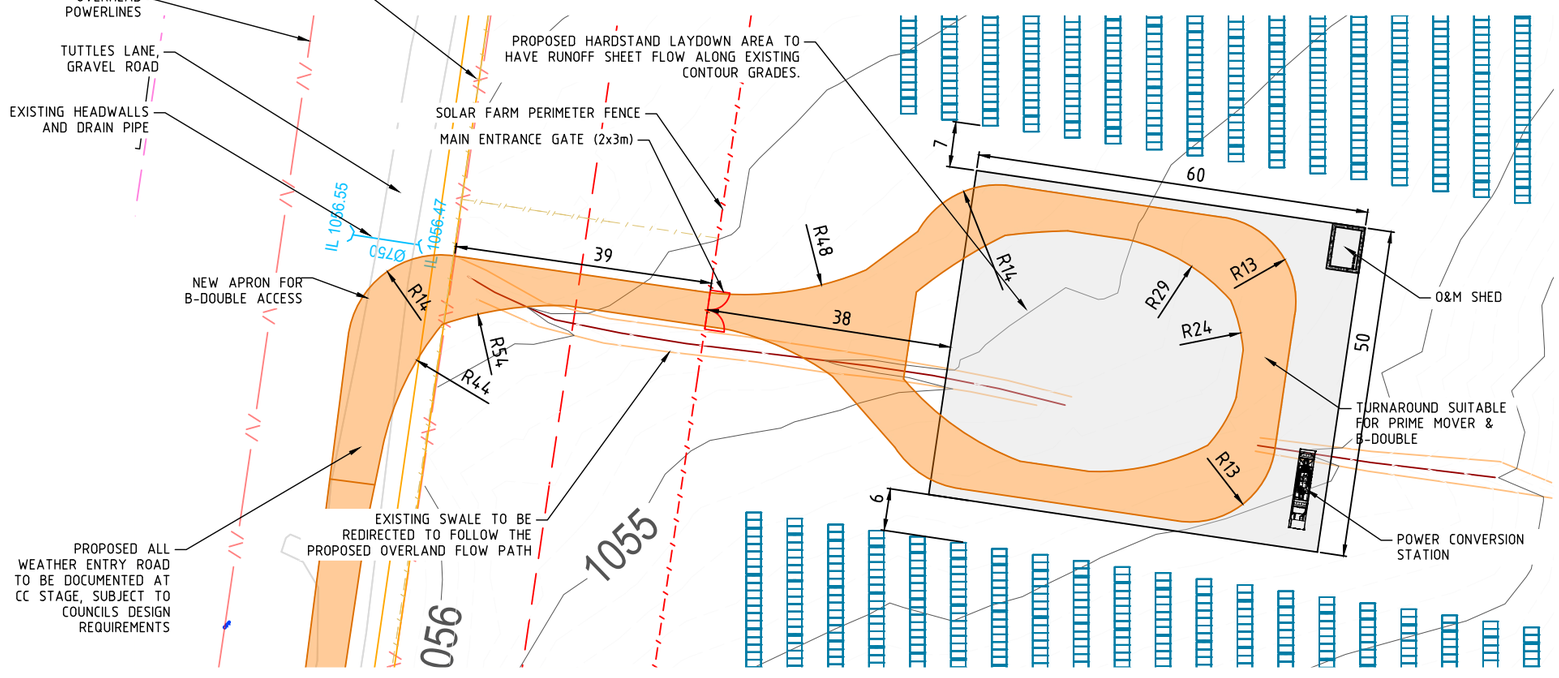


ONSITE STORMWATER DETENTION BASIN
BASE RL - 1050.15m AHD
TOP OF BANK RL - 1050.50m AHD
TOTAL VOLUME - 210.21m^3

GENERAL NOTES

1. PRELIMINARY DETAIL SHOWN, MAY CHANGE IN DETAILED DESIGN.
2. EXISTING ACCESS TRACK TO BE UPGRADED INTO ROAD TRAFFICABLE FOR PRIME MOVER AND B-DOUBLE.
3. NEW APRONS TO BE CONSTRUCTED AT THE THE ENTRANCE OFF COUNTRY ROAD.
4. REFER TO 10030-C-DET-02-1 FOR PRELIMINARY ROAD SECTIONAL DETAIL.
5. REFER DETAIL B FOR PRELIMINARY ON SITE STORMWATER DETENTION DETAIL.

DETAIL B: ON SITE STORMWATER DETENTION (1:600)



DETAIL A: ACCESS AND HARDSTAND AREA (1:940)

PROVIDENCE ASSET GROUP
Balance Civil and Energy

REFERENCES

REVISIONS						
REV.	DATE	DESCRIPTION	DRWN.	DESIGNED	CHKD.	APPR.
A	2020.12.10	FIRST ISSUE	JM	JM	SS	JM

THIS DRAWING IS THE PROPERTY OF PROVIDENCE ASSET GROUP AND IS NOT TO BE COPIED (IN WHOLE OR IN PART) FOR ANY PURPOSE OR DISCLOSED TO OTHER PARTIES WITHOUT THE APPROVAL OF PROVIDENCE ASSET GROUP OR AN AUTHORIZED AGENT.

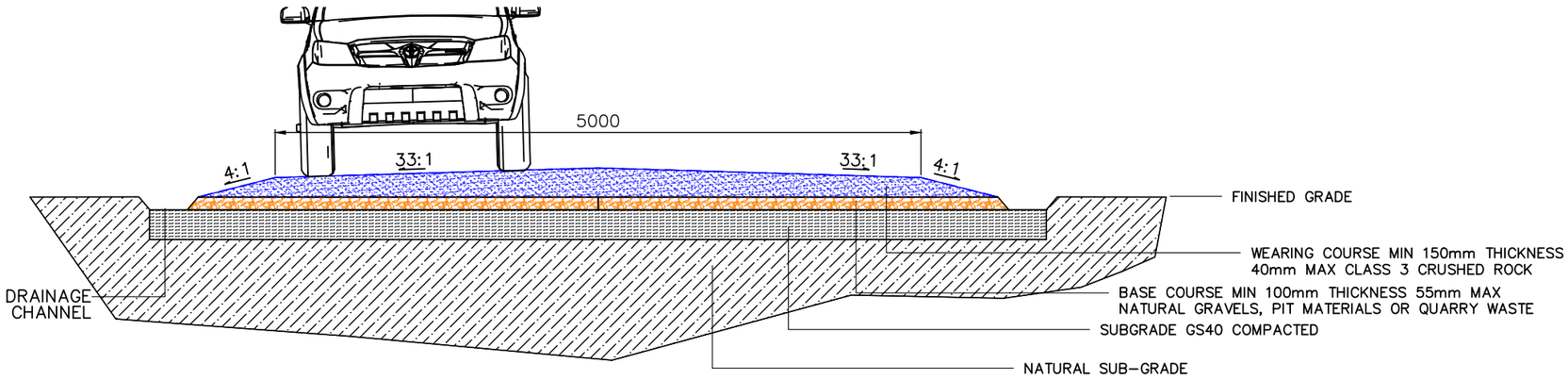
TITLE
PROVIDENCE ASSET GROUP
GLEN INNES SOLAR FARM
CIVIL DETAIL

DWG No. 10030-C-DET-01-1

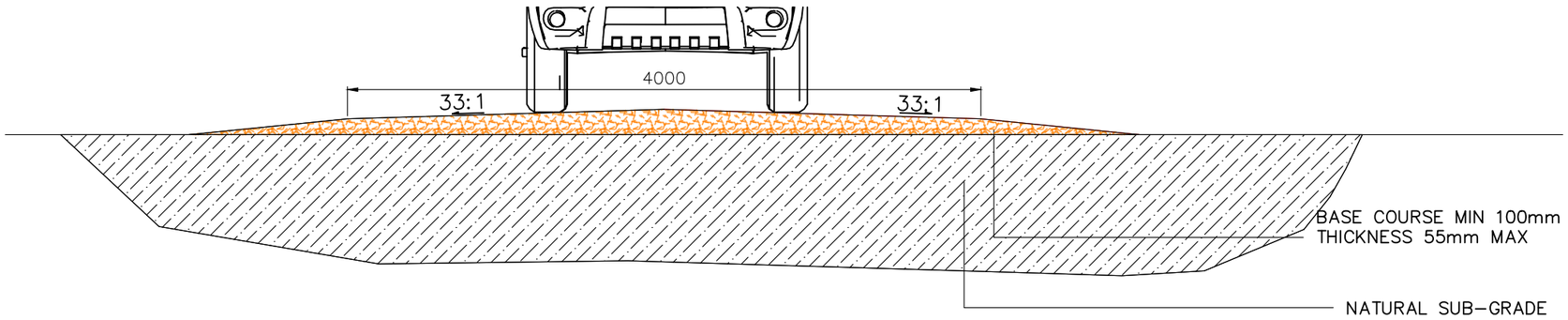
SCALE: AS SHOWN
REVISION: A
PAPER SIZE: A3

GENERAL NOTES

1. DETAILS SHOWN ARE PRELIMINARY, PAVEMENT DESIGN SUBJECT TO FINAL TRAFFICABILITY ASSESSMENT.
2. TRAFFIC LANE TYPICAL WIDTHS OF 4m TO 5m AS SHOWN. SECTIONS MAY BE WIDER THAN SHOWN TO ACCOMMODATE REQUIRED VEHICLE TURNING CIRCLES.
3. ALL ROADS TO HAVE ADEQUATE CROSS FALL FROM CENTER AND SHALL MAINTAIN MINIMUM LAYER THICKNESSES PER THE PAVEMENT DESIGNS.
4. ACCESS ROAD SHALL BE RAISED MINIMUM 150mm ABOVE EXISTING GROUND LEVEL.



1 SITE ACCESS ROAD SECTION



2 PV ARRAY ACCESS ROAD SECTION

PROVIDENCE ASSET GROUP
Balance

REFERENCES
10030-C-DET-01-1 CIVIL DETAIL

REVISIONS

REV.	DATE	DESCRIPTION	DRWN.	DESIGNED	CHKD.	APPR.
A	2020.12.08	FIRST ISSUE	JM	JM	SS	JM

THIS DRAWING IS THE PROPERTY OF PROVIDENCE ASSET GROUP AND IS NOT TO BE COPIED (IN WHOLE OR IN PART) FOR ANY PURPOSE OR DISCLOSED TO OTHER PARTIES WITHOUT THE APPROVAL OF PROVIDENCE ASSET GROUP OR AN AUTHORIZED AGENT.

TITLE
PROVIDENCE ASSET GROUP
GLEN INNES SOLAR FARM
ROAD SECTION DETAIL
TYPICAL

DWG No. 10030-C-DET-06-1

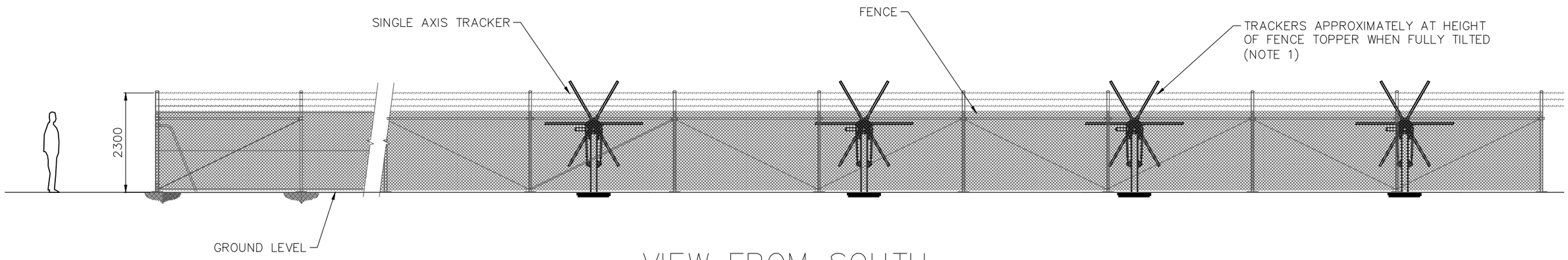
SCALE
AS SHOWN

REVISION
A

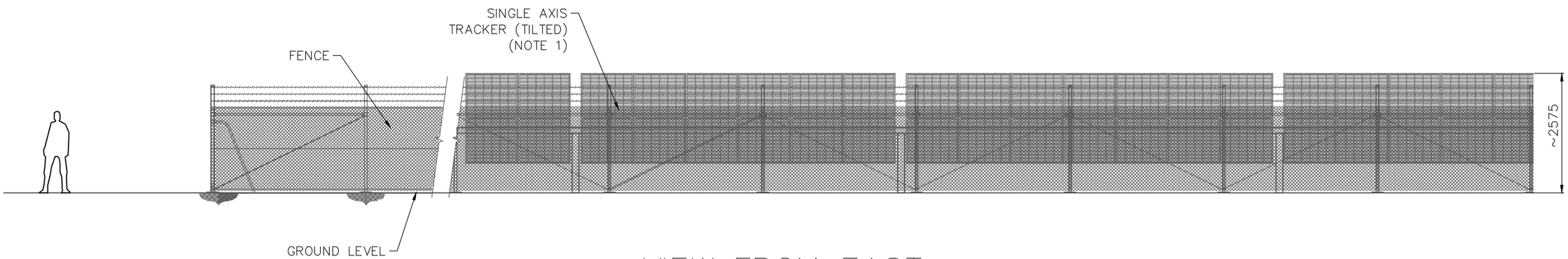
PAPER SIZE
A3

GENERAL NOTES

1. NB DETAIL PRESENTED IS PARALLEL PROJECTION. PV TRACKERS WILL BE 1–MODULE–IN PORTRAIT SINGLE AXIS TRACKING TYPE, AND WILL BE POSITIONED SUFFICIENTLY FAR FROM THE FENCELINE AS TO APPEAR SMALLER THAN AS SHOWN.
2. PRELIMINARY EQUIPMENT SELECTION:
   PV MODULE: LONGI LR5–72HPH–540M
   TRACKING SYSTEM: NEXTRACKER NX HORIZON
   DETAIL PRESENTED IS BASED UPON EQUIPMENT SELECTION, MAY CHANGE DURING DETAILED DESIGN.
3. GROUND LEVEL SIMPLIFIED TO CONSTANT ELEVATION, GROUND LEVEL VARIES ACROSS SITE.
4. REFER TO 10030–C–DET–02–1 FOR FENCING DETAIL.
5. LANDSCAPING EXTERNAL TO FENCE NOT SHOWN.



VIEW FROM SOUTH



VIEW FROM EAST

PROVIDENCE ASSET GROUP
Balance

REFERENCES

REV.	DATE	DESCRIPTION	DRWN.	DESIGNED	CHKD.	APPR.
C	2020.12.07	MINOR REVISIONS	JM	JM	SS	JM
B	2020.12.03	MINOR REVISIONS	JM	JM	SS	JM
A	2020.11.06	FIRST ISSUE	JM	JM	SS	JM

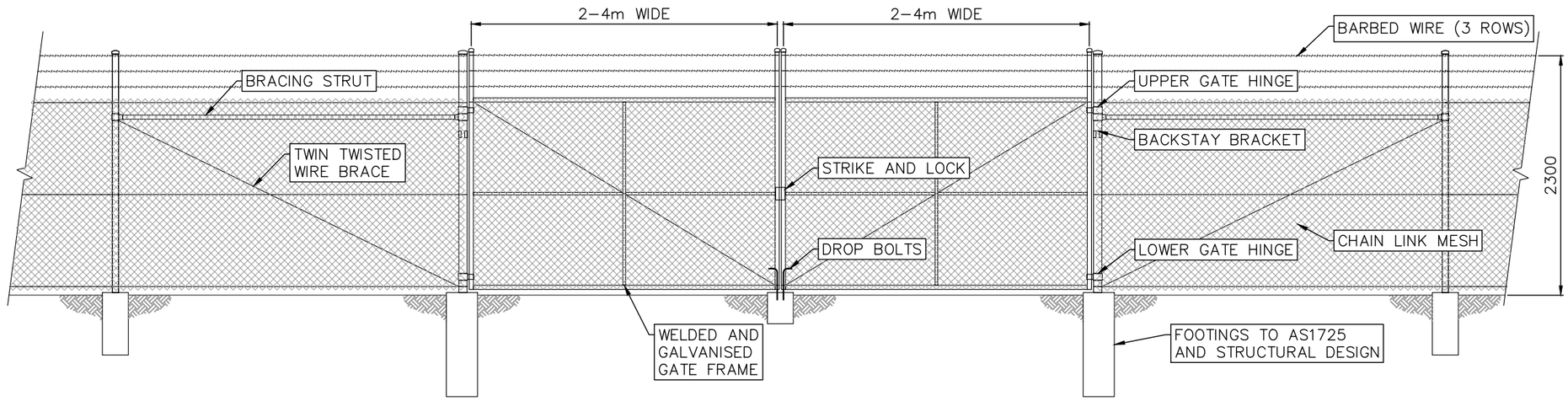
THIS DRAWING IS THE PROPERTY OF PROVIDENCE ASSET GROUP AND IS NOT TO BE COPIED (IN WHOLE OR IN PART) FOR ANY PURPOSE OR DISCLOSED TO OTHER PARTIES WITHOUT THE APPROVAL OF PROVIDENCE ASSET GROUP OR AN AUTHORIZED AGENT.

TITLE
PROVIDENCE ASSET GROUP
GLEN INNES SOLAR FARM
SITE ELEVATION DETAIL

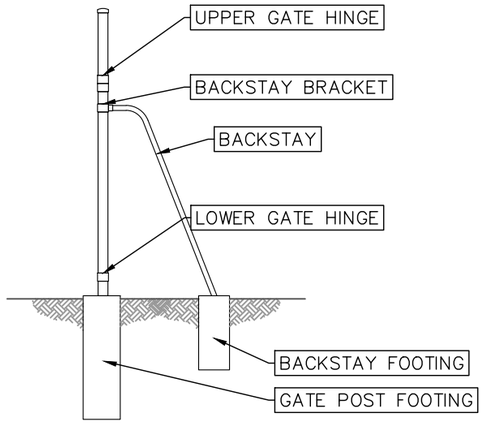
DWG No. 10030–G–DET–01–1

SCALE DNS
REVISION C
PAPER SIZE A3

9/12/2020 11:38:22 AM



TYPICAL FENCE & GATE ELEVATION



TYPICAL BACKSTAY ELEVATION

GENERAL NOTES

1. SOLAR FARM PERIMETER FENCE TO BE GALVANISED CHAIN LINK MESH FENCE WITH 3 ROWS BARBED WIRE.
2. NOMINAL MESH HEIGHT TO BE 1800mm.
3. NOMINAL OVERALL HEIGHT TO BE 2300mm +/– 100mm.
4. ALL FENCING COMPONENTS AND FOOTINGS TO COMPLY WITH AS 1725.
5. GATE WIDTH AS PER GA LAYOUT DRAWINGS.
6. BRACING STRUT AND WIRE BRACE REQUIRED AT ENDS, CORNERS AND GATES. DIAGONAL BRACE STRUT MAY ALSO BE USED IN LIEU OF BRACE & WIRE.
7. INTERMEDIATE BRACED PANEL CONSISTING OF TWIN TWISTED WIRE BRACE ON BOTH DIAGONALS REQUIRED AT MAX. 150m INTERVALS.
8. PERSONNEL ACCESS GATES REQUIRE BRACING STRUTS ON BOTH SIDES.
9. FOOTING DESIGN TO BE CONFIRMED DURING DETAILED DESIGN.
10. FENCE GENERALLY NOT REQUIRED TO BE EARTHED UNLESS IN CLOSE IS PROXIMITY TO ELECTRICAL COMPONENTS OR AS REQUIRED WITHIN UTILITY EASEMENTS OR SIMILAR. TO BE DETERMINED DURING DETAILED DESIGN.

PROVIDENCE ASSET GROUP

Balance POWER AND ENERGY

REFERENCES

REVISIONS							
C	2020.12.07	MINOR REVISIONS	JM	JM	SS	JM
B	2020.12.04	MINOR REVISIONS	JM	JM	SS	JM
A	2020.10.19	ISSUED FOR INFORMATION	JM	JM	SS	JM
REV.	DATE	DESCRIPTION	DRWN.	DESIGNED	CHKD.	APPR.

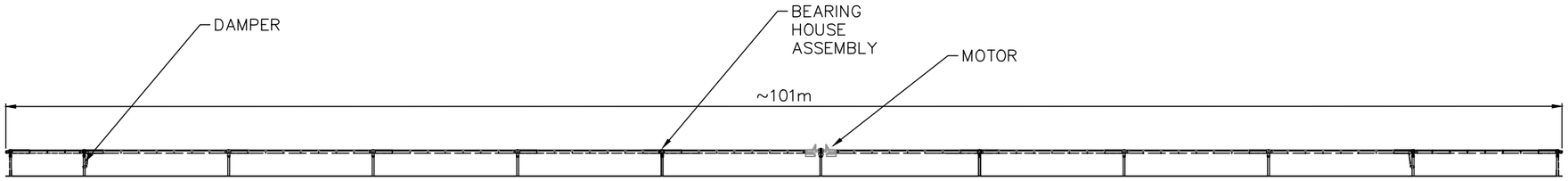
THIS DRAWING IS THE PROPERTY OF PROVIDENCE ASSET GROUP AND IS NOT TO BE COPIED (IN WHOLE OR IN PART) FOR ANY PURPOSE OR DISCLOSED TO OTHER PARTIES WITHOUT THE APPROVAL OF PROVIDENCE ASSET GROUP OR AN AUTHORIZED AGENT.

TITLE
PROVIDENCE ASSET GROUP
GLEN INNES SOLAR FARM
SECURITY FENCING DETAIL
TYPICAL

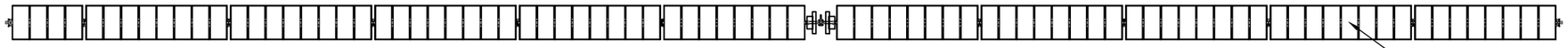
DWG No. 10030–C–DET–02–1

SCALE DNS
REVISION C
PAPER SIZE A3

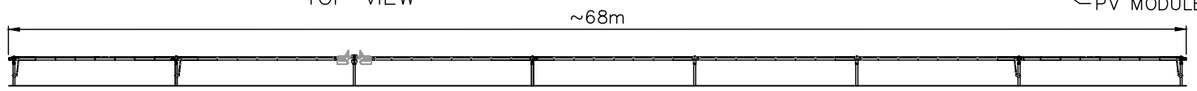
9/12/2020 11:34:32 AM



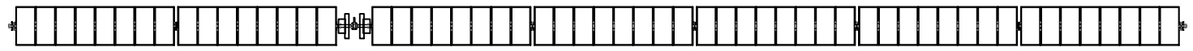
TYPICAL 3 STRING TRACKER ROW
SIDE VIEW



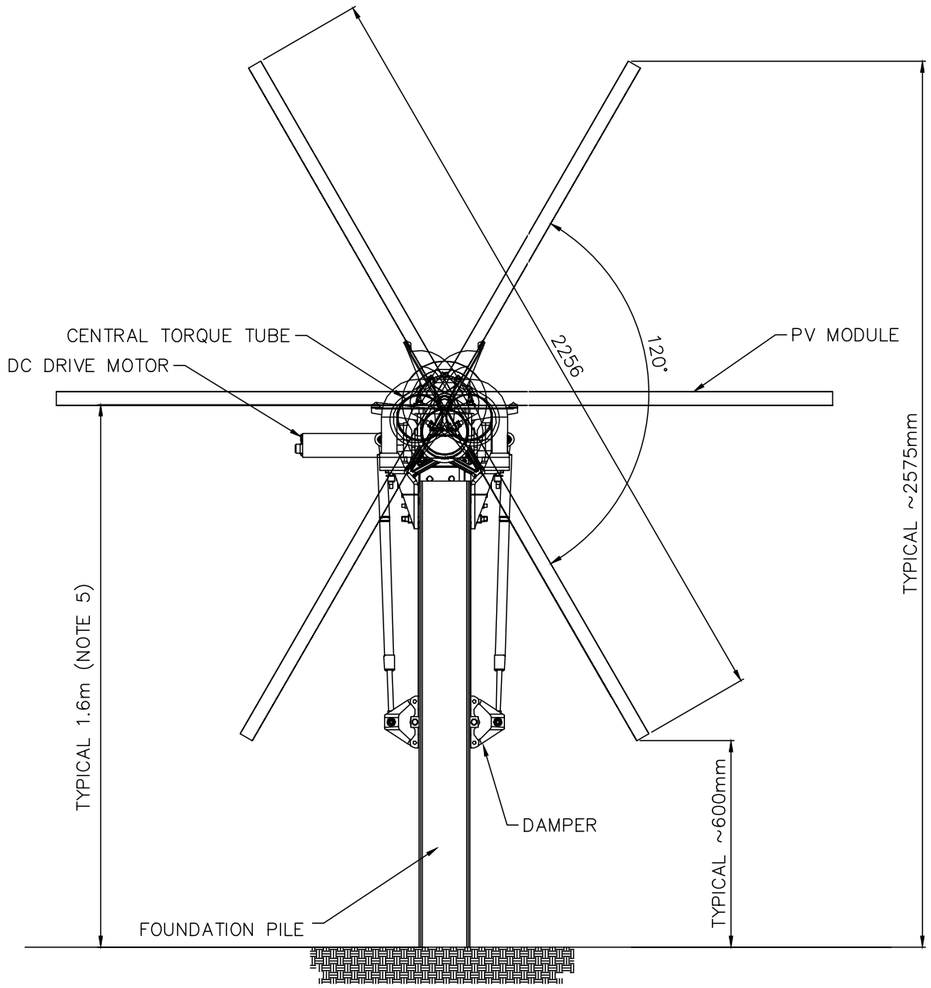
TYPICAL 3 STRING TRACKER ROW
TOP VIEW



TYPICAL 2 STRING TRACKER ROW
SIDE VIEW



TYPICAL 2 STRING TRACKER ROW
TOP VIEW



SECTION DETAIL

GENERAL NOTES

1. NEXTRACKER NX HORIZON INDEPENDENT SINGLE AXIS TRACKING SYSTEM SHOWN. TRACKING SYSTEM AND DIMENSIONS MAY CHANGE DURING DETAILED DESIGN.
2. SYSTEM FOLLOWS THE SUN POSITION TO MAXIMISE GENERATION DURING SOLAR HOURS (VIA ASTRONOMICAL ALGORITHM).
3. DIMENSIONS AND CONSTRUCTION PRESENTED ARE PRELIMINARY; FINAL DESIGN WILL DIFFER IN TRACKER FRAME LENGTH (NUMBER OF INSTALLED PV MODULES PER FRAME).
4. TRACKING SYSTEM CONSISTS OF SUPPORT FRAME INSTALLED ON MULTIPLE DRIVEN PILE (STEEL SECTION) FOUNDATIONS. EACH FRAME IS DRIVEN BY A SINGLE DC DRIVE MOTOR AND CONTROLLED BY TRACKER CONTROLLER AND NETWORK CONTROL UNIT.
5. TYPICAL HEIGHT FROM AGL TO AXIS OF ROTATION VARIES WITH GROUND UNDULATION & REQUIRED HEIGHT ABOVE FLOOD LEVEL (IF APPLICABLE) TYPICAL CLEARANCES OF 600mm EXPECTED BETWEEN GROUND LEVEL & BOTTOM EDGE OF PV MODULE AT MAXIMUM TILT.
6. TYPICAL DISTANCE BETWEEN PILES IS BETWEEN 7 TO 10m DEPENDING ON DESIGN CONDITION, AND WHETHER ROW (TABLE) IS INTERIOR OR EXTERIOR TYPE.

PROVIDENCE ASSET GROUP
Balance POWER AND ENERGY

REFERENCES

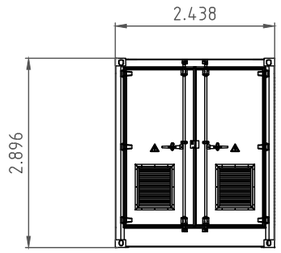
REV.	DATE	DESCRIPTION	DRWN.	DESIGNED	CHKD.	APPR.
D	2020.12.07	MINOR REVISIONS	JM	JM	SS	JM
C	2020.11.23	RE-ISSUED WITH CHANGES	JM	JM	SS	JM
B	2020.11.18	RE-ISSUED WITH CHANGES	JM	JM	SS	JM
A	2020.10.19	FIRST ISSUE	JM	JM	SS	JM

THIS DRAWING IS THE PROPERTY OF PROVIDENCE ASSET GROUP AND IS NOT TO BE COPIED (IN WHOLE OR IN PART) FOR ANY PURPOSE OR DISCLOSED TO OTHER PARTIES WITHOUT THE APPROVAL OF PROVIDENCE ASSET GROUP OR AN AUTHORIZED AGENT.

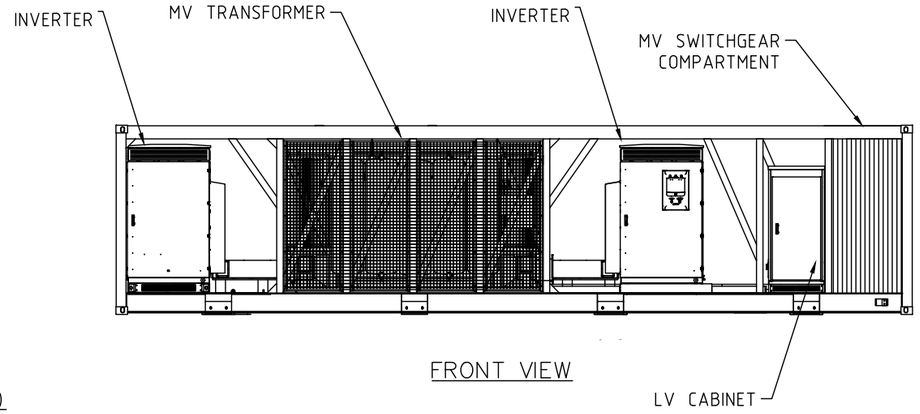
TITLE
PROVIDENCE ASSET GROUP
GLEN INNES SOLAR FARM
PV MOUNTING SYSTEM DETAIL

DWG No. 10030-E-DET-01-1

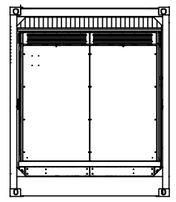
SCALE DNS
REVISION D
PAPER SIZE A3



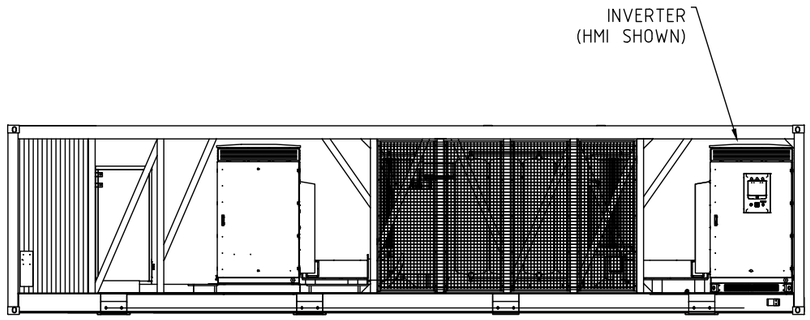
RIGHT VIEW
(RMU ACCESS)



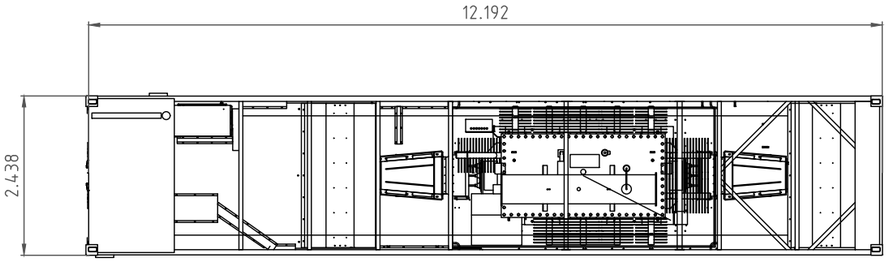
FRONT VIEW



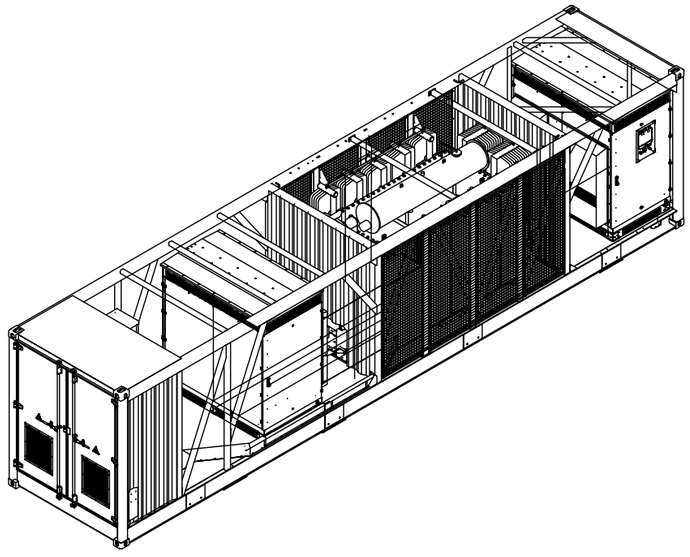
LEFT VIEW



BACK VIEW



TOP VIEW



ISOMETRIC VIEW (OPEN)

GENERAL NOTES

1. POWER CONVERSION STATION (PCS) CONSISTS OF CENTRAL PV INVERTERS, MV TRANSFORMER, MV SWITCHGEAR AND AUXILIARY PLANT. PCS IS CONTAINERISED AND RAISED ABOVE GROUND LEVEL ON CONCRETE OR DRIVEN STEEL PILE FOOTINGS.
2. TYPICAL PILE FOOTINGS WITH SURROUND OF COMPACTED EARTH WITH ~100MM BLUE METAL TOP LAYER.
3. PCU SHOWN IS THE SUNGROW SG4950HV-MV MEDIUM VOLTAGE POWER STATION SYSTEM. THE PCS MAKE AND MANUFACTURER MAY BE SUBJECT TO CHANGE.

PROVIDENCE ASSET GROUP
Balance

REFERENCES

REVISIONS

REV.	DATE	DESCRIPTION	DRWN.	DESIGNED	CHKD.	APPR.
C	2020.12.07	MINOR AMENDMENTS	JM	JM	SS	JM
B	2020.11.23	MINOR AMENDMENTS	JM	JM	SS	JM
A	2020.11.18	FIRST ISSUE	JM	JM	AA	JM

THIS DRAWING IS THE PROPERTY OF PROVIDENCE ASSET GROUP AND IS NOT TO BE COPIED (IN WHOLE OR IN PART) FOR ANY PURPOSE OR DISCLOSED TO OTHER PARTIES WITHOUT THE APPROVAL OF PROVIDENCE ASSET GROUP OR AN AUTHORIZED AGENT.

TITLE
PROVIDENCE ASSET GROUP
GLEN INNES SOLAR FARM
POWER CONVERSION STATION DETAIL
SHEET 1

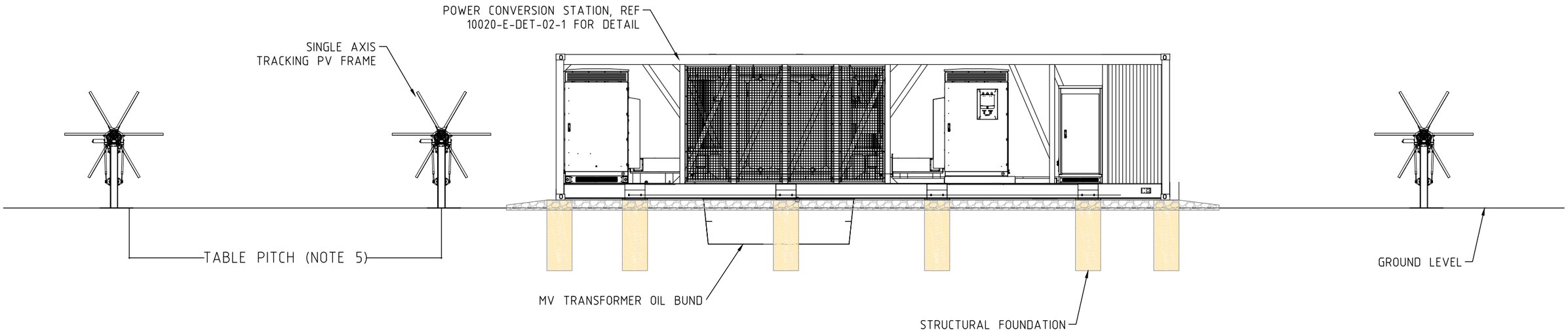
DWG No. 10030-E-DET-02-1

SCALE DNS
REVISION C
PAPER SIZE A3

9/12/2020 11:26:28 AM

GENERAL NOTES

1. TYPICAL INSTALLATION DETAIL SHOWN, MAY CHANGE DURING DETAILED DESIGN.
2. TYPICAL INSTALLATION SHOWN; PCS RAISED ABOVE GROUND LEVEL ON CONCRETE/STRUCTURAL PILE FOUNDATIONS, WITH BLUE METAL SURROUND. FOR LOW LYING AREAS SKID REQUIRES RAISING ABOVE FLOOD LEVEL BY COMPACTED EARTH MOUND. TYPICAL 1:3 BATTER, WITH ONE SIDE MIN 1:6 FOR PEDESTRIAN ACCESS, SUBJECT TO FINAL DESIGN.
3. SINGLE AXIS TRACKER ASSEMBLY – FULL HEIGHT TYPICALLY 2.575m AGL, +/– 0.5m DEPENDING ON GROUND TOPOGRAPHY. TYPICALLY 1.6m AGL, +/– 0.5m WHEN IN FLAT POSITION.
4. MINIMUM CLEARANCE OF 600MM BETWEEN GROUND LEVEL AND PV MODULE EDGE AT MAXIMUM ROTATION TO BE MAINTAINED.
5. SINGLE AXIS TRACKING FRAME – TYPICAL TABLE PITCH OF 6.0 – 7.0m
6. COMBINER BOX TYPICALLY 1.5m +/– 0.5m HIGH.



PROVIDENCE ASSET GROUP

Balance

REFERENCES

REVISIONS						
REV.	DATE	DESCRIPTION	DRWN.	DESIGNED	CHKD.	APPR.
C	2020.12.07	MINOR AMENDMENTS	JM	JM	SS	JM
B	2020.11.23	FIRST ISSUE	JM	JM	SS	JM
A	2020.11.18	FIRST ISSUE	JM	JM	SS	JM

THIS DRAWING IS THE PROPERTY OF PROVIDENCE ASSET GROUP AND IS NOT TO BE COPIED (IN WHOLE OR IN PART) FOR ANY PURPOSE OR DISCLOSED TO OTHER PARTIES WITHOUT THE APPROVAL OF PROVIDENCE ASSET GROUP OR AN AUTHORIZED AGENT.

TITLE
PROVIDENCE ASSET GROUP
GLEN INNES SOLAR FARM
POWER CONVERSION STATION DETAIL
SHEET 2

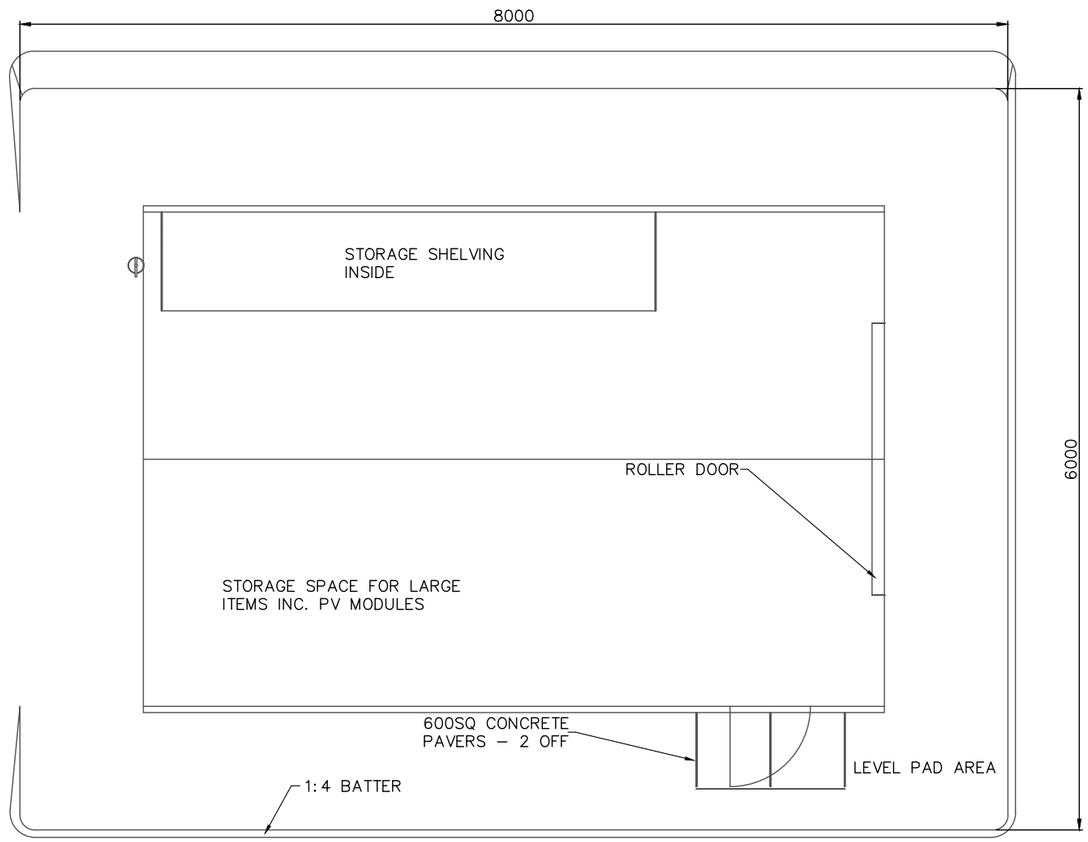
DWG No. 10030-E-DET-02-2

SCALE: DNS
REVISION: C
PAPER SIZE: A3

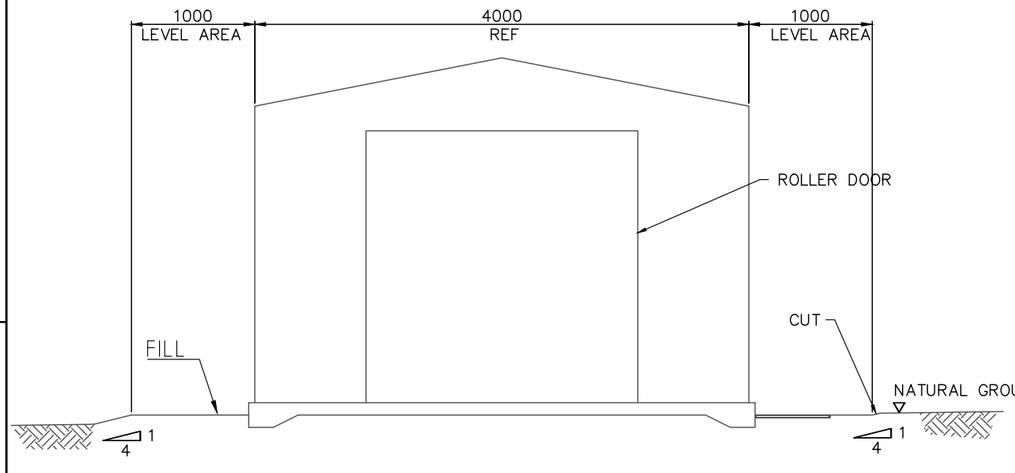
9/12/2020 11:26:51 AM

GENERAL NOTES:

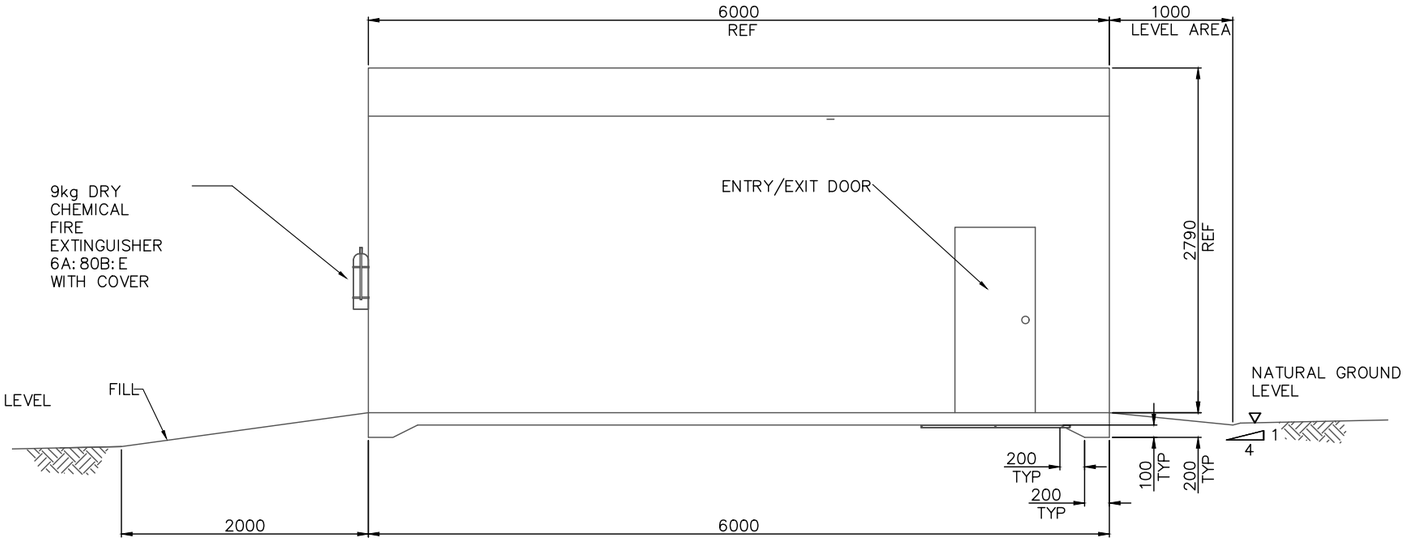
1. DIMENSIONS ARE SHOWN IN MILLIMETERS (mm)
2. SHED DESIGNED AND SUPPLIED BY (TBC).
3. WIND REGION A1, IMPORTANCE LEVEL 2
4. COMPLIES WITH PART B1 OF BUILDING CODE OF AUSTRALIA



PLAN



SIDE ELEVATION



ELEVATION

PROVIDENCE ASSET GROUP
Balance

REFERENCES

REV.	DATE	DESCRIPTION	DRWN.	DESIGNED	CHKD.	APPR.
C	2020.12.07	MINOR REVISION	JM	JM	SS	JM
B	2020.12.04	MINOR REVISION	JM	JM	SS	JM
A	2020.11.17	FIRST ISSUE	JM	JM	SS	JM

THIS DRAWING IS THE PROPERTY OF PROVIDENCE ASSET GROUP AND IS NOT TO BE COPIED (IN WHOLE OR IN PART) FOR ANY PURPOSE OR DISCLOSED TO OTHER PARTIES WITHOUT THE APPROVAL OF PROVIDENCE ASSET GROUP OR AN AUTHORIZED AGENT.

TITLE
PROVIDENCE ASSET GROUP
GLEN INNES SOLAR FARM
SHED DETAIL
TYPICAL

DWG No. 10030-C-DET-05-1

SCALE: AS SHOWN
REVISION: C
PAPER SIZE: A3

SLR

KDC

ABN 61 148 085 492

Suite 2B, 125 Bull St
Newcastle West 2302

02 4940 0442
reception@kdc.com.au
kdc.com.au

Our ref: 19310.2

29 March 2021

Glen Innes Severn Council
PO Box 61
GLEN INNES NSW 2370

Attention: Kathleen Taminiau

RE: Response to Request for Additional Information – DA-56/20-21 – Tuttles Lane, Glen Innes NSW 2370

This letter has been prepared by SLR Consulting (Previously KDC Pty Ltd) on behalf of NSW Community Renewables (Glen Innes) Pty Ltd in relation to the request for further information relating to the proposed 5MW PV Solar Farm at Tuttles Lane, Glen Innes NSW 2370 (DA-56/20-21). This letter provides a response to the request for further information letter dated 22 March 2021.

Transport for NSW (TfNSW)

1. *The support Traffic Impact Assessment (TIA) identifies that construction traffic demands will increase traffic along the identified access route and that these demands will reduce during the operational phase of the development. It is noted that these movements will occur on high-speed, rural roads typically supporting low traffic volumes. Peak construction traffic should be appropriately managed to ensure the safety of the travelling public.*

   Response: It is noted that construction traffic is temporary in nature and will be managed through a future Construction Management Plan to be prepared by the appointed contractor.

2. *Section 3.1 of the TIA provides a description of the Gwydir Highway and Tuttles Lane intersection. The description does not confirm the presence of minimum Austroads Basic (BA) turn treatments. In particular, the development proposes an increased in vehicles turning from the highway into Tuttles Lane.*

   Response: As stated in the Traffic Impact Assessment, the combination of the two-way mid-block peak hour traffic data and traffic generation figures reported in Section 6.1 in the AM and PM peak hour traffic volumes on the local and state road network during construction of the Solar Farm will be well below the existing capacity thresholds determined above then the local and state road network has sufficient spare two-way mid-block capacity to cater for the construction and operation of the Solar Farm. BA treatment is not considered necessary in this instance, while the use is considered commercial, due to the nature of the solar farm it will generate minimal vehicle movements and access from Gwydir Highway will not cause safety issues or delays for other vehicles.

3. *Images in the TIA suggest the abovementioned intersection does not meet the minimum geometry for an Austroads basic right-turn (BAR) treatment. The proposed increase in vehicles turning right from the Gwydir Highway in Tuttles Lane will increase the risk of rear-end crashes in the 100km/h speed environment.*

   Response: The TIA projected a peak of peak of 18 vehicle trips per hour consisting of 10 light vehicles, 3 roadwork vehicles, and 2 delivery vehicles. It is noted, construction is not expected to exceed the capacity of either the roads or the intersection as they are currently designed. Based on the data collected, BAR treatment is not considered necessary in this instance, while the use is considered commercial, due to the nature of the solar farm, vehicles turning right from Gwydir Highway onto Tuttles Lane will not generate an increase in traffic or increase the risk of rear-end crashes in the 100km/h speed environment.

4. *The TIA should typically consider the Austroads warrants for BA, AU or CH turn treatments to address safety for through and turning traffic. Prior to determination it is recommended that Council identify the existence of minimum Austroads intersection treatments and condition any warranted intersection treatment. It is noted that construction traffic may be managed under temporary arrangements and that works should accommodate expected operational demands.*

   Response: A traffic management plan will be prepared by the proponent for the PV Solar Farm during the construction phase to accommodate expected operational demands.

5. *TfNSW suggests that the Consent Authority may wish to obtain swept path analysis to demonstrate that the largest design vehicle can negotiate the transport route in both directions and enter and leave the site in a forward direction. The site access should be located, designed, and constructed to Council's design requirements.*

   Response: A Construction Management Plan will be prepared for the proposal within the provisions of Council's design requirements.

6. *The TIA has considered one possible transport route to the site. It is noted that access may be obtained from alternate route/s. Access should be limited to the route identified in the TIA unless assess otherwise. It is recommended that the daily and peak hourly vehicle movements be identified as a condition of consent to ensure the demand generated by the development is consistent with the assessment provided in the TIA.*

   Response: A Traffic Management Plan will be prepared for the proposal. The above is requested to be conditioned.

7. *Section 9 of the TIA provides limited details of public bus services operating in the subject area. It is unclear whether development traffic will impact on public or school bus services along the identified transport route during the construction and/or operational phase of the development. TfNSW recommends that the consent Authority seek clarification of any expected impact on bus services and consider measures where appropriate.*

Response: The TIA projected an average of 10 light vehicles per day of which will arrive between 6am and 7pm then departing the site between 5pm and 6pm. Heavy vehicles are projected to be 5 per day spread out between 10 am and 4pm. Minimal impact on public or school bus services will be expected within the construction phase.

8. *It is recommended that the Consent Authority consider requiring the preparation of a Traffic Management Plan (TMP) inclusive of temporary and ongoing measures to be implements during the construction and operational phases of the development. The TMP, inclusive of any temporary traffic control measures should be prepared by a suitable qualified person and includes a Driver Code of Conduct (COC) and details of to be implemented during peak constructions and/or periodic operational maintenance activities.*

   Response: A Traffic Management Plan will be prepared for the proposal. The above is requested to be conditioned.

9. *The National Heavy Vehicle Regulator will need to be consulted regarding the uses of Tuttles Lane by B-Doubles.*

   Response: Noted, The National Heavy Vehicle Regulator will be consulted in conjunction with the Construction Management Plan**.**

Biodiversity and Conservation Division (BCD)

BCD recommends that the council consider imposing conditions of consent requiring that:

1. *Active weed control be undertaken across the whole site on a regular basis.*

   Response: Weeds on site will be appropriately managed. Details regarding proposed Weed Management procedures can be provided to Council as a condition of consent.

2. *A vegetation rehabilitation and management plan be prepared and implemented for the south eastern section of the site.*

   Response: Details regarding proposed Vegetation Rehabilitation and Management can be provided to Council as a condition of consent.

Public Submissions

1. *Glare from tracking solar panels.*

   Response: A Reflective Glare Assessment (RGA) has been undertaken by SLR Consulting to assess the potential for reflected light induced impacts on aviation, road operations, rail operations, industrial and heavy machinery operations, and residential amenity.

   The proposed solar PV panels include solar trackers which results in minimal potential for horizontal reflectivity to occur as light is minimal in any case, due to the absorbent nature of the PV panels, coupled with the anti-reflective coating. As a result, impacts on residents,

roadway operation, and on any surrounding mechanical operations is considered to be negligible at all times of the year.

Due to the site's large distances from nearby airports, it is considered the proposal will have no impact on airport operations however aerial spraying has been considered. A generic flight scenario has been quantitatively analysed using SGHAT model and found potential for aviation glare was negligible all year round due to the low incidence angle of reflected rays resulting from the tilting action of the tracking system.

Glare resulting from onsite lighting will be mitigated in accordance with AS4282-1997 Control of the Obtrusive Effect of Outdoor Lighting effectively controlling potential for light spill and glare generated by the proposed development.

Due to the use of high-quality solar tracking systems and site buffer distances to surrounding receivers and transport networks, potential for aviation related glare, rail traffic related glare and motorist related glare is considered negligible. Recommendations and mitigation measure have been included in the report to ensure that residential nuisance glare is avoided.

2. *SLR visual assessment inadequate. Assessment should have considered all of Abbotts Road and the residents*

   Response: The visual impact assessment included consideration of all aspects of the solar PV farm including the viewpoints from Abbotts Road as shown within the VIA report. Viewpoint 4 provides a worst-case viewpoint which represents the residents looking east towards the solar site which, while located under one kilometre from the site, the rolling pastoral landscape and moderately vegetated hills absorb the solar arrays into the landscape resulting in an assessed visual impact of minor to negligible.

3. *Noise from tracking movements*

   Response: During operation, the PV panels would generate electricity which would be fed into the power grid via the adjacent existing powerline. Key noise emissions from the operation of the project are associated with the inverter and transformer(s). It is noted that emissions from these sources are anticipated to be acoustically insignificant compared to ambient background noise levels at assessed receivers. Noise from tracking system movements will emanate from approximately 136 (1 per tracker) small DC motors distributed throughout the site. As the system tracks the path of the sun, the motors activate approximately every 5 minutes, for a period of approximately 20 seconds. The noise level within the site from these motors when operating will be acoustically insignificant, and from outside the site will be inaudible.

4. *Visual impact and loss of property value.*

   Response: The establishment of the recommended trees and large shrubs provide a range of vertical canopy cover to provide visual screening to the surrounding area. Further mitigation measures include the use of anti-reflective coated solar panels and muted colours on supporting structures to blend into the surrounding environment. As such, the proposed

development is considered to have minimal visual impact on surrounding residents with impact on property values expected to be low as a result.

Other Matters

Decommissioning

On cessation of power generation operations, the solar panels along with the supporting structures and associated infrastructure are to be removed from the site. The panels themselves are to be removed and directed to an appropriately licenced facility with recycling to be prioritised over landfill options subject to availability at the decommissioning stage. Surface infrastructure such as the array frames are readily recyclable and will be directed to appropriately licenced resource recovery facilities.

As the supporting solar panel structures are proposed to be driven into the ground rather than using earthworks, they are to be similarly lifted out of the ground with no or negligible earthworks required. This significantly reduces decommissioning time and retains the natural landform of the site.

The associated energy infrastructure is to be disconnected from the grid. Infrastructure may be reconditioned for reuse elsewhere or recycled offsite. Cabling is to be recovered and directed for recycling.

Site improvements such as driveway and stormwater management are to be returned to its state prior to development. The proposed boundary landscaping is to remain on the site.

Where landfilling is required there will be a preference to large scale and appropriately licenced landfills outside of the Glen Innes region. This will ensure the landfill capacity supporting Glen Innes and surrounding areas is reserved for the needs of the community and maintain its existing projected lifespan.

Conclusion

We trust that the information provided is sufficient. If any clarification is needed or you require further information, please contact the undersigned on (02) 4940 0442.

Yours sincerely,



Rachel Pettitt
Town Planner
SLR Consulting Australia Pty Ltd (formerly KDC Pty Ltd)

STATEMENT OF ENVIRONMENTAL EFFECTS

Establishment of Solar PV Power Generation Plant

208 West Furracabad Road, Glen Innes NSW 2370

PREPARED FOR PROVIDENCE ASSET GROUP | DECEMBER 2020

SLR

KDC

This page has been left blank intentionally

Contents

1	Introduction	5
1.1	Providence Asset Group	5
1.2	Consultation with Council	5
2	The Site and Surrounds	7
2.1	Site Description	7
2.2	Site Location and Context	8
3	Project Description	9
4	Relevant Legislation and Planning Controls	11
4.1	Environmental Protection and Biodiversity Conservation Act 1999	11
4.2	Environmental Planning And Assessment Act 1979	11
4.3	National Park and Wildlife Act 1974	11
4.4	Biodiversity Conservation Act	12
4.5	State Environmental Planning Policy (State and Regional Development) 2011	12
4.6	State Environmental Planning Policy (Infrastructure) 2007	12
4.7	State Environmental Planning Policy No 55 Remediation of Land	13
4.8	Local Land Services Act 2013	13
4.9	State Environmental Planning Policy (Koala Habitat Protection) 2019	14
4.10	Glen Innes severn Local Environmental Plan 2012	14
4.11	Glen Innes Development Control Plan 2014	17
4.12	Glen Innes Severn Shire Council Local Strategic Planning Statement	17
5	Assessment of Planning Issues	19
5.1	Compliance with Planning Instruments and Controls	19
5.2	Traffic, Access and Parking	19
5.3	Stormwater, Soil and Erosion Control	20
5.4	Flora and Fauna	21
5.5	Noise	21
5.6	Landscape and Visual Impact	22
5.7	Glare Analysis	22
5.8	Heritage	23
5.8.1	Indigenous Cultural Heritage	23
5.8.2	European Heritage	23
5.9	Social and Economic Impacts	24
6	Conclusion	27

Figures

Figure 2 – Cadastral Plan (Source: Six Maps) 8
Figure 3 – Proposed Development Layout 10

Appendices

Appendix A – Architectural Plans 29
Appendix B – Stormwater Management Plan 31
Appendix C – Compliance Tables 33
Appendix D – Traffic Impact Assessment 41
Appendix E – Visual Impact Assessment, Landscape Plans and Glare Analysis 43
Appendix F – Due Diligence Aboriginal Archaeological Assessment 45
Appendix G – Acoustic Assessment 47
Appendix H – Flora and Fauna Assessment Report 49
Appendix I – Waste Management Plan 51
Appendix J – Quantity Surveyors Report 53

As of October 2nd 2020, **KDC has joined the SLR Consulting team**. To learn more about SLR, and the additional expertise that we can now provide our clients, take a read here >

1 INTRODUCTION

This Statement of Environmental Effects (SEE) is submitted to Glen Innes Severn Shire Council (Council) in support of a Development Application (DA) for a solar photovoltaic (PV) power generation plant at Tuttles Lane with the registered address of 208 West Furracabad Road, Glen Innes NSW 2370 (the site).

Specifically, the proposed development includes:

- Establishment of a grid-connected solar photovoltaic (PV) plant including associated electrical generation, supplying no greater than 5 megawatts (MW);
- New 5m wide access road at the western border of the site via Tuttles Lane;
- Removal of non-native trees and negligible amounts of native groundcover;
- Security fencing 2.3m high; and,
- Other associated site improvements as shown on the Plans at Appendix A.

This SEE has been prepared by KDC Pty Ltd (KDC) on behalf of Providence Asset Group (PAG). It describes the site, its environs, the proposed development and provides an assessment of the proposal in terms of the matters for consideration under Section 4.15 (1) of the Environmental Planning and Assessment Act 1979 (EP&A Act 1979). It should be read in conjunction with the supporting information and Plans prepared by Balance, Power and Energy Pty Ltd appended to this report (Appendix A).

1.1 PROVIDENCE ASSET GROUP

Providence Asset Group (PAG) is an Australian innovation led investment and asset management firm focusing on ethical investment within an environmental, social and corporate governance framework. Through collaborative partnerships, PAG supports and invests in projects aligned to new forms of renewable and clean energy.

PAG have now secured over 30 solar farm sites in regional NSW and Victoria, including a partnership with Manilla Community Renewable Energy Inc. to develop Australia's first community owned solar farm. Once constructed the 5MW Manilla project will be able to power the community of Manilla during daylight hours. The project is also a recipient of a NSW Government grant to develop PAG's a world first energy storage technology which will enable PAG's solar projects to provide stable energy well into the early morning and evening peak electricity consumption periods.

1.2 CONSULTATION WITH COUNCIL

A formal pre-development application meeting with Glen Innes Severn Shire Council was held on 30 October 2020 via videoconference. At this meeting, the proposed development was presented by the proponent. No formal pre-DA minutes were received. Overall, the meeting was positive, and Council were generally supportive of the development. The following matters were requested to be addressed:

- Access – Access to the site via Tuttles lane is seen as acceptable, as it already has dealt with much larger wind farm traffic. A Traffic Impact Assessment is provided at Appendix D.
- Visual Impact – Concerns were raised regarding visual impact to surrounding dwellings and screening from the main highway. A Visual Impact Assessment is provided at Appendix E.
- Waste – Concerns were raised regarding waste disposal after installation and the life cycle and disposal of solar panels. All waste is to be separated and recycled. A Waste Management Plan is provided at Appendix I.

- Flooding – Concerns were raided regarding flood impact. No flood study data is available for the site, the Planning certificate indicates the site is not flood prone.
- Transmission Lines – All transmission lines within the public road reserves are to be overhead and not underground.

Council also encourages contact with local businesses to encourage collaboration and subcontract opportunities.

2 THE SITE AND SURROUNDS

2.1 SITE DESCRIPTION

The site is legally known as Lot 32, 33, 34, 35 and 36 of DP 1834 and Lot 1 of DP251457, located adjacent to Tuttles Lane and with the registered address of 208 West Furracabad Road, Glen Innes NSW 2370. The entire site area extends to approximately 53 hectares and is primarily agricultural lands.

The site has frontage to Gwydir Highway to the south, and Tuttles Lane to the west. The site gently slopes towards the northern portion towards Chaffey's Hill and is sparsely vegetated, mostly with non-native vegetation. The area of the proposed solar PV farm is approximately 14.8 hectares as identified in Figure 1 and Figure 2.

The land used largely for agricultural purposes. A low number of scattered trees are present on the site along the southern and western border as well as the northern border. An existing dwelling is located north of the site with access via Strathbogie Road. The dwelling is approximately 561m from the location of the solar PV farm.

The development site is located across the majority of Lot 32, 33 and 34 of DP1834 and Lot 1 of DP251457, and part of Lot 35 and 36 of DP1834 fronting Tuttles Lane.

Figure 1 – Site Plan (Source: Six Maps)

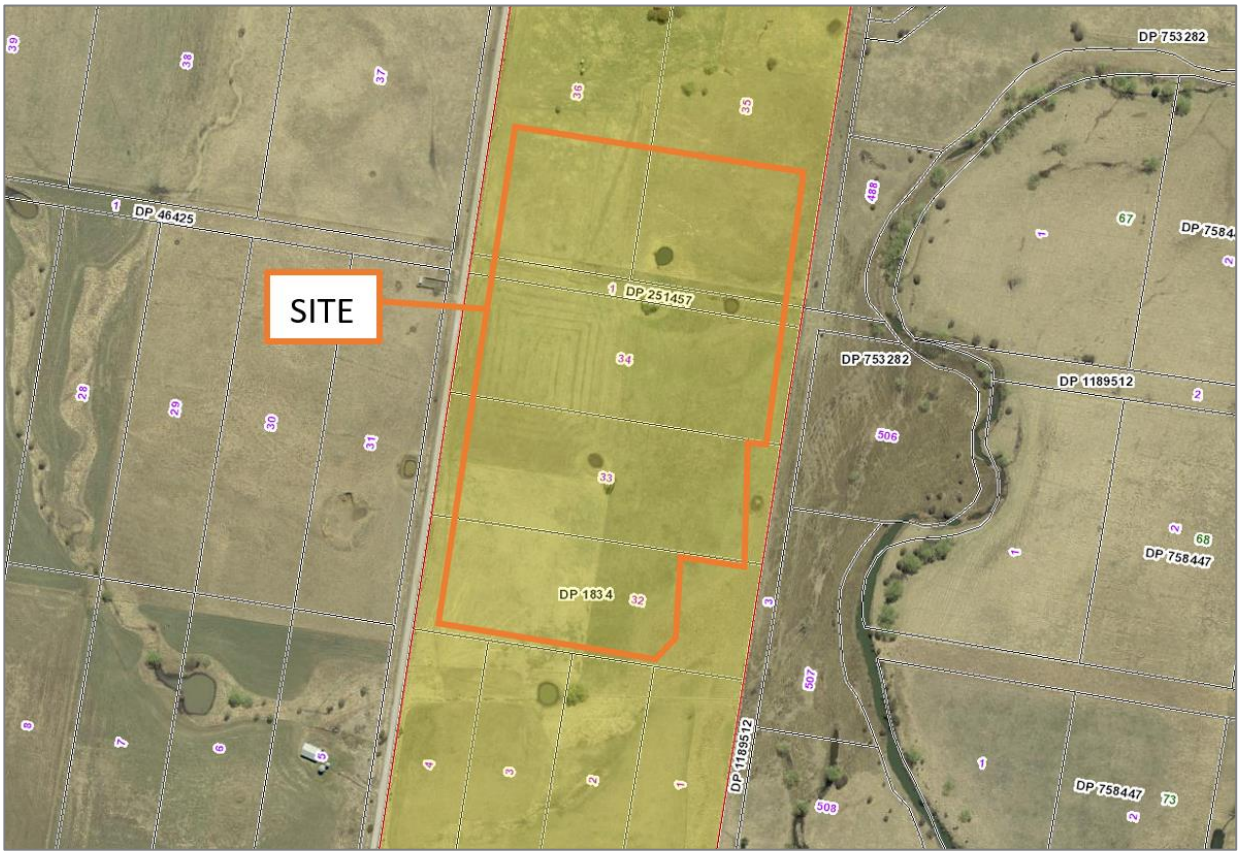
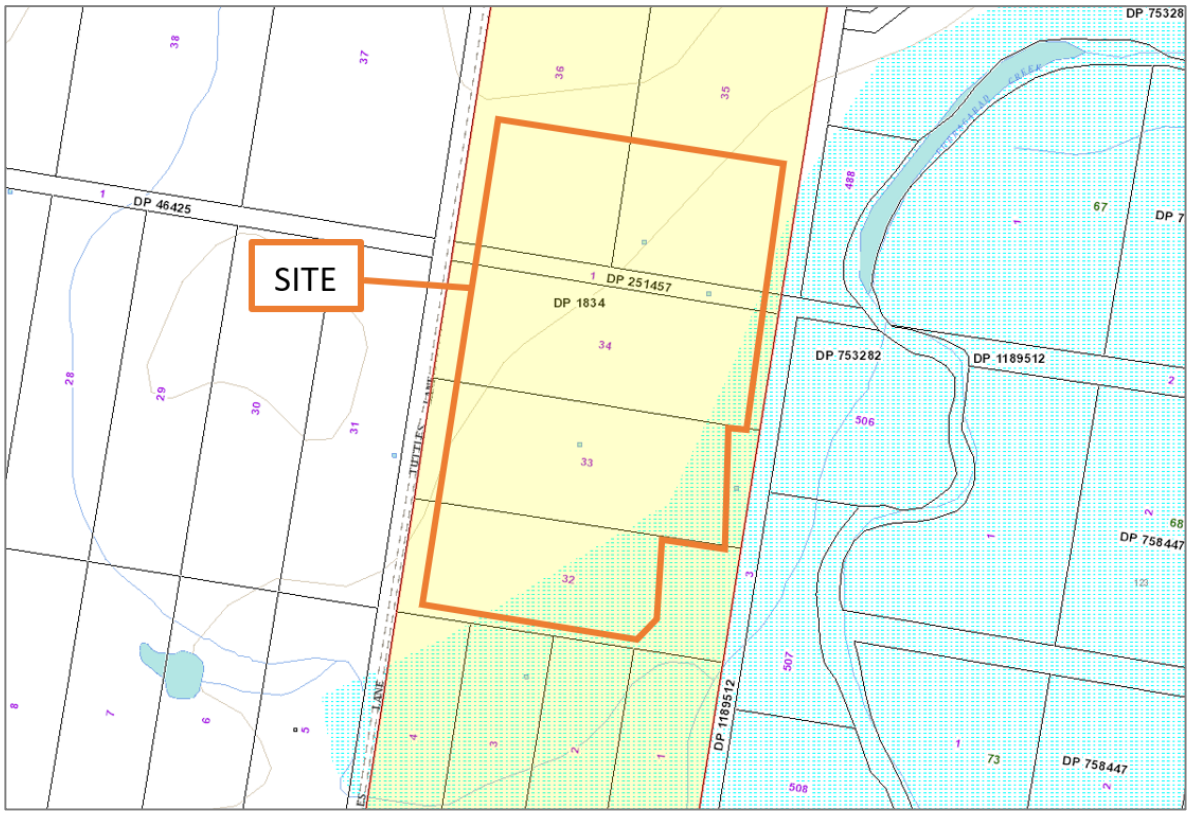


Figure 1 – Cadastral Plan (Source: Six Maps)



2.2 SITE LOCATION AND CONTEXT

The site is located approximately 1.2km west of the Glen Innes town centre, within the Glen Innes Severn Shire Council Local Government Area (LGA). Tuttles Lane is a single lane road in each direction, unsealed, unmarked with no kerb or guttering on either side.

Surrounding lands are similar to the subject site area, consisting of agricultural and primary production land with rural dwellings, sheds, dams, and scattered remnant vegetation. The site is approximately 560m from the nearest dwelling located on the northern side of Chaffeys Hill, to the north of the site area.

Furracabad Creek runs east of the site and an unnamed watercourse is running south of the site. A setback of the panels to this watercourse and associated tributaries may be required, which is consistent with the nominated development site. Glen Innes Airport is located approximately 5km north-west of the site.

3 PROJECT DESCRIPTION

The Glen Innes Solar Farm project is one of PAG's solar initiatives to be rolled out across regional Australia, with multiple benefits for rural and regional communities.

The proposal includes a no larger than 5MW grid-connected solar PV installation. The solar farm will be connected to Essential Energy's network via an 11 kV distribution line running adjacent to the eastern boundary of the site. It is noted that a separate application process is being undertaken with Essential Energy for this connection.

The proposed development aims to erect an estimated 11,424 solar PV panels with a nameplate rating of 540W. Other electrical generation infrastructure is proposed on the site including a skid-mounted MV Power Station consisting of inverters, transformer, and switchgear. Due to the capacity of the inverter system, the proposed development will produce less than 5MW. Most of the infrastructure will be pre-fabricated off-site, delivered and assembled on-site.

The PV arrangement will consist of 136 ground mounted single axis trackers. The PV arrays will have a clearance above the existing ground surface and extend to approximately 2.6m at maximum tilt. The PV mounting structure will comprise of steel posts driven to approximately 1.5m below ground using a small pile driver. Additional support structures will be attached to the piles, which would then support the PV panels.

The proposed development will not require the entire removal of vegetation within the development area, it is noted that the site has been cleared for agricultural purposes.. The proposal will not involve clearing of native vegetation that exceeds the Biodiversity Offset Scheme (BOS) threshold for the site. The proposal will result in the removal of isolated non-native paddock trees and exotic grasslands.

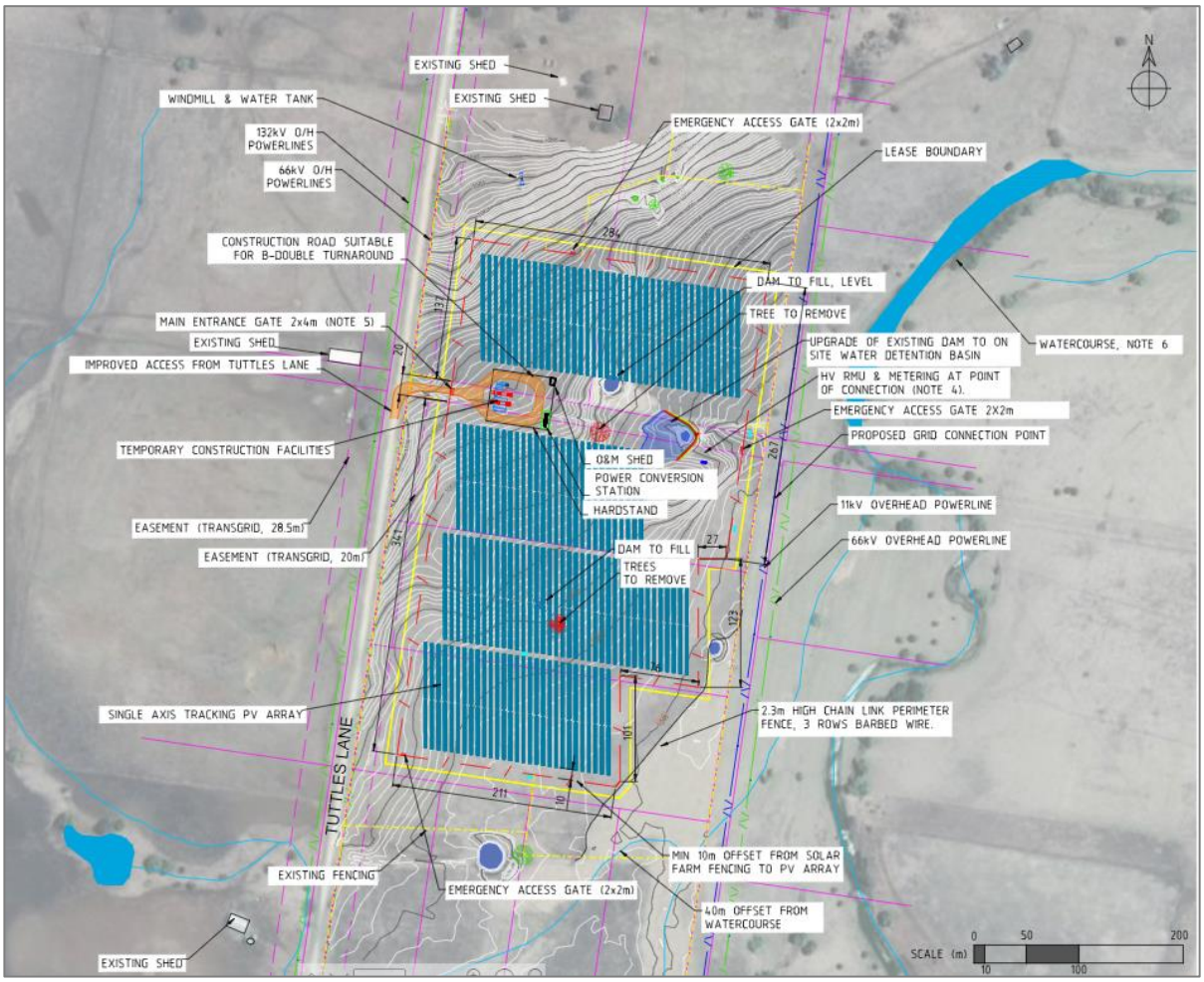
A 5m wide access road is proposed connecting the solar farm to Tuttles Lane along the western boundary. Access to the site during construction and operation will also be provided off Tuttles Lane. The solar farm will be fully fenced with 2.3m security fencing including barbed wire at the top. Gate access is provided on the western border of the site, and an emergency gate access is provided on all borders of the site. A car park area, off load area and temporary construction office are indicatively shown on the General Arrangement Plan (refer to Figure 3). Motion activated security lighting may be installed at the site.

A stormwater management system is proposed including an onsite detention basin holding a total volume of 210.21m^3 supported with a low flow outlet, refer to the Stormwater Management Plans at Appendix B. Earthworks for the project are generally limited to the establishment of the access road, drainage swales and batters, laydown area, and detention basin.

The solar PV farm would operate 24 hours a day, 7 days a week, with no permanent staff on site. Maintenance inspections will be undertaken an as needs basis.

During the construction period there is estimated to be up to 30 personnel on site for up to 6 months.

Figure 2 – Proposed Development Layout



4 RELEVANT LEGISLATION AND PLANNING CONTROLS

The following Environmental Planning Instruments (EPIs) and Development Control Plans (DCPs) are relevant to the proposed development as explored within this Section of the report:

- Environment Protection and Biodiversity Conservation Act 1999;
- Environmental Planning and Assessment Act 1979;
- National Parks and Wildlife Act 1974;
- Biodiversity Conservation Act 2016;
- State Environmental Planning Policy (Infrastructure) 2007;
- State Environmental Planning Policy (Koala Habitat Protection) 2019;
- State Environmental Planning Policy (State and Regional Development) 2011;
- State Environmental Planning Policy 55 – Remediation of Land;
- Local Land Services Act 2013;
- Glen Innes Severn Local Environmental Plan 2012;
- Glen Innes Development Control Plan 2014; and,
- Glen Innes Contributions Plan 2014.

4.1 ENVIRONMENTAL PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

Consideration of the EPBC Act 1999 revealed that impacts on Matters of National Environmental Significance (MNES) are unlikely to occur. No EPBC listed species, ecological communities, migratory species or important habitat for such entities was identified within the subject site. The assessment determined that impacts to Matters of National Environmental Significance (MNES) are unlikely; therefore, an EPBC referral to the Commonwealth Minister for the Environment is not recommended.

Full details are included in the Ecological Assessment Report at Appendix H.

4.2 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

The proposal, as with all development applications, is subject to the provisions of the Environmental Planning and Assessment Act 1979 (EP&A Act). Section 4.15(1) of the EP&A Act, 1979 provides criteria which a consent authority is to take into consideration, where relevant, when considering a DA. An assessment of the subject DA, in accordance with the relevant matters prescribed under Section 4.15(1), is provided within this SEE.

It is noted, pursuant to Section 4.46 of the EP&A Act 1979, the proposed development does not trigger integrated development.

4.3 NATIONAL PARK AND WILDLIFE ACT 1974

The National Parks and Wildlife Act 1974 includes provisions for the protection and recording of Aboriginal objects in NSW.

An Aboriginal Due Diligence investigation has been undertaken in accordance with the provisions of the National Parks and Wildlife Regulations 2009 and the accompanying Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (OEH 2010). See Appendix F for a copy of the Due Diligence Report for the proposal prepared by Virtus Heritage.

4.4 BIODIVERSITY CONSERVATION ACT

The Biodiversity Conservation Act 2016 (BC Act 2016) aims to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. To achieve its goals, the BC Act 2016 governs endangered species and communities and provides a framework for a Biodiversity Offset Scheme.

An assessment was undertaken by Kleinfelder in accordance with Section 7.3 of the BC Act 2016 to determine the significance of potential impacts of the proposed development on any threatened species or communities which are listed within the Act.

No threatened ecological communities or any listed flora or fauna were identified on site with the proposed development unlikely to cause any significant impact to any threatened species, populations or communities listed within the BC Act. Entry into the NSW BOS is not triggered by the proposed development. Further details are provided in Section 5.4 of this Report and in the Flora and Fauna assessment at Appendix H.

4.5 STATE ENVIRONMENTAL PLANNING POLICY (STATE AND REGIONAL DEVELOPMENT) 2011

Regional development classification applies to both local and designated development applications exceeding certain criteria defined by Schedule 7 of the SEPP SRD.

5 Private infrastructure and community facilities over $5 million

Development that has a capital investment value of more than $5 million for any of the following purposes:

> *(a) air transport facilities,* ***electricity generating works****, port facilities, rail infrastructure facilities, road infrastructure facilities, sewerage systems, telecommunications facilities, waste or resource management facilities, water supply systems, or wharf or boating facilities,*
>
> *(b) affordable housing, child care centres, community facilities, correctional centres, educational establishments, group homes, health services facilities or places of public worship.*

The proposed electricity generating works is considered to be private infrastructure with a CIV greater than $5 million and as a result the development is deemed to be regionally significant development and the application will be referred to the Regional Planning Panel (RPP) for determination.

4.6 STATE ENVIRONMENTAL PLANNING POLICY (INFRASTRUCTURE) 2007

Clause 45 Determination of development applications—other development

The proposed development will require works to connect to the overhead electricity power lines and as a result constitutes works within 5m of powerlines. Due to the location and nature of the proposed development referral to the electricity supply authority, Essential Energy, will be required during the assessment period.

Clause 104 - Traffic-generating development

The proposed development will not generate greater than 50 vehicle movements per hour and as such does not trigger traffic generating development under the SEPP. Referral under this clause to Transport for NSW is therefore not required.

4.7 STATE ENVIRONMENTAL PLANNING POLICY NO 55 REMEDIATION OF LAND

This SEPP requires the consent authority to consider the potential contamination status of the land prior to approving a development.

A search of the NSW EPA's *'List of NSW contaminated sites notified to the EPA'* and *'POEO Public Register'* has been undertaken which revealed no contaminated sites listed on or in the vicinity of the site. A total of 10 licences have been issued under the Protection of the Environment Operations Act in Glen Innes, however none are noted within proximity to the site. Environmental protection licences issued within Glen Innes include:

- Licence 576 – Glen Innes Severn Shire Council – Glen Innes Sewage Treatment Works, New England Highway, Glen Innes, NSW 2370– Operational;
- Licence 907 – Glen Innes Severn Shire Council – Grafton Road, Glen Innes, NSW 2370 – Operational;
- Licence 5939 – Glen Innes Severn Shire Council– Glen Innes Waste Management Depot, Rodgers Road, Glen Innes, NSW 2370 – Operational;
- Licence 20891 – Glen Innes Severn Shire Council – Wattle Vale South, 1323 Gwydir Highway, Glen Innes, NSW 2370 – Operational;
- Licence 11223 – Great Northern NSW Pty Ltd- "Weean", Western Feeder Road, Glen Innes, NSW, 2370- Operational;
- Licence 3864 – Rangers Valley Cattle Station Pty Ltd – Rangers Valley Cattle Station 1304 Rangers Valley Road, Glen Innes NSW 2307 – Operational; and
- Licence 20665 – White Rock Wind farm Pty Ltd – Between Gwydir Highway and Maybole Road, Glen Innes, NSW 2370 – Operational.

No records of any contaminated lands are noted within the Glen Innes Severn Shire LGA on the NSW EPA Contaminated Lands Register search. Further, the s10.7 Planning Certificate does not note any asbestos recorded on the site. The site is therefore not currently known to be contaminated. The proposed development is not considered to be sensitive in nature and as a result is considered to be appropriate for the site in its current state in accordance with SEPP55.

4.8 LOCAL LAND SERVICES ACT 2013

60H Category 1-exempt land mapping

(1) Land is to be designated as category 1-exempt land if the Environment Agency Head reasonably believes that—

(a) the land was cleared of native vegetation as at 1 January 1990, or

(b) the land was lawfully cleared of native vegetation between 1 January 1990 and the commencement of this Part.

(2) Land is to be designated as category 1-exempt land if the Environment Agency Head reasonably believes that—

(a) the land contains low conservation value grasslands, or

(b) the land contains native vegetation that was identified as regrowth in a property vegetation plan referred to in section 9 (2) (b) of the Native Vegetation Act 2003, or

(c) the land is of a kind prescribed by the regulations as category 1-exempt land.

(3) Land is to be designated as category 1-exempt land if the land is biodiversity certified under Part 8 of the Biodiversity Conservation Act 2016 or under any Act repealed by that Act.

(4) However—

(a) land described in subsection (1) or (2) is not to be designated as category 1-exempt land if section 60I (2) requires the land to be designated as category 2-regulated land, and

(b) land described in subsection (1) (a) is not to be designated as category 1-exempt land if the land was unlawfully cleared of native vegetation after 1 January 1990, and

(c) land described in subsection (2) (a) is not to be designated as category 1-exempt land if the land was unlawfully cleared of native vegetation after 1 January 1990.

(5) The regulations may make provision for the purposes of determining whether grasslands are low conservation value grasslands for the purposes of this Division.

The proposed development area in the subject site has been under regular cropping, grazing and pasture improvement since prior to 1990. Therefore, in accordance with the Local Land Services Act 2013, the full project development area can be considered as category 1-exempt land.

Based on the above data sources, there is sufficient evidence to support that the development area in the subject site has been under regular cropping, grazing and pasture improvement since prior to 1990. Therefore, in accordance with the Local Land Services Act 2013, the full project development area can be considered as category 1-exempt land

4.9 STATE ENVIRONMENTAL PLANNING POLICY (KOALA HABITAT PROTECTION) 2019

The State Environmental Planning Policy (Koala Habitat Protection) 2019 (Koala SEPP) aims to encourage the conservation and management of areas of natural vegetation that provide habitat for koalas to support a permanent free-living population over their present range and reverse the current trend of koala population decline.

The proposed development will not directly impact an area identified by the Koala Development Application Map. No koala's or evidence of koalas were identified during the Flora and Fauna Assessment Report, as outlined in the Flora and Fauna Assessment at Appendix H.

4.10 GLEN INNES SEVERN LOCAL ENVIRONMENTAL PLAN 2012

The entire priority investigation area is zoned RU1 Primary Production under the Glen Innes Severn Local Environmental Plan 2012 (LEP 2012), see Figure 4.

Figure 4– Land Zone Extract Glen Innes Severn LEP 2012 (LZN_003A)



Zone RU1 Primary Production

1 Objectives of zone

- *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.*

2 Permitted without consent

Environmental protection works, Extensive agriculture; Flood mitigation works; Forestry; Home-based child care; Home occupations; Roads; Roadside stalls

3 Permitted with consent

Aquaculture; Backpackers' accommodation; Bed and breakfast accommodation; Building identification signs; Business identification signs; Cellar door premises; Dual occupancies; Dwelling houses; Extractive industries; Farm buildings; Farm stay accommodation; Funeral homes; Group homes; Home industries; Intensive livestock agriculture; Intensive plant agriculture; Kiosks; Landscaping material supplies; Open cut mining; Plant nurseries; Restaurants or cafes; Rural supplies; Rural workers' dwellings; Timber yards; Turf farming; Any other development not specified in item 2 or 4

4 Prohibited

Amusement centres; Boat building and repair facilities; Car parks; Centre-based child care facilities; Commercial premises; Depots; Entertainment facilities; Exhibition homes; Exhibition villages; Function centres; Health services facilities; Heavy industrial storage establishments; Highway service centres; Industrial retail outlets; Industries; Marinas; Mooring pens; Moorings; Passenger transport facilities; Places of public worship; Public administration buildings; Registered clubs; Residential accommodation; Respite day care centres; Restricted premises; Service stations; Sex services premises; Signage; Storage premises; Tourist and visitor accommodation; Vehicle body repair workshops; Vehicle repair stations; Warehouse or distribution centres; Wholesale supplies

The proposed land use, defined as *electricity generating works*, is permitted within the RU1 zoned as *any other development not specified in item 2 or 3*.

LEP 2012 definition:

> ***electricity generating works*** *means a building or place used for the purpose of—*
>
> *(a) making or generating electricity, or*
>
> *(b) electricity storage*

Clause 4.1 Minimum Subdivision Lot Size

The minimum lot size for subdivision across the investigation area is 40 hectares. Subdivision does not form part of the scope of works for the solar PV farm. This clause is relevant however for BDAR thresholds (refer to Section 5.2).

Clause 4.3 Height of Buildings

This clause has not been adopted under LEP 2012.

Clause 4.4 Floor Space Ratio

This clause has not been adopted under LEP 2012.

Clause 5.10 Heritage Conservation

The investigation area does not contain a listed heritage item nor is the area mapped as a heritage conservation area under the LEP 2012.

Clause 7.1 Flood Planning

The site is not mapped within a flood prone land area under the LEP 2013. The Planning Certificate for the site states that the land 'is not subject to flood related development controls.

Clause 7.2 Drinking Water Catchments

The investigation area is not mapped within a drinking water catchment area under the LEP 2012.

Clause 7.3 Essential Services

Development consent must not be granted to development unless the consent authority is satisfied that any of the following services that are essential for the development are available or that adequate arrangements have been made to make them available when required—

(a) the supply of water,

(b) the supply of electricity,

(c) the disposal and management of sewage,

(d) stormwater drainage or on-site conservation,

(e) suitable road access.

Provision of services, including stormwater drainage, and vehicular access suitable for the proposed development will be satisfactory provided for the site.

In summary, the PV solar farm project concept is compliant with the relevant clauses and controls contained within Glen Innes Severn LEP 2012.

4.11 GLEN INNES DEVELOPMENT CONTROL PLAN 2014

The Glen Innes Development Control Plan (DCP) 2014 applies to all land within the Glen Innes Local Government Area (LGA), including the subject site. The relevant sections of the DCP include:

+ Chapter 4 – Rural Development
+ Chapter 7 – Access and Parking

A full assessment against the relevant components of the DCP is included in table format at Appendix C.

4.12 GLEN INNES SEVERN SHIRE COUNCIL LOCAL STRATEGIC PLANNING STATEMENT

The Glen Innes Severn Shire Council Local Strategic Planning Statement provides an overall plan to manage development in the Glen Innes region.

The Strategic Plan distinctly highlights the role of renewable energy in the growth of the New England region with the plan's visions outlining the need for the area to harness the solar and wind potential. Planning Priority 10 is to promote and support the transition to renewable energy. Action 10.1 encourages the development of wind and solar farms in the New England Region.

The proposed development on the subject site will align with the goals of the Strategic Plan as it will provide an appropriately sized renewable energy project in a location with ready access to the electrical network which will support the regional development of Glen Innes and the larger Glen Innes Severn Shire LGA and New England Region.

This page has been left blank intentionally

5 ASSESSMENT OF PLANNING ISSUES

The following is an assessment of the environmental effects of the proposed development as described in the preceding sections of this SEE. The assessment considers only those matters under Section 4.15(1) of the EP&A Act 1979 that are relevant to the proposal.

5.1 COMPLIANCE WITH PLANNING INSTRUMENTS AND CONTROLS

Unless otherwise stated, the proposed development either complies with or is consistent with all relevant planning instruments and controls set out in Section 4 of this SEE, in that:

- The proposed solar farm will have minimal impact on any potential listed flora or fauna under the BC Act 2016;
- The development is classified as Regional Development under SEPP State and Regional Development and will therefore be determined by the RPP;
- The proposal complies with the requirements of SEPP Infrastructure and referral to the road authority will not be required as the proposal is not classified as traffic generating development;
- The proposed Solar PV Farm is permissible within the RU1 Primary Production zone under the Glen Innes LEP 2012; and,
- The proposal is generally consistent with the objectives and relevant controls within Glen Innes DCP 2014. A detailed assessment of the proposed development against the relevant provisions of the DCP is provided in the table at Appendix C.

5.2 TRAFFIC, ACCESS AND PARKING

Traffic

A Traffic Impact Assessment (TIA) has been undertaken by Intersect Traffic and is attached at Appendix D. The anticipated rates of traffic likely to be generated from the proposed development (both during construction and once operational) are discussed in the TIA.

The majority of traffic movements associated with the development will occur during the construction of the solar farm (approximate 6-month period) with the delivery of panels and prefabricated structural supports. Deliveries during construction works would be expected to be within rigid and articulated vehicles and the access road has been designed to safely accommodate these vehicles.

Traffic movements generated during operation would include a single staff light vehicle movement associated with maintenance inspections and specific maintenance work (on an as needs basis) which would be short term and infrequent.

Peak hour construction traffic has been calculated with a predicted peak of 18 vehicle trips per hour consisting of 10 light vehicles, 3 roadwork vehicles, and 2 delivery vehicles. Based on the data collected from traffic surveys the surrounding road network has sufficient capacity to cater to the projected construction traffic with capacity to spare for future development in the area. It is noted that construction traffic is temporary in nature and will be managed through a future Construction Management Plan.

The TIA notes the existing condition of the surrounding road network, in particular the unsealed Tuttles Lane. As such, the TIA notes that at the time of assessment, Tuttles Lane was found to be in good condition and is currently servicing a number of rural properties in the area. Tuttles Lane is a two-lane two-way unsealed road and is 7 metres wide. With these

recommendations it is considered Tuttles Lane is suitable to cater for the expected construction traffic associated with the development.

The TIA considers surrounding roads including Gwydir Highway and New England Highway which will be utilised for delivery and personnel transport. The TIA found both roads to be in excellent condition and suitable for heavy vehicle traffic around the site.

In summary, the additional traffic anticipated from the proposal has been assigned to the road network where it was found that the surrounding road network (both now and in 10 years) is capable of accommodating the expected additional traffic from the proposal.

Access and Internal Circulation

During the construction phase of the development there will be a construction access point off Tuttles Lane at the western boundary of the site. This access point off Tuttles Lane while established for the purposes of construction and operation of the Solar Farm, is anticipated to also be used for access to the existing agricultural land present on site. The proposed driveway will provide for the turning movements of cars and service vehicles, in accordance with Council controls and the Australian Standard for Parking Facilities (Part 1: Off-street car parking and Part 2: Off-street commercial vehicle facilities), AS 2890.1:2004 and AS 2890.2 –2002. Furthermore, sight distance at the proposed access was observed to be in excess of 250 metres in each direction and therefore complies with the relevant Australian Standards.

Parking

The Glen Innes Severn Council DCP 2014 sets out the relevant on-site car parking rates for land uses within the Glen Innes area. The relevant car parking provisions for a solar farm is as follows:

- 1 space per 100m^2 GFA (minimum 2 spaces per single occupation)

With no buildings on the site and only 1 employee engaged in the day to day operation of the solar farm, the development is only required to provide 2 on-site car parking spaces to comply with the DCP.

Consideration of construction parking demand has also been considered with potential for up to 30 employees projected. A total of 10 car parks are proposed with additional space afforded for potential onsite overflow if required. The car parking area would comply with the requirements of Australian Standard AS2890.1-2004 Parking Facilities – Part 1 Off-street car parking with parking bay sizes 2.4 m x 5.4 m and aisle widths of 5.8 metres. Therefore, the on-site car parking is considered suitable for the development ensuring all vehicle movements to and from the site off Tuttles Lane will be undertaken in a forward direction.

5.3 STORMWATER, SOIL AND EROSION CONTROL

The proposed stormwater management system has been designed to reduce post-development flows to align with the pre-development conditions on the site. To achieve this, a detention basin is proposed towards the north-eastern corner of the development area. This basin provides a holding volume of 210.21m^3 and is supported with a low flow pipe and overflow weir. The stormwater management system proposed has been designed in accordance with Council requirements and with the proposed mitigation measures achieves compliance with the pre-development stormwater flows.

The stormwater drainage strategy for the development can be summarised as:

(i) All impervious runoff from the proposed Photovoltaic Arrays will discharge to the existing ground surface where the natural flow regime will be maintained.

(ii) Runoff from the proposed gravel/hardstand area catchment will be conveyed via sheet flow and the re-graded existing swale to the proposed above ground onsite stormwater detention basin.

(iii) Discharge from the above ground onsite stormwater detention basing will be limited to the pre-development flow rates

Provided the above stormwater drainage philosophy is adopted for the site, the proposed solar farm will limit the post-development peak flows to pre-development flow rates for the 1 EY, 10% AEP and 1% AEP events.

Detailed Stormwater Plans and Report including DRAINS modelling have been prepared DRB Consulting Engineers provided at Appendix B.

5.4 FLORA AND FAUNA

Kleinfelder have undertaken a Flora and Fauna Assessment of the proposed development (refer Appendix H). This assessment has been undertaken with reference to the EP&A Act 1979 as well as the BC Act 2016 and the EPBC Act 1999.

As noted within the Flora and Fauna Assessment, the site is mainly cleared of vegetation due to previous agricultural development. As such there is minimal removal required. Only planted paddock non-native trees and negligible amounts of native groundcover will be required to be removed. Impacts on biodiversity values have been addressed through an iterative design process to avoid areas of higher biodiversity value within the site.

Field surveys undertaken by qualified ecologist(s) recorded no threatened flora or fauna species on the site with the proposed development unlikely to cause a significant impact to any threatened species, populations or ecological communities listed under the NSW BC Act. Entry into the NSW BOS is not triggered by the proposed development.

No EPBC listed species, ecological communities, migratory species, or important habitat for such entities were identified within the subject site. The Flora and Fauna Assessment determined that impacts to Matters of National Environmental Significance are unlikely; therefore, an EPBC referral to the Commonwealth Minister for the Environment is not recommended.

Inclusion of the avoidance and mitigation measures made within the Flora and Fauna Assessment in relation to erosion control, dust control, chemical spills, tree removal, and management of displaced fauna will be followed to reduce potential impacts to biodiversity values within the subject site and the environment.

5.5 NOISE

A Noise Assessment (NA) undertaken by Muller Acoustic Consultants measured and modelled the potential noise generation for the operation (both during construction and once operational) including sleep disturbance noise emissions (refer to Appendix G).

Operational Noise

The results of the NA demonstrate that emissions from the project would satisfy the relevant Project Noise Trigger Levels (PNTL) at all assessed receivers for all assessment periods once the noise controls are implemented. Furthermore, sleep disturbance is not anticipated, as emissions from impact noise are predicted to remain below the EPA screening criterion for sleep disturbance and awakenings.

Based on the NA results, there are no noise related issues which would prevent the approval of the project. The results of the assessment shows compliance with the relevant operational and road noise criteria. Accordingly, no additional ameliorative measures will be required.

Construction Noise

Modelled noise emissions from all four project construction activities identify that relevant noise management levels will not be exceeded. Road noise emissions are predicted to satisfy the relevant Road Noise Policy (RNP) criteria at all receivers along the proposed transportation route. Vibration impacts from the proposed works are considered to be negligible.

5.6 LANDSCAPE AND VISUAL IMPACT

Visual Impact

It is relevant to consider the visual impact of the proposal given the existing rural landscape character of the area and location of a number of neighbouring properties within 1km radius of the site. SLR Consulting has undertaken a Visual Impact Assessment (VIA) to assess the potential visual amenity changes which may occur as a result of the proposed development, see Appendix E.

The VIA considered the potential impacts of the development from Grafton Street, Derby Street, Ferguson Street, Abbotts Road and Martin Lookout from Watsons Drive. The proposed development was considered to have minor to moderate impacts from Grafton Street, Derby Street and Ferguson Street. Mitigation measures proposed for the potential visual impacts include informal shrub planting to a maximum height of 3m to integrate the solar array appearance into the landscape. It was considered the development would have minor to negligible impacts on the viewpoints from Abbotts Road and Watsons Road.

Typically, it was considered views to the site from local roads and other public locations in the area were very limited. Implementation of the mitigation measures as detailed within the VIA will provide an effective visual buffer compatible with the rural landscape of the Glen Innes area enhancing the visual amenity for local residents and visitors to the area.

Landscaping

In line with the recommendations of the VIA, SLR Consulting have prepared a Landscape Plan to compliment development at the site (refer Appendix E). The Landscape Plan aims to provide screening of the development from nearby residences through the provision of screening trees along the eastern and western boundaries along with car park/laydown area trees.

The planting schedule is based mainly on durable native species which enhance the local ecology and complement the rural character of the surrounding landscape. Shrubs will be used along the eastern and western boundary to screen any potential visual or glare impacts to nearby dwellings. The planting schedule includes Western Silver Wattle, Stocky hop Bush, Mat Rush and Velvet Mock Olive. The included shrub species will range between 1-4m in height. For further details see included Landscape Plan (refer Appendix E).

5.7 GLARE ANALYSIS

A Reflective Glare Assessment (RGA) has been undertaken by SLR Consulting to assess the potential for reflected light induced impacts on aviation, road operations, rail operations, industrial and heavy machinery operations, and residential amenity.

The proposed solar PV panels include solar trackers which results in minimal potential for horizontal reflectivity to occur as light is generally reflected upwards. As a result, impacts on residents, roadway operation, and on any surrounding mechanical operations is considered to be negligible at all times of the year.

Due to the site's large distances from nearby airports, it is considered the proposal will have no impact on airport operations however aerial spraying has been considered. A generic flight scenario has been quantitatively analysed using SGHAT

model and found potential for aviation glare was negligible all year round due to the low incidence angle of reflected rays resulting from the tilting action of the tracking system.

Glare resulting from onsite lighting will be mitigated in accordance with AS4282-1997 *Control of the Obtrusive Effect of Outdoor Lighting* effectively controlling potential for light spill and glare generated by the proposed development.

Due to the use of high-quality solar tracking systems and site buffer distances to surrounding receivers and transport networks, potential for aviation related glare, rail traffic related glare and motorist related glare is considered negligible. Recommendations and mitigation measure have been included in the report to ensure that residential nuisance glare is avoided. For further detail and discussion see Appendix E.

5.8 HERITAGE

5.8.1 INDIGENOUS CULTURAL HERITAGE

Virtus Heritage undertook an Aboriginal Archaeological Due Diligence Assessment (Appendix F) for the proposed development area in accordance with the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (2010) and where applicable, the requirements of the Code of Practice for Archaeological Investigation of Aboriginal Objects, NSW (2010).

A site inspection was undertaken on 17 November 2020 within the Glen Innes Local Aboriginal Lands Council (LALC) area. The inspection was carried out by Senior Archaeologist, Julian Travaglia. Glen Innes LALC advised that no site officers were available to accompany the field survey and gave permission for a site inspection to occur without a LALC site officer present.

There are no previously recorded sites within the project area based on heritage searches and background research of previous archaeological investigations to date. No Aboriginal objects or sites were observed in the project area and given the disturbance and lack of any undisturbed soils, the project area is deemed to have a very low potential for archaeological deposits.

Due to the impacts of the site's previous agricultural use including vegetation clearing for pasture improvement based on the high level of disturbance observed during the site inspection, the project area has a very low potential for Aboriginal objects or intact cultural deposits to occur.

The Due Diligence assessment in coordination with consultations made with the Glen Innes LALC made several recommendations to ensure the protection of any found Aboriginal artifact during constriction. It was recommended that the project impacts avoid the small area of sensitive landform (creek terrace) in the north west corner of the survey area. If project impacts cannot avoid the sensitive landform (creek terrace), a further Aboriginal Cultural Heritage Assessment will be required due to potential Aboriginal objects below the plough/ cultivation zone.

The site development area has been positioned to avoid the sensitive landform area as recommended by the Aboriginal Archaeological Due Diligence Assessment.

All site workers should also be briefed on the possible identification of Aboriginal sites during the construction phase and their responsibilities according to the provisions of the NPW Act 1974 in case any unknown objects or items are uncovered during excavation. Further procedures and protocols are to be established as part of any future Construction Management Plan.

5.8.2 EUROPEAN HERITAGE

The site does not contain any listed heritage items under Schedule 5 of LEP 2010, nor is it located within a heritage conservation area. No other heritage items are located in proximity to the site.

5.9 SOCIAL AND ECONOMIC IMPACTS

An analysis of the social and economic impacts associated with the development of the site is detailed in this section to ensure that, where relevant, social and economic considerations are an integral part of the development assessment process.

The proposed establishment of a solar farm on the site is anticipated to have an ongoing positive social and economic impact on the local Glen Innes area and the broader community.

A review of existing renewable projects along with NSW State Government research reveals support for renewable energy projects is generally favourable within the North West Region (including the broader Glen Innes region). This research revealed:

- 94 per cent of respondents supported using renewables to generate electricity in NSW.
- 81 per cent believed NSW should increase the use of renewables over the next five years.
- 95 per cent supported the use of solar farms in NSW, 92 per cent in their local region, and 84 per cent within 1–2 kilometres of where they lived.

The most common perceived advantages of renewables included environmental benefits and lower cost of electricity. The most common perceived disadvantages included higher cost and concerns about efficiency and reliability. In the North West, 74 per cent were prepared to use renewables 'provided I don't have to pay more for my electricity' and 22 per cent were prepared to pay more to support them.

The proposed solar farm is predicted to improve intergenerational equity through its beneficial contribution to Australia's climate change and greenhouse gas minimisation efforts, specifically:

- Directly contribute to helping Australia in meeting the Renewable Energy Target;
- Reduce greenhouse gas emissions required to meet Australia's international climate conditions; and
- Assist in the transition towards cleaner electricity generation.

This is achieved by the potential to generate up to 5MW of electricity potentially powering 2,000 homes during daylight hours whilst reducing CO2 emissions by around 200,000 tonnes over the lifespan of the project.

Ongoing communication with the community has been highlighted as an imperative to maximise social benefits of the proposed development. Further recommendations include the following:

- Liaison with local industry representatives to maximise the use of local contractors, manufacturing facilities, materials;
- Establish visual screening early to minimise the visual impact on the solar farm. Visual screening should be done in consultation with closest property holders in accordance with Visual Impact Assessment and Landscaping Plan;
- Establish good relations with people living in the vicinity of the proposal site at the beginning of the proposal and maintain; and
- Implement a community consultation plan to manage impacts to community stakeholders, including but not limited to:
    - Mitigation measures to reduce potential construction impacts.

- 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.
- Information on how potential customers can access the renewable energy source.
- A process to monitor the predicted social impacts and amend mitigation and management measures as required.

In summary, the proposed establishment of a Solar PV Farm on the site is anticipated to have an ongoing positive social and economic impact on the local area and the broader Glen Innes community. Overall, it is considered that the development:

+ Is consistent with the regulatory and business development framework, including state government legislation and the Glen Innes Severn Shire Council strategic plans;
+ Will have positive impacts intergenerational equity, with the provision of cleaner energy in the future;
+ Supports Commonwealth and NSW climate change commitments;
+ Will generate enough clean, renewable energy for about 2,000 homes;
+ Is an appropriate development in relation to the projected changes to population and demographics in the region;
+ Is unlikely to have significant negative social impacts to the locality and region; and
+ Would be a benefit contributing to the overall community sustainability of the Glen Innes community.

This page has been left blank intentionally

6 CONCLUSION

The proposed solar PV electrical generation operation located at Tuttles Lane (208 West Furracabad Road) Glen Innes will provide electrical power to support the needs of Glen Innes and the surrounding agricultural operations along with rural towns and villages. With the growth of the Glen Innes area, the new electrical generator proposed under this DA will greatly assist in meeting the growing electrical demands required to support that growth.

The site has been chosen for its suitability in terms of land use zoning, relatively flat topography, limited trees and vegetation and access to high capacity transmission lines.

The proposed solar PV electrical generation plant is permissible with consent within the RU1 Primary Production zone, under the Glen Innes LEP 2012. The proposed development is consistent with the objectives of the RU1 Primary Production zone as it will provide a compatible land use which minimises land use conflict in the area whilst contributing to the land use diversity of the area. The proposal will not increase demand for public services or facilities and will have minimal impact on native vegetation and wildlife corridors or on waterways, wetlands, or riparian zones. The development is compliant with the relevant LEP clauses, presenting no variations to any development standard. The proposal is generally compliant with the requirements of Glen Innes DCP 2014.

The design of the development incorporates appropriate stormwater management, respects the natural environment, and minimises potential amenity impacts on neighbouring properties.

Due to the use of high-quality solar tracking systems and site buffer distances to surrounding receivers and transport networks, potential for glare impacts on the surrounding area is considered to be negligible.

This SEE has addressed the potential impacts arising from the proposal on surrounding properties including traffic, access and parking, noise, visual amenity, ecological, and waste and water management. Where necessary, mitigation measures are proposed to minimise these potential impacts and reduce potential risk associated with the development.

Given the merit of the design and the absence of any significant adverse environmental impacts or planning issues, the DA is considered to be in the public's interest and worthy of Council's support.

This page has been left blank intentionally

Appendix A – Architectural Plans

Balance, Power and Energy Pty Ltd

This page has been left blank intentionally

Appendix B – Stormwater Management Plan

DRB Consulting Engineers Pty Ltd

This page has been left blank intentionally

Appendix C – Compliance Tables

KDC Pty Ltd

Table 1 – Glen Innes DCP 2014 Compliance

Control	Requirement	Comment	Compliance
Chapter 4 – Rural Development			
4.5 Vehicular Access Requirements	▪ Access to a development shall be located having regard to its potential impact on the landscape and native vegetation and shall be unobtrusive and sympathetic to the existing landform and neighbouring development.	The proposed access road will be construction from Tuttles Lane to the construction site. The Traffic Impact Assessment located at Appendix D concluded the proposed site access to be suitably located and satisfactory for us for the solar farm.	Y
	▪ All development is required to have coincidental legal and physical access from a public road to the development site. In this regard, Council may require evidence from a registered surveyor that this is the case.	The proposed site access road will be from a public road, Tuttles Lane, approximately 820m north of Gwydir Highway.	Y
	▪ Where a part of any access is via an unformed Crown road, the road may first require dedication as a Council public road, and then construction to an appropriate standard once Council approval has been gained for the work. For a single residential dwelling, the minimum standard of construction where the owner will be responsible for ongoing track maintenance is in accordance with the former Department of Land and Water Conservation publication "Guidelines for the Planning, Construction and Maintenance of Tracks".	Noted.	Y
	▪ Road and drainage designs may need to be submitted to Council at the applicant's expense prior to approval of any roadworks within a Council public road reserve.	A Traffic Impact Assessment (Appendix D) and Stormwater Management Plan (Appendix B) has been prepared for this proposal.	Y
	▪ The developer will be responsible for construction or upgrading of any vehicle access in accordance with Council standards, including:	The Traffic Impact Assessment, located at Appendix D, has addressed internal circulation, access, traffic generation, parking and an assessment of the exiting surrounding road network conditions.	Y

	o A suitable width all-weather pavement from the road to the entrance gate or stock grid. o Where the access crosses a table drain, a minimum 375mm diameter pipe with headwalls, or concrete dish drain on the alignment of the table drain. o Any entrance gate or stock grid should be set back a minimum distance of 15 metres from the edge of the traffic lane for single unit truck access, or 22 metres for semi-trailer access. o The access is to be located at where safe intersection sight distances can be achieved, including a minimum gap sight distance of 5 seconds. o A Council Road Opening Permit is required prior to performing any work within a public road reservation. Forms and advice on relevant fees can be obtained from Council's Engineering Services department.		
4.6 Environmental Considerations - Requirements	▪ Development shall not be carried out on slopes greater than 20%. If development on slopes greater than 20% is unavoidable, Council may require a geotechnical assessment.	The site area is relatively flat and does not have a slope greater than 20%.	Y
	▪ Clearing of native vegetation – applications are to identify the area and number of trees to be cleared as part of the application. Clearing which does not form part of a Development Application to Council must be approved by the relevant Local Land Services (LLS) (refer to Note below).	No native trees will be required to be removed. Exotic grassland and planted non-native paddock trees will be removed. Further details are provided in the Flora and Fauna Assessment provided at Appendix H.	Y
	▪ Where development is likely to have a significant impact on threatened species, populations or ecological communities, or their habitats within the meaning of the Threatened Species Conservation Act 1995, Environment Protection and Biodiversity Conservation Act (EPBC) Act 1999 and	As indicated within the Flora and Fauna Assessment (Appendix H), no threatened species or ecological communities were identified to be impacted by the proposed development.	Y

	Fisheries Management Act 1994., Council will require the submission of the following:		
	o An ecological assessment prepared by a suitably qualified, experienced and independent person or persons; and/or	A Flora and Fauna Assessment has been prepared for the proposal and is located at Appendix H.	Y
	o A preliminary Vegetation Management Plan (VMP) prepared by a suitably-qualified and experienced person such as an Ecologist, Bush Regenerator, Horticulturist or Landscape Architect with practical, demonstrated experience in bush regeneration., and/or	N/A	N/A
	o Compensatory planting prepared in accordance with Table 4.1.	N/A	N/A
	▪ Riparian lands within a subdivision are to be stabilised and revegetated according to stream order and buffer category. Water courses classified as stream order 3 or greater (Strahler method) require a riparian buffer of at least 40 m	N/A	N/A
	▪ Roads are to be located outside riparian buffer areas where possible. Where roads traverse the riparian buffer area, the road design is to minimise the area of disturbance and demonstrate minimal impact on the riparian function and integrity.	N/A	N/A
	▪ Driveway/roadway crossings/other infrastructure located over waterways are to have regard to the requirements for fish passage in accordance with relevant NSW State Government requirements under the Fisheries Management Act 1994.	N/A	N/A
4.7 Flooding	In low-lying areas a flood study may be required to determine appropriate floor levels for habitable structures. Waterway crossings on any access roadways should be designed to permit two-wheel drive access from a public	N/A, the proposed site is not located within a flood prone area.	N/A

	road to the residence during a critical one (1) in 100 year storm event		
4.8 Land Use Buffers	▪ Buffers from development to rural land uses are to be established in accordance with the NSW DPI Land Use Conflict Risk Assessment Guide. ▪ Where a proposed development for a dwelling or tourist accommodation will adjoin an agricultural enterprise on an adjoining property, a minimum 100m separation shall be provided. Where the 100m buffer cannot be achieved, Council will consider the use of vegetative buffers on the proposed development site ▪ Any new residence should be located a minimum distance of 2km from any active or proposed wind turbine, unless suitable measures are taken in the design and construction of the dwelling to ameliorate any noise or other impacts	Appropriate buffers will be put in place for the development. The development will be a sufficient distance from all nearby land uses.	Y
4.10 Services	*Electricity and Telecommunications Infrastructure* ▪ Any structures associated with the provision of electricity and telecommunications to the development shall be sited to have minimal environmental impact including vegetation removal and visual impact.	The proposed site has been previously cleared for agricultural purposes in the past. All environmental and visual impacts have been included in the Visual Impact Assessment provided at Appendix E.	Y
	▪ Applications are required to demonstrate the method of power supply.	The proposed power supply for the site will be demonstrated in the plans provided at Appendix A.	Y
	▪ Council supports the use of solar energy supplies.	The proposed solar farm is therefore in support from council.	Y
	▪ Where generators are proposed, controls shall be placed on the hours of operation and levels of noise emission having regard to the proximity of neighbouring development and the environment.	N/A	N/A
	Water	N/A	N/A

	Rural buildings without a reticulated water supply shall have water storage facilities containing a minimum of 22,000 litres of potable water for domestic purposes.		
Chapter 7 – Access and Parking			
7.4 Access and Traffic Generation	Minor development proposals are unlikely to significantly impact the receiving road network, however, consideration of traffic generation and access locations is still required. For more significant developments, Council may require a Traffic Impact Assessment to be prepared addressing the following matters: ▪ Development involving access off a classified road (New England Highway and Gwydir Highway) will be referred to the Roads and Maritime Services (RMS) for comment. ▪ Traffic Generating Development (Schedule 3 of SEPP Infrastructure) will be referred to the RMS as Integrated Development and will require their General Terms of Approval. ▪ The rate of traffic generation associated with the proposed development. ▪ Any impact additional traffic generated may have on traffic efficiency, amenity, safety, and road pavement life.	A Traffic Impact Assessment has been prepared for this proposal and is located at Appendix D. The TIA has addressed internal circulation, access, traffic generation, parking and an assessment of the exiting surrounding road network conditions.	Y
7.5 Vehicular Crossover and Driveway Width – Design Requirements	The following requirements must be taken into consideration at the design stage of a medium density development: ▪ driveways, manoeuvring areas and parking areas are generally to be designed in accordance with the provisions of AS2890.1 Parking Facilities: Off-Street Parking	As above, a Traffic Impact Assessment has been prepared for this proposal and is located at Appendix D. The TIA has addressed internal circulation, access, traffic generation, parking and an assessment of the exiting surrounding road network conditions. All parking and access to the site will be designed in accordance with AS2890.1 Parking Facilities: Off-Street Parking	Y
	▪ long straight driveways are to be avoided ▪ all vehicles must enter and leave the site in a forward direction	The proposed driveway will be a length appropriate for the site and use __ and will provide a turning circle.	Y

	▪ the location of visitor parking facilities should be evident from the street so that their use is encouraged ▪ the location of resident and visitor parking shall be behind the building line; ▪ one car parking space per unit is to be enclosed and form part of the unit entitlement should the development be strata subdivided and, ▪ all driveways, parking areas and vehicular turning areas are to be constructed with a base course of adequate depth to suit design traffic, and are to be sealed from kerbline with either bitumen, asphaltic concrete or interlocking pavers. Full details should be indicated on the plans submitted with the Development Application. The use of decorative paving e.g. interlocking pavers, grasscrete etc for access and visitor parking is strongly encouraged. ▪ each resident car parking space is to have minimum dimensions of 6m x 3m. Other parking spaces are to have minimum dimensions of 5.5m x 2.6m. Car parking spaces are to be adequately delineated and maintained at all times.	All vehicles will be able to enter and exit the site in a forward direction via a turning circle that will be included with the access road. Construction vehicle parking during construction and maintenance vehicle parking during operation is all that is required for this development. Visitor parking is not necessary. Full details of the proposed car parking, access lane and turning area are included in the Traffic Impact Assessment located at Appendix D. All parking bays will have dimensions of 2.4 m x 5.4 as per the requirements of Australian Standard AS2890.1-2004 Parking Facilities – Part 1 Off-street car parking,	Y Y Y
7.6 Parking Controls	▪ Car-parking spaces are to be provided on the same lot as the proposed development. Multi-lot land holdings may require consolidation to comply with this control. (Reason: To ensure car parking remains annexed to the approved development.) ▪ Additional parking spaces required for any new development or redevelopment shall comply with the controls of this chapter and Table 7.1: Off-street Parking Rates ▪ Accessible car parking spaces are to be provided in accordance with the Disability (Access to Premises - Buildings) Standards 2010. ▪ Accessible car parking spaces are to be located as close as possible to the main pedestrian entrance and should	All required car parking will be provided on-site. According to car parking controls, the development requires: - 1 space per 100m² GFA (minimum 2 spaces per single occupation) According to these requirements, 2 on-site car parking spaces need to be provided, which is an excess of the necessary requirements for the site. Adequate parking spaces will also be provided on the hardstand area for construction employees, with at least 10 on-site parks being provided.	Y

	have regard to the use and function of the building. ▪ Council will apply the controls of this Chapter if it considers a proposed Change of Use requiring consent will produce a substantially different parking requirement than those attributable to the previous use of premises. ▪ Development proposals that provide less parking than required by this Chapter shall be supported by a parking study. ▪ On-site parking design must meet the relevant Australian Standards (AS 2890.1 and 2890.2 2004). ▪ All required car parking areas, driveways, turning areas and loading areas are paved in either a bitumen seal coat, asphaltic or bituminous concrete, cement concrete, concrete paving blocks, or brick paving blocks. The standard of paving required will be dependent upon the type of development proposed, with regard to traffic loadings including turning movements of heavy vehicles. ▪ In villages and rural areas all-weather paving of driveways, turning areas, loading areas and car parking areas is required. Surface materials to be at the discretion of Council's Director of Infrastructure Services ▪ All parking spaces shall be suitably line-marked and sign-posted and be graded and drained to Council's stormwater system. ▪ Free and uninterrupted access to car parking areas shall be maintained at all times. ▪ Stacked car parking is only permissible in conjunction with single dwelling houses and dual occupancies. Exceptions to this control are at the discretion of Council. ▪ Car parking areas are to be incorporated into the building or provided at, or behind, the front setback of the building.	See the Traffic Impact Assessment located at Appendix D for further details on parking requirements.	

This page has been left blank intentionally

Appendix D – Traffic Impact Assessment

Intersect Traffic

This page has been left blank intentionally

Appendix E – Visual Impact Assessment, Landscape Plans and Glare Analysis

SLR Consulting

This page has been left blank intentionally

Appendix F – Due Diligence Aboriginal Archaeological Assessment

Virtus Heritage

This page has been left blank intentionally

Appendix G – Acoustic Assessment

Muller Acoustic Consulting

This page has been left blank intentionally

Appendix H – Flora and Fauna Assessment Report

Kleinfelder

This page has been left blank intentionally

Appendix I – Waste Management Plan

KDC Pty Ltd

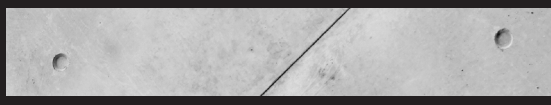
This page has been left blank intentionally

Appendix J – Quantity Surveyors Report

RPS Group

This page has been left blank intentionally







KDC

02 4940 0442
reception@kdc.com.au www.kdc.com.au

SLR



IT IS THE BUILDERS RESPONSIBILITY TO CONFIRM DEPTH & LOCATION OF ALL SERVICES PRIOR TO CONSTRUCTION AS THIS MAY AFFECT THE DESIGN.

DIAL 1100 BEFORE YOU DIG

LEGEND

+16.69 EXISTING FINISHED SURFACE LEVEL, CONTOURS SHOWN ARE ALSO EXISTING

INDICATES DIRECTION OF SURFACE FLOW

OVERLAND FLOW PATH

REVISIONS

REV	DATE	DRN	CHK	APP	DRAWING STATUS
B	08.12.20	F.M.	M.M.	M.M.	ISSUED FOR DA
A	01.12.20	F.M.	M.M.	M.M.	ISSUED FOR CLIENT REVIEW

This drawing is not approved for construction unless signed.

Matthew McNamara
BEng (Civil) Hons MIE (Aust)

COPYRIGHT - This drawing and the information provided shall remain the property of DRB Consulting Engineers Pty Ltd (DRB) and may not be used, copied or reproduced, in whole or part, for any purpose other than that for which it was supplied without the prior consent of DRB.

North

PO BOX 4105 Kotara East 2305
0402 915 549
ABN 64 625 755 482
DRB CONSULTING ENGINEERS

STORMWATER MANAGEMENT PLAN
GLEN INNES SOLAR FARM ,
GLEN INNES
PROVIDENCE ASSET GROUP

DRAWING STATUS: NOT FOR CONSTRUCTION

SHEET SIZE: A1

SCALE: 1:2000

PROJECT REF No.: 200521

DRAWING No.: CIV01

REVISION: B

IT IS THE BUILDERS RESPONSIBILITY TO CONFIRM DEPTH & LOCATION OF ALL SERVICES PRIOR TO CONSTRUCTION AS THIS MAY AFFECT THE DESIGN.

DIAL 1100 BEFORE YOU DIG

1m TOP OF BANK

BATTER 1V:3H

Ø150 LOW FLOW PIPE

PROVIDE GABION ROCK MATTRESS ON OUTLET TO LIMIT EROSION.

INV. 1050.15

1050.5

1050.4

1050.3

1050.2

1050.1

1050.0

Dam

ONSITE STORMWATER DETENTION BASIN
BASE RL - 1050.15m AHD
TOP OF BANK RL - 1050.50m AHD
TOTAL VOLUME - 210.21m^3

5.5m WIDE WEIR AT RL 1050.35
8.5M WIDE WEIR AT 1050.50

1% AEP EXTENT

BATTER 1V:3H

AREA OF DISTURBANCE = 183m^2

1050.0
1050.1
1050.2
1050.3
1050.4
1050.5

1050.40

LEGEND

INV. 10.47 — INVERT LEVEL

uPVC STORMWATER PIPE

EXISTING SURFACE CONTOUR

7.90 — OVERLAND FLOW PATH

PROPOSED CONTOUR LEVEL

REVISIONS						
B	08.12.20	F.M.	M.M.	M.M.	ISSUED FOR DA
A	01.12.20	F.M.	M.M.	M.M.	ISSUED FOR CLIENT REVIEW
REV	DATE	DRN	CHK	APP	DRAWING STATUS

This drawing is not approved for construction unless signed.

Mathew McNamara
BEng (Civil) Hons MIE (Aust)

COPYRIGHT - This drawing and the information provided shall remain the property of DRB Consulting Engineers Pty Ltd (DRB) and may not be used, copied or reproduced, in whole or part, for any purpose other than that for which it was supplied without the prior consent of DRB.

North

PO BOX 4105 Kotara East 2305
0402 915 549
ABN 64 625 755 482
DRB CONSULTING ENGINEERS

PROPOSED BASIN PLAN
GLEN INNES SOLAR FARM ,
GLEN INNES
PROVIDENCE ASSET GROUP

DRAWING STATUS: NOT FOR CONSTRUCTION

SHEET SIZE: A1

SCALE: 1:100

PROJECT REF No.: 200521

DRAWING No.: CIV02

REVISION: B



TRAFFIC IMPACT ASSESSMENT

SOLAR PHOTOVOLTAIC (PV) POWER GENERATING FARM & ASSOCIATED SUPPORTIVE INFRASTRUCTURE

LOTS 32,33,34,35 & 36 DP 1834 AND LOT 1 DP 251457 TUTTLES LANE, GLEN INNES

PREPARED FOR: PROVIDENCE ASSET GROUP

DECEMBER 2020

20/190

TRAFFIC IMPACT ASSESSMENT
PROVIDENCE ASSET GROUP

SOLAR PHOTVOLTAIC (PV) POWER FARM
LOTS 32,33,34,35 & 36 DP 1834 AND LOT 1 DP 251457
TUTTLES LANE, GLEN INNES

Intersect Traffic Pty Ltd (ABN: 43 112 606 952)

Address:
16 Mount Harris Drive
Maitland Vale NSW 2320
PO Box 268
East Maitland NSW 2323

Contact:
(Mob) 0423 324 188
Email: jeff@intersecttraffic.com.au

QUALITY ASSURANCE

This document has been prepared, checked and released in accordance with the Quality Control Standards established by Intersect Traffic Pty Ltd.

Issue	Date	Description	By
A	19/11/20	Draft	JG
B	20/11/20	Edit	JG
C	15/12/20	Final Proof	JG
D	15/12/20	Approved	JG

Copyright © Intersect Traffic Pty Ltd

This document has been authorised by

Date 15th December 2020

Disclaimer

This report has been prepared based on the information supplied by the client and investigation undertaken by Intersect Traffic Pty Ltd & other consultants. Recommendations are based on Intersect Traffic's professional judgement only and whilst every effort has been taken to provide accurate advice, Council and any other regulatory authorities may not concur with the recommendations expressed within this report. This document and the information are solely for the use of the authorised recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that for which it was supplied by Intersect Traffic Pty Ltd. Intersect Traffic makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.

Confidentiality Statement

All information, concepts, ideas, strategies, commercial data and all other information whatsoever contained within this document as well as any and all ideas and concepts described during the presentation are provided on a commercial in confidence basis and remain the intellectual property and Copyright of Intersect Traffic Pty Ltd and affiliated entities.

CONTENTS

1.0 INTRODUCTION 1

2.0 SITE DESCRIPTION 2

3.0 EXISTING ROAD NETWORK 4

3.1 GWYDIR HIGHWAY 4

3.2 TUTTLES LANE 4

3.3 NEW ENGLAND HIGHWAY 5

4.0 ALTERNATE TRANSPORT MODES 5

5.0 DEVELOPMENT PROPOSAL 6

6.0 TRAFFIC IMPACTS 6

6.1 – TRAFFIC GENERATION AND TRIP DISTRIBUTION 6

6.2 – ROAD CAPACITY 8

6.3 – INTERSECTION CAPACITY 9

6.4 ACCESS ASSESSMENT 10

7.0 ON-SITE CAR PARKING 10

8.0 ALTERNATE TRANSPORT MODES 11

9.0 CONCLUSIONS 12

10.0 RECOMMENDATION 12

ATTACHMENTS

ATTACHMENT A DEVELOPMENT PLANS

ATTACHMENT B TRAFFIC COUNT DATA

ATTACHMENT C TRAFFIC GENERATION INFORMATION

FIGURES

Figure 1 – Site Location 2

PHOTOGRAPHS

Photograph 1 – Development site from existing access 3

Photograph 2 – Gwydir Highway / Tuttles Lane T-intersection. 3

Photograph 3 – Gwydir Highway, near site. 4

Photograph 4 – Tuttles Lane, near Gwydir Highway. 5

TABLES

Table 1 – Rural Road Mid-Block Capacity Table 8

Table 2 – Environmental Road Capacity Table 9

Table 3 – Uninterrupted flow condition thresholds at an intersection 9



1.0 INTRODUCTION

Intersect Traffic Pty Ltd (Intersect Traffic) has been engaged by Providence Asset Group to prepare a traffic impact assessment report for a proposed Solar Photovoltaic (PV) Power Farm (up to 5MW) on Lots 32,33,34,35 & 36 DP1834 and Lot 1 DP251457 Tuttles Lane, Glen Innes.

The proposed development involves installation of solar panel banks, off-load area, inverter and AC combiner area, HV switchboard area, MV power station area, direct connection to a suitable existing power line to the east of the site, on-site car parking and temporary construction office. Vehicular access to the site will be via a new access road with turnaround area off Tuttles Lane approximately 820 metres north of the Gwydir Highway. The development concept plans are shown in ***Attachment A.***

This report is required to support a development application to Glen Innes Severn Shire Council and allow the Council to assess the proposal in respect of its impact on the local and state road network.

This report presents the findings of the traffic and parking assessment and includes the following:

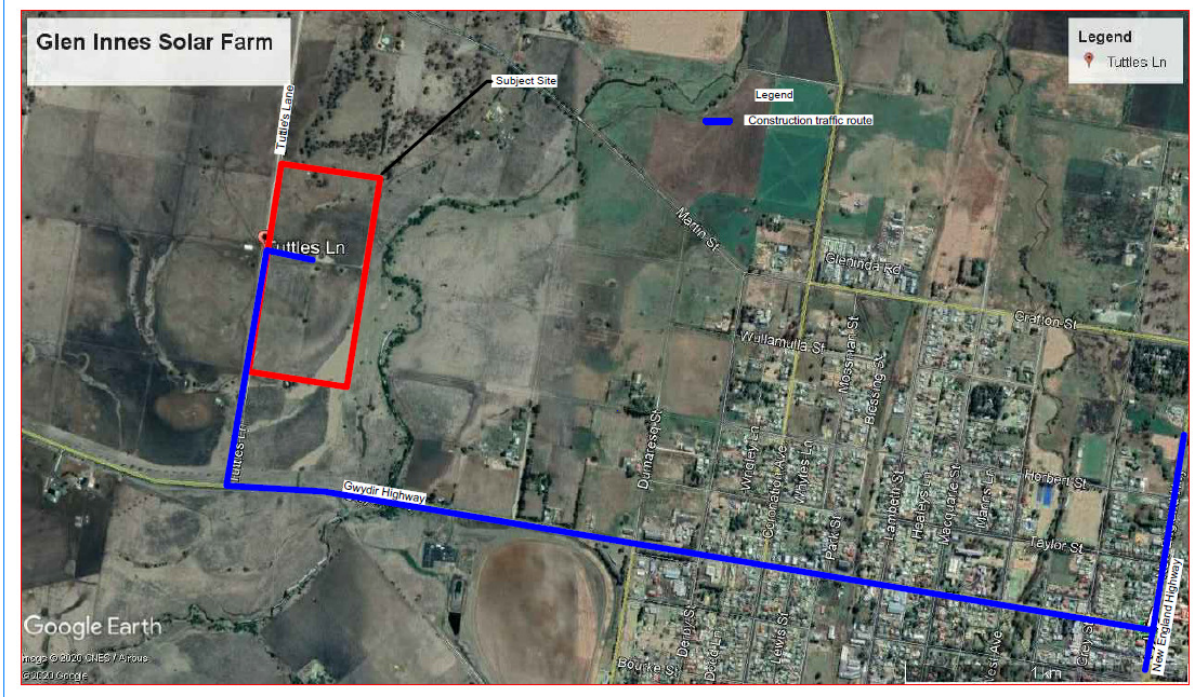
1. An outline of the existing situation near the site.
2. Assessment of the additional traffic generated by the proposal, identifies a preferred delivery route and the additional traffic's impact on the local road network.
3. Review of the adequacy of the proposed vehicular access to the site.
4. Review of the suitability and provision of on-site car parking through assessment against Council and Australian Standards requirements.
5. Presentation of conclusions and recommendations.

2.0 SITE DESCRIPTION

The subject site is shown in ***Figure 1*** below. It is located on the eastern side of Tuttles Lane, Glen Innes approximately 450 metres north of the Gwydir Highway and approximately 3 kilometres north-west of the Glen Innes CBD. The site currently contains vacant rural pasture used for agricultural purposes.

The property has the formal titles of Lots 32,33,34,35 & 36 DP1834 and Lot 1 DP251457, 208 West Furracabad Road, Glen Innes but the road frontage access for the site is directly off Tuttles Lane. The development area for the proposal is approximately 14.8 hectares. The site is currently zoned RU1 – Primary Production pursuant to the Glen Innes Severn LEP (2012).

The existing vehicular access to the site is currently provided off Tuttle' Lane via an unformed rural access crossing approximately 450 metres north of the Gwydir Highway respectively . Deliveries to the site will use the identified delivery road shown on ***Figure 1*** being via the New England Highway and Gwydir Highway from the south from Sydney and Newcastle or from the north from Brisbane. Noting Tuttles Lane is not a designated B-Double route, Council will need to provide special permission for B-Doubles to deliver materials to the site however the applicant has advised that Glen Innes Severn Shire Council has already advised this may be considered. It is considered that the short length of Tuttles Lane to be used by B-Double delivery vehicles is suitable to carry these vehicles. ***Photograph 1*** below shows the existing development site from Tuttles Lane from the eastern access to the site while ***Photograph 2*** shows the existing Gwydir Highway / Tuttles Lane T-intersection near the site. At this stage it is proposed to use a temporary construction access off Tuttles Lane central to the site approximately 820 metres north of the Gwydir Highway.



Intersect Traffic
16 Mount Harris Dr, Maitland Vale NSW 2320
PO Box 268, East Maitland NSW 2323
P: (02) 49366200 M: 0423 324 188
e-mail jeff@intersecttraffic.com.au

PLAN INFORMATION:
Location Plan - Solar Power Farm
Tuttle's Lane, Glen Innes

JOB: Solar Power Plant and associated infrstructure
CLIENT: Providence Asset Group | JOB REF: 20/190 | DATE: 18/11/2020
SCALE: N / A | SHEET 1 OF 1 SHEETS | DWG: Location Plan.dwg

Figure 1 – Site Location



Photograph 1 – Development site from existing access



Photograph 2 – Gwydir Highway / Tuttles Lane T-intersection.

3.0 EXISTING ROAD NETWORK

3.1 Gwydir Highway

The Gwydir Highway is a classified state highway (SH12) with its primary function to connect the Pacific Highway at South Grafton to the Castlereagh Highway at Walgett through Glen Innes, Inverell, Warialda, Moree and Collarenebri. As such it is an arterial road and major NSW transport route from inland NSW to the NSW coastal area. As a sealed rural arterial road the Gwydir Highway is under the care and control of Transport for NSW (TfNSW).

Near Tuttles Lane the Gwydir Highway is a two-lane two-way sealed rural road with a 9-metre wide sealed carriageway consisting of 3.5 metre wide travel lanes and 1 metre wide sealed shoulders. Additional turning lanes are provided at major intersections along its length. Near the site the speed zoning is 100 km/h and at the time of inspection the Gwydir Highway was observed to be in good condition as shown in ***Photograph 3*** below. It is considered suitable for use by heavy vehicle traffic.



Photograph 3 – Gwydir Highway, near site.

3.2 Tuttles Lane

Tuttles Lane is a local rural road with its primary function to provide vehicular access to properties along its length. As a local road it is under the care and control of Glen Innes Severn Shire Council and a 100 km/h speed zoning would also apply to Tuttles Lane. Note Tuttles Lane is not a designated B-Double route.

Tuttles Lane is a two lane two unsealed rural road 7 metres wide. This allows two lanes of traffic flow, one in each direction but provides little parking or pull over areas along its length. It currently services a number of rural properties in the area. At the time of inspection Tuttles Lane near the development site was found to be in good condition as shown in ***Photograph 4*** below.



Photograph 4 – Tuttles Lane, near Gwydir Highway.

3.3 New England Highway

The New England Highway is a classified state highway (SH9) with its primary function to connect the regions of Newcastle, Hunter Valley, New England and through to Queensland. As such it is an arterial road and major NSW transport route. As a sealed rural arterial road the New England Highway is under the care and control of Transport for NSW (TfNSW).

Near the site the New England Highway is a two-lane two-way sealed rural road with a 9-metre wide sealed carriageway consisting of 3.5 metre wide travel lanes and 1 metre wide sealed shoulders. Near the site through Glen Innes the speed zoning is 60 km/h and at the time of inspection the New England Highway was observed to be in excellent condition.

4.0 ALTERNATE TRANSPORT MODES

There are no regular public transport (bus) services within Glen Innes though a number of charter companies run school services in the area. Therefore the site is not serviced at all be public transport services.

As a rural area there are no pedestrian footpaths or on / off road cycleways within the local road network. Near the site pedestrians are generally required to utilise the grass verges and road shoulders / pavement while cyclists are required to utilise the road shoulders or share the travel lanes with other vehicles.

5.0 DEVELOPMENT PROPOSAL

The proposed development involves the construction of a Solar Photovoltaic (PV) Power Farm on the site. The development concept plans are shown in ***Attachment A*** with the specific works involved in the expansion listed below:

- Installation of temporary construction office and amenities.
- Installation of Solar Panel arrays.
- Earthworks for construction lay-down area, hardstand areas and internal roads.
- Installation of inverters, transformers and switchgear.
- Construction of unsealed access road from Tuttles Lane to the construction site.
- Construction of security fence and entrance gate; and
- Drainage and landscaping to Glen Innes Severn Shire Council requirements.

The development will require a team of 30 construction employees for a period of up to 6 months working 7 am to 5 pm Monday to Friday and 8 am – 1 pm on Saturdays. The majority of traffic movements associated with the development will occur during the construction of the solar power farm. Traffic movements generated by the operation of the development would include a single staff light vehicle movement associated with maintenance inspections as required and specific maintenance work which would be short term and infrequent. Deliveries during construction works would be expected to be within rigid and articulated vehicles. More detail on construction traffic is provided later in this report.

6.0 TRAFFIC IMPACTS

6.1 – Traffic Generation and Trip Distribution

The RMS publication "*RTA's Guide to Traffic Generating Developments (2002)*" provides advice on the traffic generating potential of different land uses. However this document does not cover Solar Farms therefore determining traffic generation is reliant on advice from the applicant regarding construction and operation of the development.

From an operational perspective traffic generation is expected to be minimal with only regular daily maintenance inspections carried out when necessary. Therefore based on 1 visit per day per week a peak hour traffic generation of 2 vehicle trips per hour (vtph) has been assumed for this assessment. There may be times when specific maintenance tasks have to be undertaken but these will be infrequent, short-term and undertaken under a construction traffic management plan for the work. Construction traffic estimates for the development are as follows based on the information provided in ***Attachment C***.

- Construction employees on-site – Maximum 30 transported in up to 10 light vehicles per day arriving between 6 am and 7 am and departing between 5 pm and 6 pm.
- Deliveries – Mainly heavy rigid vehicles and articulated vehicles (AV). Maximum – 8 per day but average of 5 per day between 10 am and 4 pm. Whilst these are likely to mostly arrive outside the peak hour traffic generation periods associated with the arrival and departure of employees, logistically there could be occurrences when due to circumstances out of the control of the contractor, a delivery arrives during the peak hour periods.
- Other vehicles – Some earthworks plant may be required on-site as well as concrete agitators and road base material deliveries during construction of the access. It would be expected a maximum frequency of 3 deliveries within a peak hour is assumed.
- Construction period – up to 6 months

Based on this advice the likely peak hour traffic generation which will occur in the AM peak coinciding with employees arriving on site and in the PM peak coinciding with employees leaving the site is calculated below. It is also noted deliveries involve 2 trips with an inbound trip and an outbound trip.

AM peak = 10 inbound employees + 3 x 2 roadworks and other plant + 1 x 2 deliveries = 18 vtph (14 inbound and 4 outbound).
PM peak = 10 outbound employees + 3 x 2 roadworks and other plant + 1 x 2 deliveries = 18 vtph (14 outbound and 4 inbound).

It is expected that the distribution of trips will be all east towards Glen Innes with deliveries being via the New England Highway from the south or north originating from either Newcastle or Sydney or Brisbane. In accessing the site the likely transportation routes as envisaged is shown on the location plan (***Figure 1***) in this report.

Existing traffic volumes in the area were recorded by Intersect Traffic at the Gwydir Highway / Tuttles Lane intersection during the likely peak AM and PM traffic periods (road network) i.e. 8 am – 9 am and 3.00 pm – 4.00 pm on Wednesday 11th November 2020 and Tuesday 10th November 2020 respectively. These periods were chosen following interrogation of Transport for NSW (TfNSW) data in the area on its Traffic Volume Viewer application. The data sheets for these counts are provided in ***Attachment B***.

These traffic counts determined that the relevant peak hour two-way mid-block traffic volumes on the state and local road network in the AM and PM periods during this period were.

- Gwydir Highway east of Tuttles Lane - 148 vtph in the AM peak and 136 vtph in the PM peak.
- Gwydir Highway west of Tuttles Lane – 147 vtph in the AM peak and 141 vtph in the PM peak.
- Tuttles Lane north of the Gwydir Highway – 3 vtph in the AM peak and 9 vtph in the PM peak.

A review of TfNSW's Traffic Volume Viewer identifies that current two way peak hour traffic volumes on the New England Highway north and south of Glen Innes are 300 vtph and 420 vtph respectively.

Given the construction will be completed within a 6 month period and the peak operational traffic volume from the site is only 2 vtph there is no need to do a 2030 (10 year horizon period) assessment of this development.



6.2 – Road Capacity

Table 4.5 of the TfNSW publication "*RTA's Guide to Traffic Generating Developments"* provides some guidance on likely mid-block capacity of two-lane two-way rural roads. This table is reproduced below as ***Table 1***:

Table 1 – Rural Road Mid-Block Capacity Table

Table 4.5
peak hour flow on two-lane rural roads (veh/hr)
(Design speed of 100km/hr)

Terrain	Level of Service	Percent of Heavy Vehicles			
		0	5	10	15
Level	B	630	590	560	530
	C	1030	970	920	870
	D	1630	1550	1480	1410
	E	2630	2500	2390	2290
Rolling	B	500	420	360	310
	C	920	760	650	570
	D	1370	1140	970	700
	E	2420	2000	1720	1510
Mountainous	B	340	230	180	150
	C	600	410	320	260
	D	1050	680	500	400
	E	2160	1400	1040	820

The data for Table 4.5 assumes the following criteria:

- *terrain level* with 20% no overtaking.
- *rolling* with 40% no overtaking.
- *mountainous* with 60% no overtaking.
- 3.7 m traffic lane width with side clearances of at least 2m.
- 60/40 directional split of traffic.

Source: - RTA's Guide to Traffic Generating Developments (2002)

It is assumed that the appropriate terrain levels for the Gwydir Highway and Tuttles Lane are Level and Rolling respectively and that a satisfactory level of service (LoS) on the road network is a LoS C. Therefore after adopting a 5 % heavy vehicle percentage on traffic volumes the above table suggests the relevant two-way mid-block road capacities for a LoS C are as follows.

- Gwydir Highway / New England Highway – 1,550 vtph; and
- Tuttles Lane – 1,140 vtph.

However as a local road performing a property access function only it is considered that two-way mid-block traffic volumes on Tuttles Lane should be restricted to the Environmental Capacity Guidelines contained in Table 4.6 of *RTA's Guide to Traffic Generating Developments* which are reproduced as ***Table 2*** *below.* This table therefore indicates two-way mid-block traffic volumes on Tuttles Lane should be restricted to below 300 vtph.

Therefore the two-way mid-block road capacity thresholds adopted in this assessment are.

- Gwydir Highway / New England Highway – 1,550 vtph; and
- Tuttles Lane – 300 vtph.

Table 2 – Environmental Road Capacity Table

Table 4.6
Environmental capacity performance standards on residential streets

Road class	Road type	Maximum Speed (km/hr)	Maximum peak hour volume (veh/hr)
Local	Access way	25	100
	Street	40	200 environmental goal
			300 maximum
Collector	Street	50	300 environmental goal
			500 maximum

Note: Maximum speed relates to the appropriate design maximum speeds in new residential developments. In existing areas maximum speed relates to 85th percentile speed.

Source: - RTA's Guide to Traffic Generating Developments (2002)

As the combination of the two-way mid-block peak hour traffic data and traffic generation figures reported in ***Section 6.1*** in the AM and PM peak hour traffic volumes on the local and state road network during construction of the Solar Farm will be well below the existing capacity thresholds determined above then the local and state road network has sufficient spare two-way mid-block capacity to cater for the construction and operation of the Solar Farm. The addition of up to 18 vtph will not cause the capacity thresholds determined above to be reached therefore it can be concluded that the proposed development will not adversely impact on the local and state road network mid-block efficiency.

6.3 – Intersection Capacity

The main intersection impacted by the construction of the development is the Gwydir Highway / Tuttles Lane priority controlled give way T-intersection. However traffic volumes at this intersection are well below the thresholds sourced from Austroads *Guide to Traffic Management Part 6 – Intersections, Interchanges and Crossings (2010),* reproduced below in ***Table 3*** of this report***.*** The Guide states that if traffic volumes are not above these thresholds, then uninterrupted flow conditions can be assumed and little or no delay will be experienced by motorists at these intersections. No further intersection analysis is then required.

Table 3 – Uninterrupted flow condition thresholds at an intersection

Major road type[1]	Major road flow (vph)[2]	Minor road flow (vph)[3]
Two-lane	400	250
	500	200
	650	100
Four-lane	1000	100
	1500	50
	2000	25

Source: - Austroads Guide to Traffic Management – Part 6: Intersections, Interchanges and Crossings (2010)

With traffic flows on the Gwydir Highway being less than 150 vtph and traffic flows on Tuttles Lane being less than 10 vtph then it is clearly seen that the intersection is currently operating with uninterrupted flow conditions which was confirmed by observation on site. The additional 18 vtph generated by the construction of the Solar Farm will not result in the thresholds within the above table being reach therefore it can be concluded that during construction and post development the Gwydir Highway / Tuttles Lane intersection will continue to operate with uninterrupted flow conditions therefore it is reasonable to conclude that the development does not adversely impact on the operation of this intersection or any other intersection on the local and state road network.

6.4 Access Assessment

In terms of width, the access to the development providing access to a user class 1 (long term) car parking facility with less than 25 car spaces fronting a local road is required to be a category 1 access (Table 3.1 of the Standard). Table 3.2 of the Standard then specifies a category 1 access facility as a combined entry / exit between 3.0 to 5.5 metres wide. However the proposed entrance width at the combined entry / exit access at Tuttles Lane will need to be a minimum 12.5 metres wide to cater for the swept turning paths for delivery vehicles during the construction stage and satisfy the requirements of Australian Standard *AS2890.1-2004 Parking Facilities – Part 1 Off-street car parking* and Australian Standard *AS2890.2-2002 Parking Facilities – Part 2 Off-street commercial vehicle facilities.*

Sight distance at the proposed access off Tuttles Lane was observed to be in excess of 250 metres in each direction which therefore complies with the requirements of Figure 3.2 of Australian Standard *AS2890.1-2004 Parking Facilities – Part 1 Off-street car parking (160 metres minimum SSD for 100 km/h*) as well as Austroads *Guide to Road Design – Part 4A – Unsignalised and signalised intersections - Table 3.2 (248 metres for 100 km/h)* for safe intersection sight distance.

It is therefore concluded that the proposed site access is suitably located and satisfactory for use for the Solar Farm as it complies with the requirements of Australian Standard *AS2890.1-2004 Parking Facilities – Part 1 Off-street car parking* and Australian Standard *AS2890.2-2002 Parking Facilities – Part 2 Off-street commercial vehicle facilities.*

The main issue with access for construction vehicles to the site is the suitability of the local road network to safely cater for heavy vehicle deliveries. In this regard it is noted that Tuttles Lane has an unsealed pavement a minimum 6 metres wide, therefore complies with Austroads Standards for Rural Roads with less than 500 vtph. It would therefore allow two heavy vehicles to pass each other at slow speed. Therefore it is considered the proposed transportation route to the site is suitable to carry heavy vehicles and thus is suitable to cater for the construction traffic from the Solar Farm construction. However, the additional heavy vehicle loading from the construction may accelerate the deterioration in the unsealed pavement along the transportation route. It is therefore recommended that a dilapidation report be prepared for the project in regard to Tuttles Lane in consultation with Glen Innes Severn Shire Council to identify unsatisfactory pavement damage caused by the construction of the Solar Farm and ensure the road network is repaired to Council's satisfaction post the construction stage of the development. This will require pre and post construction stage inspections of the road pavement along the proposed transport routes. As an unsealed pavement, maintenance works during construction may also need to be considered in the dilapidation report process.

Overall with a suitable condition of consent included for the preparation of a dilapidation report covering Tuttles Lane and the satisfactory repair of the local road network post construction it is considered the local and state road network would be suitable to cater for the expected construction traffic associated with the development.

7.0 ON-SITE CAR PARKING

On-site car parking for the proposal is required to comply with the Industrial Development controls of the Glen Innes Severn Shire Council DCP (2014). Adopting the industrial development rates for this project the relevant on-site car parking provision during the operation of the Solar Farm is.

- *1 space per 100m² GFA (minimum 2 spaces per single occupation)*

With no building proposed for the Solar Farm the development is required to provide 2 on-site car parking space under the DCP requirements. This will be an excess of parking for the operation of the solar farm which will on a regular basis only require 1 car parking space for a maintenance

vehicle that will visit the site no more than once or twice a week. However it is the responsibility of the applicant to also provide sufficient on-site car parking for construction employees during the duration of the construction of the development for the development to comply with the car parking objectives of the DCP. Construction employee car parking will be provided on the hard stand area identified as the construction lay down area and this is large enough to cater for the expected storage requirements during construction as well as the provision of at least 10 on-site car parks for construction employees which is the expected traffic generation from employees to the site as well as being in excess of the Industrial land use requirements of the Glen Innes Severn Shire Council DCP (2014). With significant overflow parking areas also on site it is considered reasonable to conclude the development provides sufficient on-site car parking that complies with the objectives and controls related to car parking required within the Glen Innes Severn Shire Council DCP (2014).

The employee car parking area would need to comply with the requirements of Australian Standard *AS2890.1-2004 Parking Facilities – Part 1 Off-street car parking* with parking bay sizes 2.4 m x 5.4 m and aisle widths of 5.8 metres. There is sufficient room on-site to ensure compliance with this requirement which could be covered by a suitable condition of consent. Overall it is considered suitable on-site car parking can be provided for the development ensuring all vehicle movements to and from the site off Tuttles Lane will be undertaken in a forward direction.



8.0 ALTERNATE TRANSPORT MODES

The proposed development will not generate any increase in public transport demand during both the construction and operational phases of the development particularly given the site is not currently serviced by convenient public transport. Therefore there is no nexus for the provision of new services or improved infrastructure resulting from the development. Similarly, the development will not generate any additional pedestrian or cycle traffic during both the construction and operation phases of the development therefore no nexus exists for the provision of additional pedestrian paths or cycle ways near the site.

9.0 CONCLUSIONS

This traffic and parking assessment for the proposed Solar Photovoltaic (PV) Power Farm (up to 5MW) on Lots 32,33,34,35 & 36 DP1834 and Lot 1 DP251457 Tuttles Lane, Glen Innes has determined the following:

- The development during construction will generate up to an additional 18 vehicle movements to and from the site during the weekday AM and PM peak periods but only 2 vtph during the operation of the Solar Farm.
- The existing peak traffic volumes on the local and state road network are well below the two-way mid-block capacity threshold of 1,550 vtph for the Gwydir Highway and New England Highway (LoS C) as well as the environmental capacity of 300 vtph for the local road network (Tuttles Lane). Traffic volumes will remain below these thresholds during the construction and operation of the development.
- The Gwydir Highway / Tuttles Lane intersection will continue to operate with uninterrupted flow conditions during and post construction of the Solar Farm with little if any impact on the operation of the intersection resulting from the development.
- It is also reasonable to conclude the development will not adversely impact on the intersections on the wider state road network given the high levels of intersection control on the major intersections.
- Therefore, the additional construction and operational traffic generated by this development will not adversely impact on the efficiency or effectiveness of the local and state road network.
- The proposed site access is suitable for use for construction and operation of the development being compliant with Australian Standard and Austroads requirements.
- With a suitable condition of consent included for the preparation of a dilapidation report covering Tuttles Lane and the satisfactory repair of the local road network post construction it is considered the local and state road network would be suitable to cater for the expected construction traffic associated with the development.
- There is sufficient area on-site to accommodate the expected peak parking demand generated by the development during both construction and operation with the provision of an AS2890.1-2004 compliant car park within the construction laydown area for a minimum 10 spaces as well as the provision of numerous overflow parking areas on the site.
- The proposed development will not generate any increase in public transport demand therefore no nexus exists for the provision of new services or improved infrastructure resulting from the development. Similarly, the development will not generate any additional pedestrian or cycle traffic therefore no nexus exists for the provision of additional pedestrian paths or cycle ways near the site.

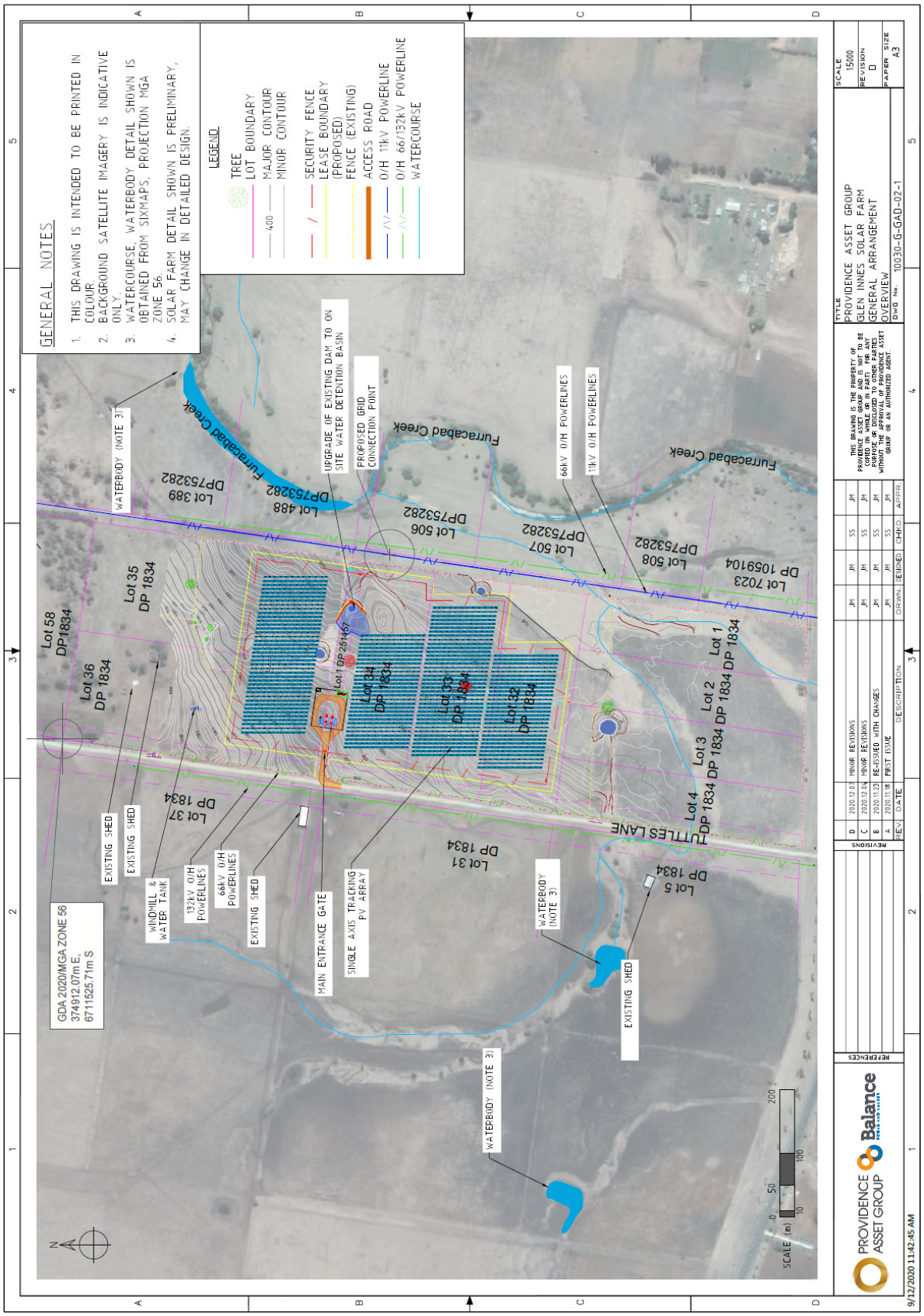
10.0 RECOMMENDATION

Having carried out this traffic and parking assessment for the proposed Solar Photovoltaic (PV) Power Farm (up to 5MW) on Lots 32,33,34,35 & 36 DP1834 and Lot 1 DP251457 Tuttles Lane, Glen Innes, it is recommended that the proposal can be supported from a traffic perspective as the development will not adversely impact on the local road network and complies with all relevant requirements of Glen Innes Severn Shire Council, Austroads, Australian Standards and TfNSW.



JR Garry BE (Civil), Masters of Traffic
Director
Intersect Traffic Pty Ltd

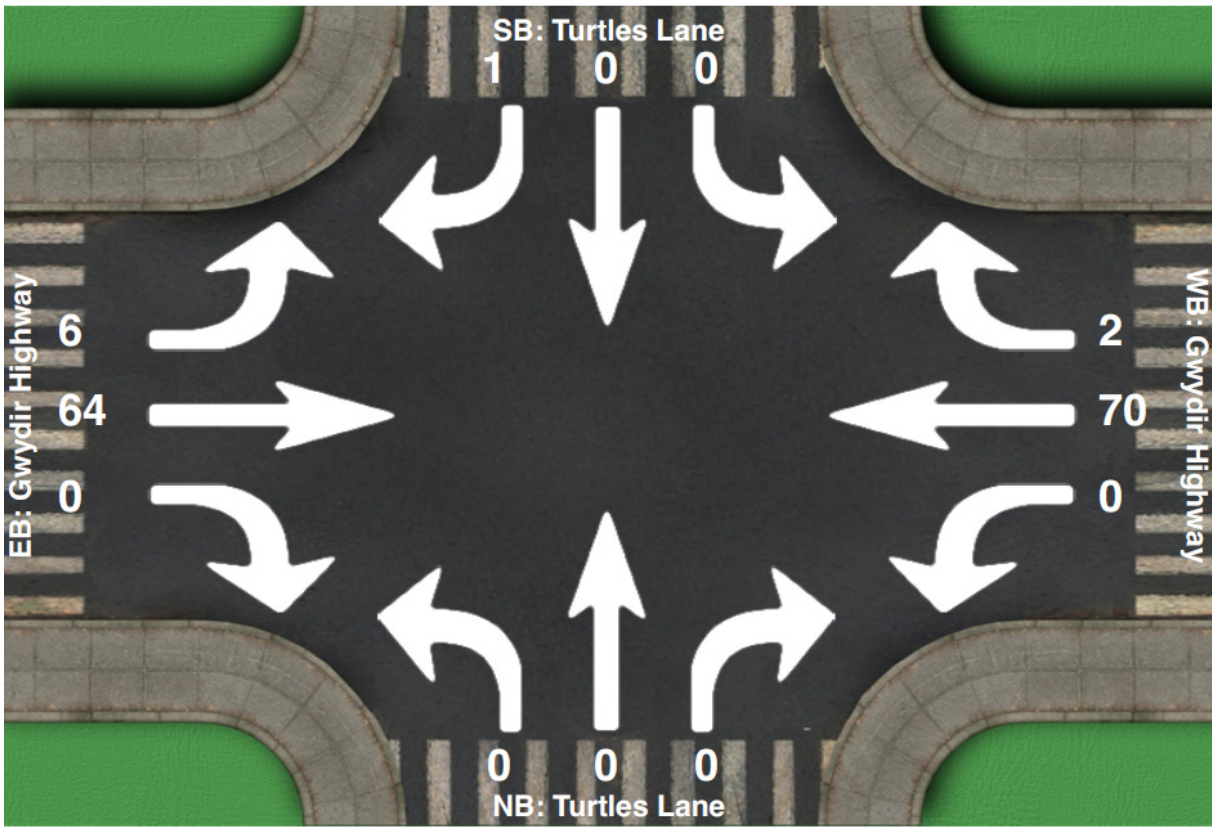
ATTACHMENT A
DEVELOPMENT PLANS


GENERAL NOTES
1. THIS DRAWING IS INTENDED TO BE PRINTED IN COLOUR.
2. BACKGROUND SATELLITE IMAGERY IS INDICATIVE ONLY.
3. WATERCOURSE, WATERBODY DETAIL SHOWN IS OBTAINED FROM SIXMAPS, PROJECTION MGA ZONE 56
4. SOLAR FARM DETAIL SHOWN IS PRELIMINARY, MAY CHANGE IN DETAILED DESIGN.
LEGEND
TREE
LOT BOUNDARY
MAJOR CONTOUR
MINOR CONTOUR
SECURITY FENCE
LEASE BOUNDARY (PROPOSED)
FENCE (EXISTING)
ACCESS ROAD
O/H 11kV POWERLINE
O/H 66/132kV POWERLINE
WATERCOURSE
Furracabad Creek
WATERBODY (NOTE 3)
UPGRADE OF EXISTING DAM TO ON SITE WATER DETENTION BASIN
PROPOSED GRID CONNECTION POINT
66kV O/H POWERLINES
11kV O/H POWERLINES
Lot 58 DP1834
Lot 35 DP 1834
Lot 36 DP 1834
Lot 37 DP 1834
Lot 34 DP 1834
Lot 33 DP 1834
Lot 32 DP 1834
Lot 31 DP 1834
Lot 5 DP 1834
Lot 1 DP 1834
Lot 2 DP 1834
Lot 3 DP 1834
Lot 4 DP 1834
Lot 1 DP 251467
Lot 388 DP753282
Lot 389 DP753282
Lot 488 DP753282
Lot 506 DP753282
Lot 507 DP753282
Lot 508 DP753282
Lot 7023 DP 1059104
TUTTLES LANE
EXISTING SHED
WINDMILL & WATER TANK
132kV O/H POWERLINES
66kV O/H POWERLINES
MAIN ENTRANCE GATE
SINGLE AXIS TRACKING PV ARRAY
GDA 2020/MGA ZONE 56
374912.07m E;
6711525.71m S
N
SCALE (m) 0 50 100 200
REVISIONS
D 2020.12.07 MINOR REVISIONS JM JM SS JM
C 2020.12.04 MINOR REVISIONS JM JM SS JM
B 2020.11.23 RE-ISSUED WITH CHANGES JM JM SS JM
A 2020.11.18 FIRST ISSUE JM JM SS JM
REV DATE DESCRIPTION DRWN DESIGNED CHKD APPR
REFERENCES
PROVIDENCE ASSET GROUP
Balance
THIS DRAWING IS THE PROPERTY OF PROVIDENCE ASSET GROUP AND IS NOT TO BE COPIED IN WHOLE OR IN PART, FOR ANY PURPOSE, OR DISCLOSED TO OTHER PARTIES WITHOUT THE APPROVAL OF PROVIDENCE ASSET GROUP OR AN AUTHORISED AGENT.
TITLE
PROVIDENCE ASSET GROUP
GLEN INNES SOLAR FARM
GENERAL ARRANGEMENT
OVERVIEW
Dwg No 10030-G-GAD-02-1
SCALE 1:5000
REVISION D
PAPER SIZE A3
9/12/2020 11:42:45 AM

ATTACHMENT B
TRAFFIC COUNT DATA

Intersection Peak Hour

Location: Turtles Lane at Gwydir Highway, Glen Innes
GPS Coordinates:
Date: 2020-11-10
Day of week: Tuesday
Weather:
Analyst: Jeff



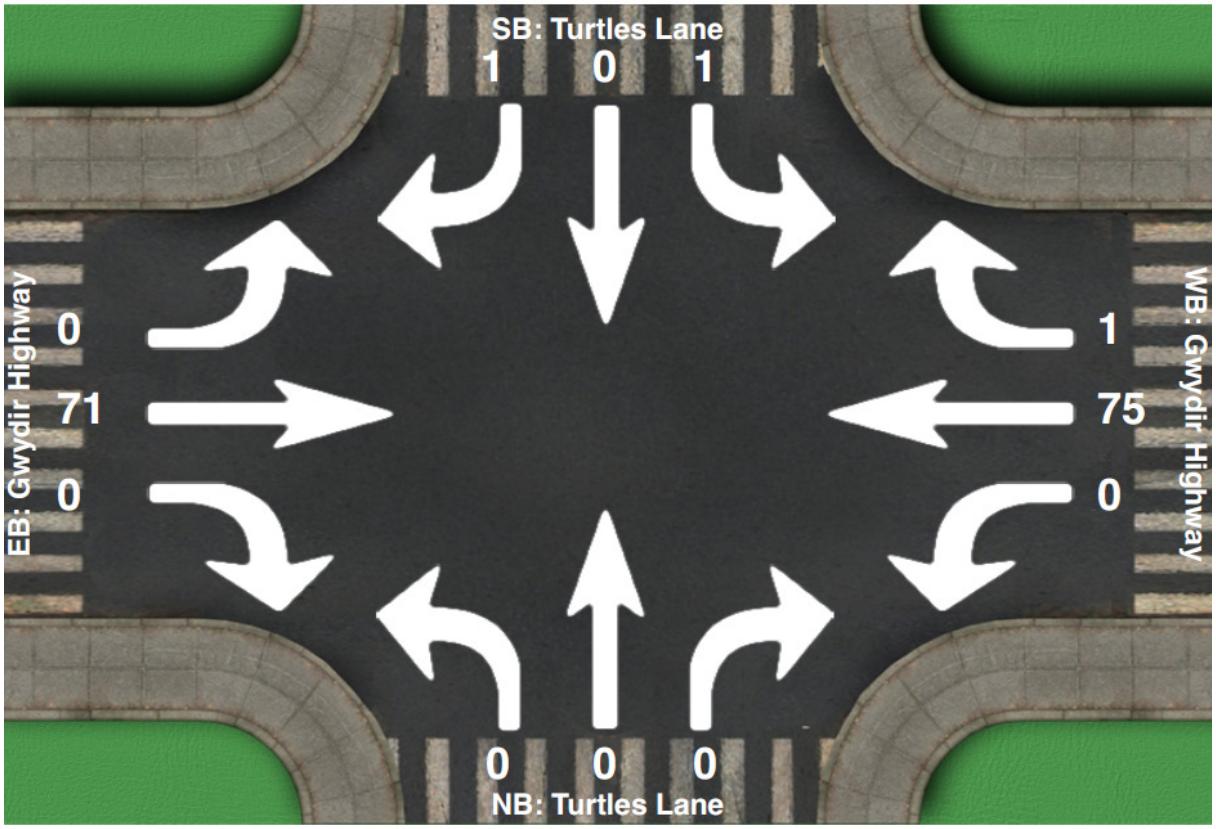
Intersection Peak Hour

15:15 - 16:15

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	0	0	1	0	70	2	0	0	0	6	64	0	143
Factor	0.00	0.00	0.25	0.00	0.88	0.50	0.00	0.00	0.00	0.50	0.73	0.00	0.94
Approach Factor	0.25			0.86			0.00			0.73			

Intersection Peak Hour

Location: Turtles Lane at Gwydir Highway, Glen Innes
GPS Coordinates:
Date: 2020-11-11
Day of week: Wednesday
Weather:
Analyst: Jeff



Intersection Peak Hour

08:00 - 09:00

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	1	0	1	0	75	1	0	0	0	0	71	0	149
Factor	0.25	0.00	0.25	0.00	0.78	0.25	0.00	0.00	0.00	0.00	0.68	0.00	0.78
Approach Factor	0.50			0.79			0.00			0.68			

ATTACHMENT C
TRAFFIC GENERATION INFORMATION

PROVIDENCE ASSET GROUP

Preliminary Solar Farm Vehicle Movement Guidance

27/03/2020

1 Traffic Generated by Construction Works

During the construction of the solar farm, it is estimated that approximately 50 x 40 ft containers will be transported to site. Added to these containers are waste traffic, equipment, temporary installations and workforce transport to and from site. A logistics agent will be engaged to manage the freight from the delivery port [TBC] to the solar farm site.

An estimation of the traffic created by the worksite is provided in Figure 1, below.

The vehicular traffic for the transport vehicles is based on a 3-axle rigid truck. The General Mass Limit (GML) for a 3-axle load is assumed to be 20 tonnes based on The Australian Trucking Association's 'Technical Advisory Procedure for Truck Configurations' [24]. Depending on the availability of vehicles it may be possible that a conventional B-doubles will transport equipment to site. The GML for this vehicle is 40 tonnes. In this case the vehicular traffic for the container loads will reduce by a factor of 2 for each B-double transporting equipment to site.

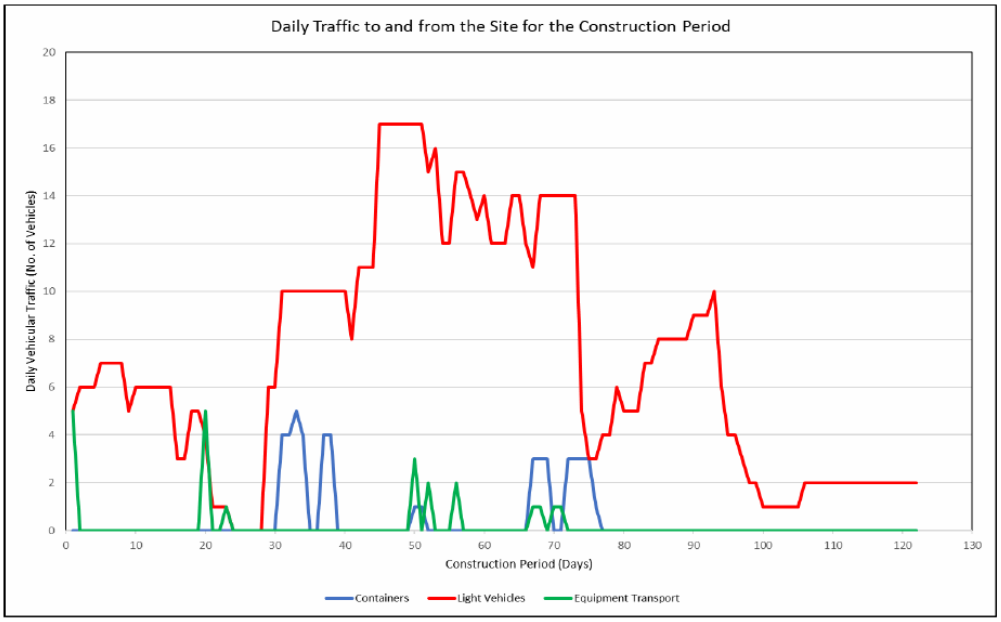


Figure 1 - Daily Traffic to and from Site for the Construction Period

At the peak of the equipment supply, the number of transport vehicles entering and leaving the solar farm site will be 4 to 5 daily for a period of just over a month into the construction period. There will be another busy week midway through the construction period where there will be approximately 3 transport vehicles entering and leaving the site daily.

All heavy transport to and from the site will predominantly be on standard working days between 8am and 4pm.

It is anticipated that there will be up to 30 personnel working on the site during the construction period that will generate the anticipated light vehicle traffic.

The light traffic will be concentrated at the beginning and the end of the day around 6-7am and 4-5pm. The container transport will be concentrated between 10am and 3pm.

2 Impact on Existing Traffic

With a maximum of eight to ten light vehicles and six to eight heavy vehicles travelling to and from the site daily, it is not anticipated that the increased traffic due to construction works will have any significant impact on the existing traffic.

3 Additional Road Signage of Existing Road

It is suggested that road signage is provided for the proposed site entrance on Manilla Road. The recommended locations of the warning signs be placed at distances of 200 metres approaching the intersection to the north and south. The warning signs will indicate that it is a construction site entrance. The entrance to the site on Mannum Road will be designed for the anticipated heavy transport loads volumes during the construction period that are detailed in Section 1. A Traffic Control Plan will be submitted to the DPTI Traffic Management Centre for approval, with all signage to be placed and maintained to the satisfaction of the Commissioner of Highways.

4 Parking

All parking for site personnel will be on site. This will be sign posted at the site entrance. Balance will not permit parking on Mannum Road and will incorporate this in the site induction.

5 O&M Traffic

Once the solar farm has been constructed and has entered the “operations and maintenance” stage the traffic onto site will consist of light vehicles, with few exceptions, at a frequency of 1 to 5 visits per fortnight.

5MW Solar Farm - Typical Vehicle Movements			
Construction - Major Equipment	Load	Quantity	Comments
Piling & Tracker Components	40' Container / Trailer	24	Doubles if permitted / practical
PV Modules	40' Container / Trailer	26	Doubles if permitted / practical
Switchgear	20' Container / Trailer	1	
Inverters	20' Container / Trailer	2	
Cranes	~50T	3	
Cables	40' Container / Trailer	2	Doubles if permitted / practical
Balance of Plant (BOP)	40' Container / Trailer	3	
Civil Plant	Float or Drop Deck	8	4ea at mob / demob
Piling Plant	Float or Drop Deck	4	2ea at mob / demob
Site Facilities	Float/Drop Deck/40' Trailer	8	4ea at mob / demob
Light trucks - 6 wheelers	local deliveries - sand, gen fteight etc	10	
Light trucks - 4 wheelers	local deliveries - sand, gen fteight etc	10	
		101	
Construction - Light Vehicles / Other	Load	Quantity	Comments
Light Vehicle - 4WD ute or similar	Personell / tools	384	Average 4 per day
Light Vehicle - ?	Workforce private vehicles	576	Average 6 per day - depends on engagement of workforce
		960	
O&M	Load	Quantity	Comments
Light Vehicle - 4WD ute or similar	fortnightly inspection	30	1 per fortnight, plus additional
Light Vehicle - 4WD ute or similar	3 monthly Inspections	8	2 visits, 4 times per year
Light Vehicle - 4WD ute or similar	Faults	4	
Light trucks - 4 wheelers	PV Module cleaning	2	Once per Year
		44	

GLEN INNES SOLAR FARM

Visual Analysis, Landscape Concept and Reflectivity Statement

Prepared for:

Providence Asset Group

704/99 Bathurst Street, SYDNEY NSW 2000

SLR Ref: 631.00000-20401 Version No: -v0.2 December 2020



PROJECT NAME

Location	Lots 32, 33, 34,35,36 of DP1834 and Lot 1 of DP 251457, Glen Innes NSW 2370
Project Number	631.00000.20401
Client	Providence Asset Group

PREPARED BY

SLR Consulting (Pty Ltd)

ABN 29 001 584 612

Level 2, 15 Astor Terrace, Spring Hill QLD 4000

PO Box 26, Spring Hill QLD 4004 Australia

Phone +61 7 3858 4815

www.slrconsulting.com

BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Providence Asset Group (the Client).
Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the client. No warranties or guarantees are expressed or should be inferred by any third parties.
This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

This report has been designed to be reproduced at A3 size.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
620.00000.20401-v0.1	18 December 2020	Dallas Ellis	Dean Butcher	Dean Butcher
620.00000.20401-v0.2	22 December 2020	Dallas Ellis	Dean Butcher	Dean Butcher



CONTENTS

1. INTRODUCTION 2
1.1 Background 2
1.2 Site Location 2

2. BASELINE VISUAL ENVIRONMENT 3
2.1 Subject Site and Surrounding Context 3

3. LANDSCAPE CHARACTER ANALYSIS 3
3.1 Regional Context 3

4. PROPOSAL 4
4.1 Project Description 4

5. VISUAL IMPACT ASSESSMENT 5
5.1 Process 5
5.2 Assessment of Visual Impacts for Key Receptors 5
5.3 Receptor Sensitivity 6
5.4 Magnitude of Landscape Change 6
5.5 Impact of Significance on Landscape Character 6
5.6 Summary of Potential Landscape Character Impacts 6

6. SUMMARY OF ASSESSMENT 19
6.1 Summary of Assessment 19
6.2 Mitigation Measures 19

7. REFLECTIVE GLARE 20
7.1 Glare Conditions Assessed 20
7.2 Key Project Characteristics Relevant to Glare 20
7.3 Receivers and Associated Impacts 20
7.4 Glare Criteria 21
7.5 Glare Impact Assumptions 22
7.6 Glare Impact Assessment 24
7.7 Glare Assessment Conclusion 26

8. LANDSCAPE CONCEPT 27
8.1 LANDSCAPE PLAN 27

1. INTRODUCTION

1.1 Background

This Visual Analysis and Landscape Concept has been prepared for the proposed Solar Farm near Glen Innes, NSW.

This visual analysis assessment has been prepared to provide an effective and objective assessment of the anticipated high level impacts of the project on the surrounding visual environment.

SLR has worked closely with other members of the project team in determining and rating visual impacts of the proposed solar farm project works on its immediate surrounds as well as suggesting mitigation measures to further reduce any impacts that may occur.

There are 3 parts to this report.

- Visual Analysis
- Reflectivity Analysis and
- Landscape Concept

1.2 Site Location

The land on which the Solar Farm is located (the subject site) for the proposed Solar Farm (the project) is situated approximately 1.5km north west of the township of Glen Innes, NSW.

The site is located at Tuttles Lane,and the proposed development will consist of solar panels mounted on single-axis trackers connected to a power conversion station with an access and hardstand area from Tuttles Lane. The development will be confined to Lot 32 DP1834, Lot 33 DP1834, Lot 34 DP1834, Lot 35 DP1834, Lot 36 DP1834 and Lot DP251457 (**Figure 1**).



Figure 1. Locality Plan

2. BASELINE VISUAL ENVIRONMENT

2.1 Subject Site and Surrounding Context

The subject site is located on the eastern side of Tuttles Lane, Glen Innes and is a typically open grassed rural site, similar to those rural properties surrounding it. The site is approximately 1.4 km from the edge of Glen Innes township (Derby Street). The site falls generally from north west to south east from approximately AHD 1065m to AHD 1048m.

2.1.2 Roads and Access

The subject site is accessed by one road, Tuttles Lane which is unsealed and is aligned to the west of the subject site. The Gwydir Highway (B76) is located approximately 400m to the south of the subject site. It is a sealed classified state highway and joins Glen Innes to the south. There are a number of other local and unsealed roads to the east and west of the subject site.

2.1.3 Vegetation

The subject site is largely cleared of vegetation (trees and shrubs), except for scattered trees on the northern side of the proposed Solar Farm lease area and trees along the Furracabad Creek to the east of the proposed Solar Farm. There are also a number of established medium sized trees on the hills to the west of the site.

2.1.4 Structures

There are no structures on the subject site except for a small shed north of the proposed lease area, windmill, water tanks and solar pumps. There is an existing shed on the western side of the proposed Solar Farm.

2.1.5 Infrastructure

Apart from Tuttles lane, the only other relevant infrastructure in the vicinity of the subject site are the power poles and lines to the west along Tuttles Lane and to the east parallel to Furracabad Road.

3. LANDSCAPE CHARACTER ANALYSIS

3.1 Regional Context

The landscape character of the region surrounding the site is flat to gently undulating, open rural lands used with a mix of pastoral and agricultural uses. Whilst the vegetation is sparse on the agricultural lands, it is typically concentrated on the elevated local hills surrounding Glen Innes. Vegetation along the Furracabad Creek and local tributaries also contributes to the local rural character.

3.2 Baseline Visual Character of Subject Site and Surrounds

The subject site is typical of the rural landscape character of the region in that it is open, gently undulating and typically grassed (minimal tree coverage). As the size of the site is small in the context of its surrounds, it utilises the ‘borrowed landscape’ of the adjoining rolling hills to define its visual context and define local views. The vegetation on the hills provides the local visual context a more vegetated feel when viewing the site from the south and east.

4. PROPOSAL

4.1 Project Description

A full description of the proposal is provided within the main Statement of Environmental Effects and site plans, but a brief description is as follows. Section 4.1.1 identifies key elements of the proposal that are of particular relevance to an assessment of impacts on the visual analysis

4.1.1 Indicative project Layout

The solar electricity generating facility will consist of the following elements:

- Solar array area of approximately 9.95 hectares within a total fenced area of approximately 13.3 hectares
- Solar array mounted on trackers (136 sets)
- Rectangular photovoltaic module
- Trackers area horizontal single-axis type
- Solar array up to 2.6m high with +/-60° rotation angle
- Trackers orientated north - south
- Associated infrastructure
- Power Conversion Station (PCS)
- Site access from Vine Lane via a 4m wide road
- Security fencing
- Car park area
- Off-load and hardstand area
- Onsite stormwater and detention basin

During construction, temporary facilities located within the site may include:

- Construction office

4.1.2 Solar panel dimensions and arrangement

The proposed solar array module dimensions are approximately 1.1 m wide x 2.3m high. They are mounted on a tracking system that will maximise the electricity production. The tracking system rotates about a north-south axis to follow the sun with the aim of orienting each panel to be as close to perpendicular as possible to the incoming sun.

The tracking systems will be arranged in rows running in a north-south direction as indicated in **Figure 2** The enclosure for the solar panel arrays and associated equipment will cover approximately 12Ha. The diagram in **Figure 2.1** illustrates the dimensions and rotation of the panels. The panels only rotate from east to west and are not tilted toward the north.

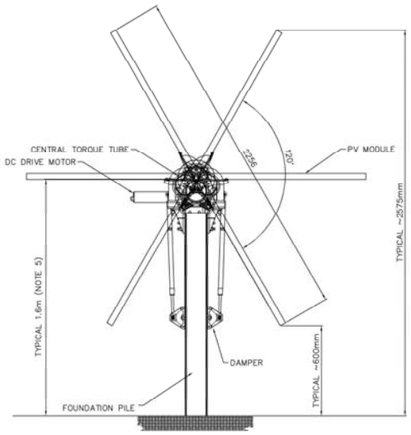


Figure 2.1 Solar panel / tracking system



Figure 2. Concept layout of the project

5. VISUAL IMPACT ASSESSMENT

5.1 Process

The Visual Impact Analysis generally applies the assessment techniques set out in the 'Guidelines for Landscape and Visual Impact Assessment, Third Edition' (2013) prepared by The Landscape Institute and the Institute for Environmental Management and Assessment (UK).

The analysis includes the following:

- Review of the proposal (scale, bulk, height, technical specifications and landscape);
- Analysis of the subject site (visual exposure, visual qualities and landscape values);
- Identification of potential impacts on key receptors including the rating of magnitude for each receptor group;
- Rating of impact significance for each receptor group.
- The significance is evaluated as a product of the sensitivity or value of the receptor, and the magnitude of impacts on the receptor; and
- Potential mitigation measures to meet the necessary planning requirements and any community expectations.
- The report included a desktop analysis and a visual site investigation in November 2020. The desktop review included the review of aerial photography, site topography and vegetation cover.

Photo-montages were also prepared to inform the analysis.

5.2 Assessment of Visual Impacts for Key Receptors

Photographic imagery was taken of the site to assist in the assessment of visual impacts. Photos were taken with a Canon EOS 6D Mark II digital single-lens reflex (DLSR) camera with a 50 mm lens.

Three photomontage images were prepared to assist in the Visual Analysis process; all from public receptor points.

The receptors used in the photomontage were selected to investigate a range of visual solutions and illustrating views from areas of perceived sensitivity. During the site investigation, local areas around the site were observed to determine the potential visibility of the proposed Solar Farm.

For the purposes of this Visual Analysis a Photomontage image was produced from each of the three viewpoints chosen. The approximate extent of the proposed Solar Farm has been identified to give a general impression of the location on site and the approximate height.

The Photo montage Images are represented in Section 5.8 and show the following overlays of information.

- Existing visual baseline (existing landform);
- Overlay of the final solar farm proposed development

5.3 Receptor Sensitivity

The receptor sensitivity is derived from a combination of factors including:

- Receptors interest in the visual environment (high, medium or low interest in their everyday visual environment and the duration of the effect);
- Receptors viewing opportunity (prolonged, regular viewing opportunities); and
- Number of viewers and their distance/ angle of view from the source of the effect, extent of screening/ filtering of view.

Whilst the assessment of visual values and effects is largely measured on a qualitative basis, assessment against scale enables a more objective evaluation and comparison of sensitivity of receptors and magnitude of effects. The Receptor Sensitivity Rating is described as being High, Medium, Low or Negligible as described in **Table 1.**

5.4 Magnitude of Landscape Change

The Magnitude of Change to the landscape character depends on the nature, scale, intensity, extent and duration of the impacts/ change due to proposal. The magnitude of change also depends on the loss, change or addition of any feature to the existing landscape and is based on the character type that is most likely to be impacted by the project prior to the addition of any mitigation measures.

The Magnitude of Change is described as being High, Medium, Low or Negligible as described in **Table 2**.

Descriptions of Magnitude and Sensitivity are illustrative only and there is no defined boundary between levels of impacts.

Table 1. Receptor Sensitivity Rating

Receptor Sensitivity	Description
High	• Visitors to heritage sites, regionally important locations, scenic routes, lookouts within 2.5km with quality views, important views of the site and surrounding areas where landscape is the specific focus. • High numbers of visitors • Views to landscape that are rare and or unique and are possibly vulnerable to change • Views from residences within 1km of the site or are representative of high quality views
Medium	• Travellers/visitors along roads or rail routes that are not scenic routes but offer quality views within 2.5km of the site • Medium numbers of visitors/ residents (rural communities or townships) • Views that are representative of local character or sense of place but are not rare or unique • Views from residences beyond immediate vicinity (1km-5km) of the site or are representative of moderate quality views • Recreational users/ viewers beyond 2.5km from the site with moderate interest in their surrounds
Low	• Travellers/visitors along roads or rail routes that are not scenic routes but offer reasonable views within 4km of the site • People at place of work where setting or views not important to quality of working environment • Recreational users not dependent on views or scenic quality of landscape • View experience takes in broad context with which site is visible but not an important element. • Small numbers of visitors with passing interest in their surroundings (those travelling along mid-level roads) • Viewers whose interest is not specifically focused on landscape or scenic qualities (commuters, workers)
Negligible	• Very occasional or low level of users with passing interest in their surrounds (those travelling along minor roads or views from the air) • Travellers/visitors along unsealed roads offering views greater than 4km of the site

5.5 Impact of Significance on Landscape Character

The Impact Significance is evaluated according to 2 key criteria as noted above and is reflected in **Table 3.**
The rating is a means of comparing impacts on different receptors. Professional judgement and experience have been applied in order to identify the level of significance for each character type which has been assessed on its own merits.

- The sensitivity of the receptor or existing landscape; and
- The magnitude of the change or impact that is likely to occur.

The process of assessment and the use of the ratings tables reflect typical outcomes for visual impacts.

- Impacts on receptors that are particularly sensitive to change in views and visual amenity are more likely to be significant.
- Impacts that constitute a substantial change to the visual environment are likely to be more significant than the impacts that do not cause substantial change.

5.6 Summary of Potential Landscape Character Impacts

The following sheets summarise the assessment of impacts on each of the identified visual receptor groups.

Three representative viewpoints were identified where the site could be seen preferably from public locations. Due to the distances from the site, presence of topographic and vegetated features, surrounding structures and the limited views from publicly accessible areas, the choice of viable views was limited. The following sheets describe and rate the sensitivity of each viewpoint, the nature and magnitude of impacts likely to occur and the resultant significance of impacts for each receptor.

Typically views to the site from local roads and other public locations in the area were very limited. Photos from each receptor are provided and photomontages prepared to show how the proposed Solar Farm will be perceived from that particular viewpoint. Mitigation measures have been included where appropriate.

Table 2. Magnitude of Change

Magnitude of Change	Description
High	Dominant Change • Major change in view at close distances, affecting substantial part of the view continuously visible for a long duration or obstructing a substantial part or important elements of the view • Overwhelming loss or additional features in the view such as the nature of view or character of landscape fundamentally changed • Views to key landscape features affected • Visual amenity of local residents or road users substantially diminished • Substantial change to the landscape due to loss of and or change to elements, features or characteristics of the landscape creating an overall worsening of landscape quality
Medium	Considerable Change • Clearly perceptible changes in views at intermediate distances resulting in either distinct new element in a significant part of the view or a more widely ranging, less concentrated change across a wider area • Significant loss or addition of features in the view, such that nature of view or character of landscape is altered • Noticeable contrast of any new features in the view such that the nature of the view or landscape character is changed • Noticeable contrast of any new features or changes compared to existing landscape • Views to key landscapes partially obstructed but views remain intact
Low	Noticeable Change • Minor memorable change to the landscape or views • Temporary or reversible impact • Landscape dominant element and built form/ development well integrated within it • Little permanent change or no fundamental change to local landscape character
Negligible	Barely Perceptible Change • No memorable or rarely perceptible change to landscape character or key views

Table 3. Effect Significance Rating

Receptor Sensitivity	Magnitude of Change in Landscape				
	High (Dominant Change)	Medium (Considerable Change)	Low (Noticeable Change)	Negligible (Barely Perceptible Change)
High	High	Moderate-High	Moderate	Minor-Moderate
Medium	Moderate-High	High	Minor-Moderate	Minor
Low	Moderate	Minor-Moderate	Minor	Minor-Negligible
Negligible	Minor-Moderate	Minor	Minor-Negligible	Negligible

5.6.1 Selected Viewports



Figure 3. Selected Visual Receptors and Direction of View

5.6.2 Viewpoint 1 - Existing



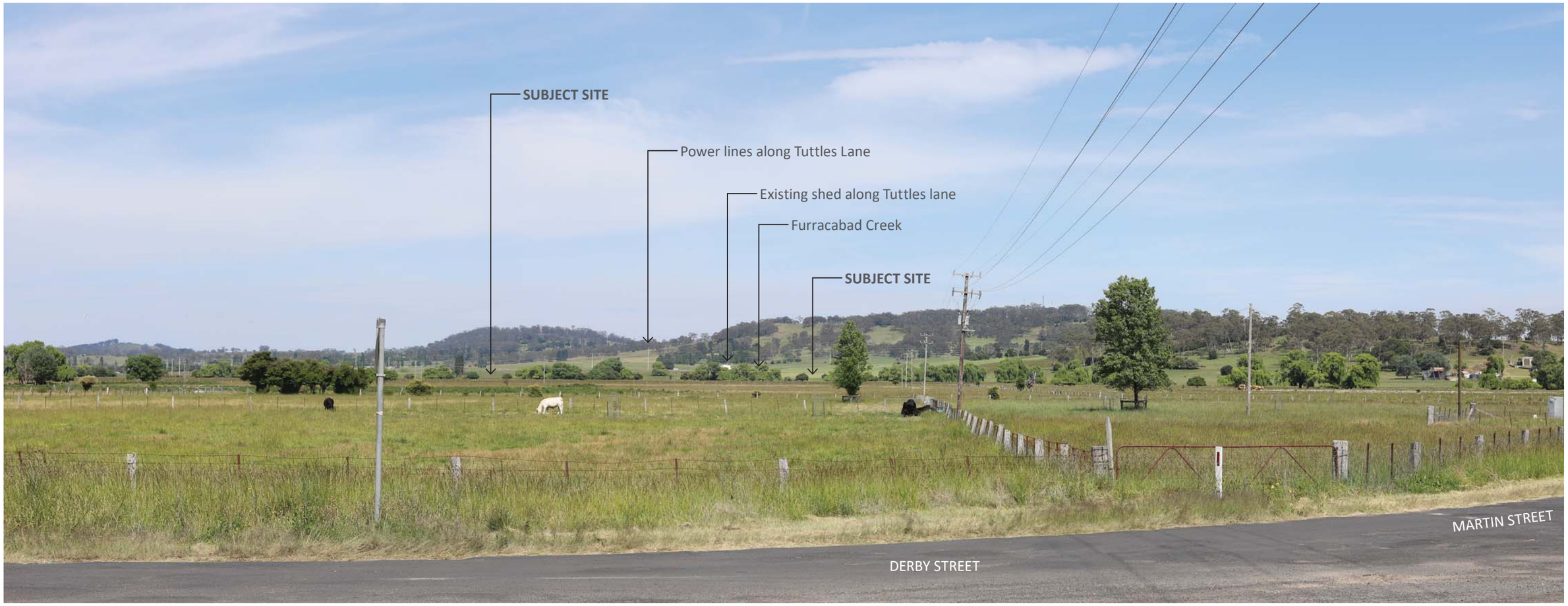
Receptor - VP1	Grafton Street, Glen Innes
Coordinate Location	29°43’40.014” S 151°44’54.282” E
View Description	View from the Grafton Street looking west toward the solar farm site.
Distance from Site	Approximate 3.850km
Comments • Open rural (pastoral) landscape, with minimal canopy vegetation in the background. The rural township is dominated by low density residential dwellings and established vegetation visible in the foreground and middle ground of the view. • Vegetated hills to the north and west of the subject site from this viewpoint are clearly visible and terminate views.	

5.6.3 Viewpoint 1 - Proposed



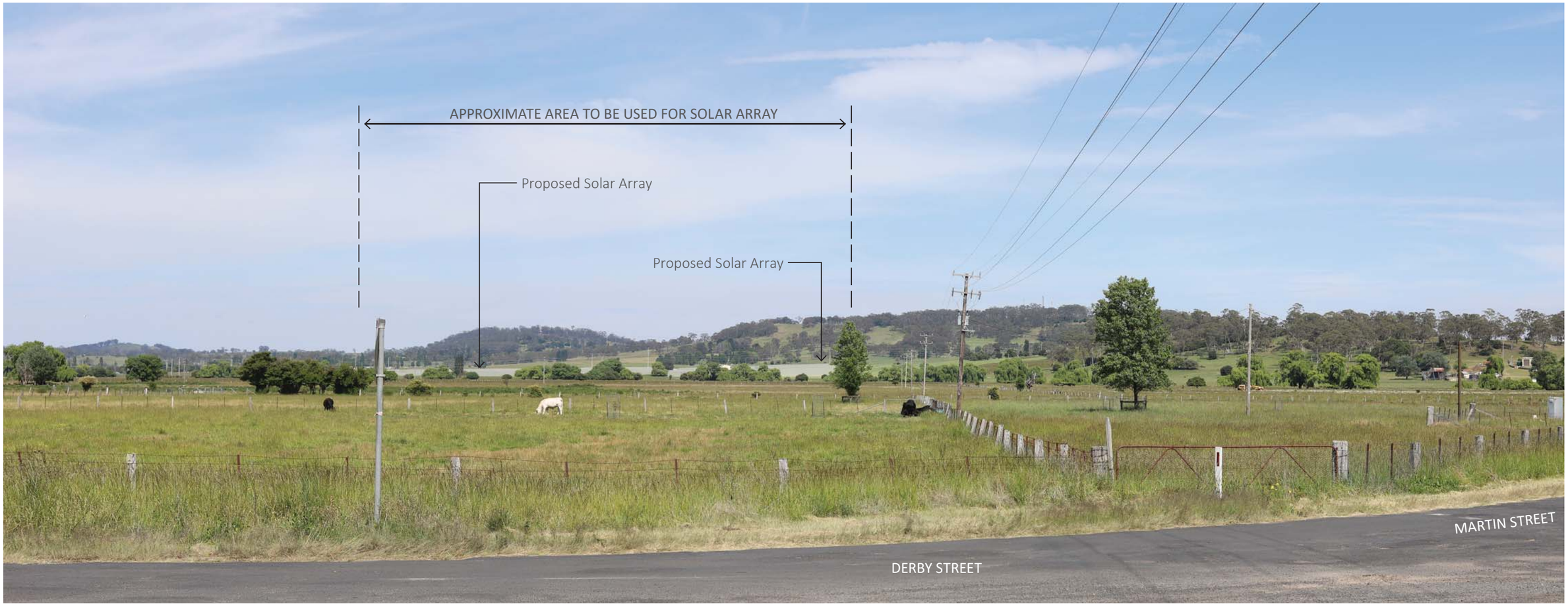
Receptor - VP1 Summary of Impact Assessment	
Receptor Sensitivity	Medium
View Magnitude of Landscape Change	Low
Impact Significance	Minor - Moderate
Mitigation Measures	• Informal shrub planting (to a maximum height of 3m) adjoining lease boundary could integrate the solar array appearance into the landscape. • No tree planting or formal shrub planting.

5.6.4 Viewpoint 2 - Existing



Receptor - VP2	Derby Street, Glen Innes
Coordinate Location	29°43’28.11” S 151°43’24.93” E
View Description	View from the intersection of Derby Street, Grafton Street and Martin Street
Distance from Site	Approximate 1.36km
Comments • Open rural (pastoral) landscape, with minimal canopy vegetation in the foreground (dominant landscape character type in the region) and vegetated hills in the background. • The site slopes up gently from Furracabad Creek to the west.	

5.6.5 Viewpoint 2 - Proposed



Receptor - VP2 Summary of Impact Assessment	
Receptor Sensitivity	Medium
View Magnitude of Landscape Change	Low
Impact Significance	Minor - Moderate
Mitigation Measures	• Informal shrub planting (to a maximum height of 3m) adjoining lease boundary could integrate the solar array appearance into the landscape. • No tree planting or formal shrub planting.

5.6.4 Viewpoint 3 - Existing



Receptor - VP3	Ferguson Street, Glen Innes
Coordinate Location	29°43’56.064” S 151°42’52.704” E
View Description	View from Ferguson Street, looking north west towards the solar farm site
Distance from Site	Approximate 780m to the edge of the site
Comments • Open rural (pastoral) landscape, with minimal canopy vegetation in the foreground (dominant landscape character type in the region) and vegetated hills in the background. • The site slopes up gently from Furracabad Creek to the west.	

5.6.5 Viewpoint 3 - Proposed



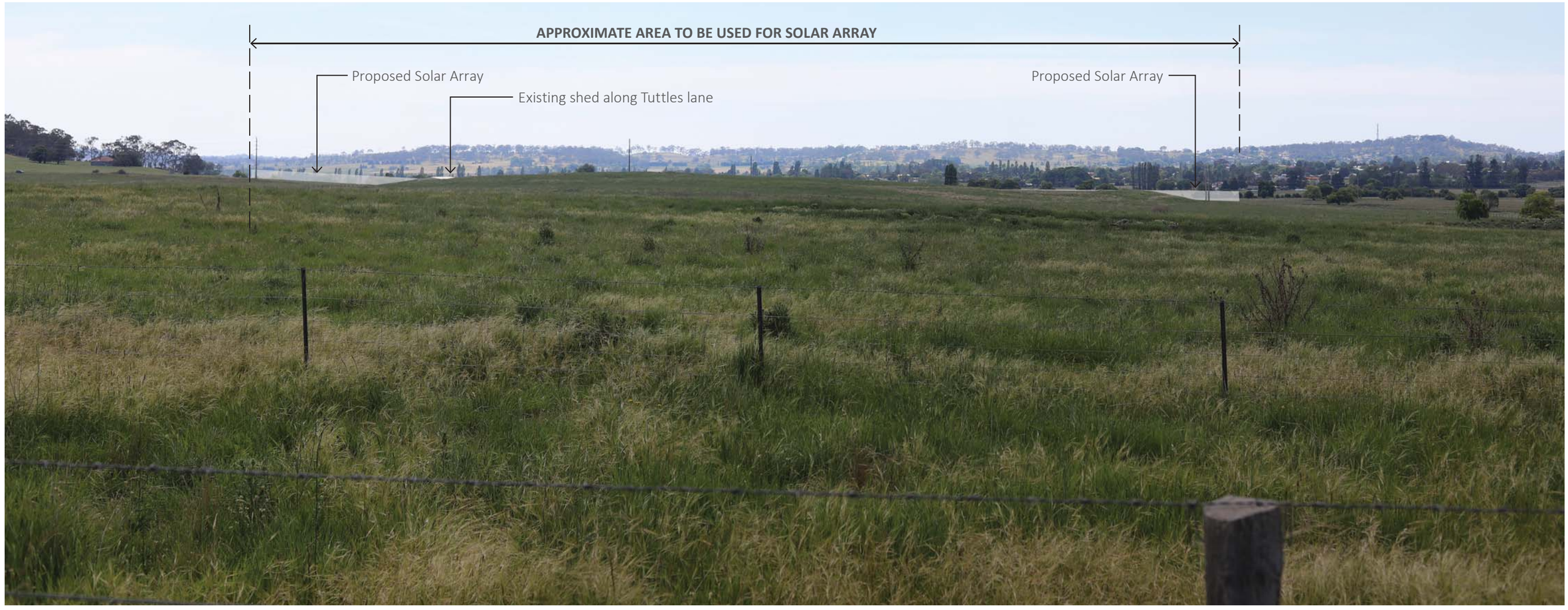
Receptor - VP3 Summary of Impact Assessment	
Receptor Sensitivity	Medium
View Magnitude of Landscape Change	Low
Impact Significance	Minor - Moderate
Mitigation Measures	• Informal shrub planting (to a maximum height of 3m) adjoining lease boundary could integrate the solar array appearance into the landscape. • No tree planting or formal shrub planting.

5.6.6 Viewpoint 4 - Existing



Receptor - VP4	Abbotts Road, Glen Innes
Coordinate Location	29°43’28.776” S 151°41’47.106” E
View Description	View from Abbotts Road, looking east towards the solar farm site
Distance from Site	Approximate 908 m
Comments • Open rolling pastoral landscape character in the foreground with moderately vegetated hills in the background of the view. • Rural township in the middle ground with residential built form and established vegetation.	

5.6.6 Viewpoint 4 - Proposed



Receptor - VP4 Summary of Impact Assessment	
Receptor Sensitivity	Negligible
View Magnitude of Landscape Change	Minor
Impact Significance	Minor - Negligible
Mitigation Measures	• No mitigation considered necessary for this view.

5.6.6 Viewpoint 5 - Existing



Receptor - VP5	Martins Lookout Watsons Drive, Glen Innes
Coordinate Location	29°44’38.178” S 151°45’3.18” E
View Description	View from Martins Lookout on Watsons Drive, looking north west towards the solar farm site
Distance from Site	Approximate 4.5km
Comments • Rural township character dominant in the foreground (residential built form with established vegetation). • Rural landscapes in the background with open fields, moderately vegetated hills and gently undulating topography.	

5.6.6 Viewpoint 5 - Proposed



Receptor - VP5 Summary of Impact Assessment	
Receptor Sensitivity	Negligible
View Magnitude of Landscape Change	Minor
Impact Significance	Minor - Negligible
Mitigation Measures	• Informal shrub planting (to a maximum height of 3m) adjoining lease boundary could integrate the solar array appearance into the landscape. • No tree planting or formal shrub planting.

6. SUMMARY OF ASSESSMENT

6.1 Summary of Assessment

The visual environment for the subject site and surrounding area is characterised by open, flat rural land.

Whilst, the subject site itself has been cleared of vegetation, existing stands of established vegetation located on the elevated hills to the west of the site contribute to the natural rural character of the area.

Although the subject site is located within a relatively short distance from the Glen Innes township, views of the site from public viewpoints are generally limited. This is due to the presence of obstructions such as topographic features, vegetation and built elements. From the Glen Innes township the Solar Farm will generally not be visible. Select elevated areas and open locations nearby have views of the site from the eastern side of the town.

The nature of the array as outlined above including its height have meant that the relative visual impacts of the Solar Farm are generally low, especially given the distance from most notable public vantage points.

The relative distance of the receptors from the site as shown in viewpoints VP1 and VP5 has dictated that it is not prominent within the visual context from these locations. It could therefore be reasonably assumed that the proposed Solar Farm would also not be prominent from these locations given its maximum height of around 2.5m The viewpoints VP2, VP3 and VP4 which are closer to the site, represent the site as a larger part of the viewshed but in all 3 views the site is still not prominent in comparison to other elements such as the local hills and vegetation. As a result of low elevation, obstructions of views to the array as well as its limited height, it was considered that the Solar Farm would be moderately visible and have a minimal level of prominence.

The vegetation along Furracabad Creek will also partially screen the solar array especially from viewpoints VP2 and VP3. The existing urbanised character of Glen Innes contributes to the integration of the solar array into the urban fabric rather than an isolated element within a totally rural setting.

6.2 Mitigation Measures

As described in the summary for each of the 5 viewpoints, mitigation measures would only be required on the eastern side of the development for the following reasons:

- The height and nature of the proposed solar farm
- The varying distance from public vantage points
- A moderate level of viewers/ users

The informal planting of native shrubs to a height of between 3-4m would complement the existing rural character along Furracabad Creek on the eastern side of the proposed Solar Farm lease area. This would occur outside of the fence line and would assist in minimising visual impacts of the development on the surrounding township and rural areas.

As a temporary measure the fences could be covered with a material such as hessian that provided an ‘instant’ visual screen prior to the establishment of the plants. The material however would need to ensure that it did not create greater visual impacts than that of the solar array.

The planting of trees directly adjoining the solar farm would not be encouraged due to the potential for shadows to be cast over the array during certain times of the day.

Whilst this planting will help screen the Solar Farm as viewed from the viewpoints VP1, VP2, VP3 and VP5, its benefits will be of little value to viewpoint VP4.

Table 4. Summary of Visual Impact Ratings for each Receptor

Receptor	Receptor Sensitivity	Magnitude of Change	Effect Significance
VP1	Medium	Low	Minor-Moderate
VP2	Medium	Low	Minor-Moderate
VP3	Medium	Low	Minor-Moderate
VP4	Negligible	Minor	Minor-Negligible
VP5	Negligible	Minor	Minor-Negligible

7. REFLECTIVE GLARE

7.1 Glare Conditions Assessed

The following potential glare conditions have been considered:

- Daytime Reflective glare (and glint) arising from the solar PV panels within the facility:

- Aviation Sector Reflective Glare;
- Motorist "Disability" Reflective Glare and Pedestrian "Discomfort"
- Reflective Glare;
- Rail Operator Reflective Glare;
- Industrial critical machinery operators (heavy vehicles, etc.) Reflective Glare; and
- Residential "Nuisance" Glare

- Night-time Illumination glare if any 24/7 security lighting is incorporated into the Project in the future; none is currently planned.

7.2 Key Project Characteristics Relevant to Glare

The proposed solar array would consist of 153 trackers oriented in a north-south direction, each supporting either 52 or 84 x 540W solar panels (11,648 panels in total);

- The trackers are "single-axis" capable of rotating solar panels to a maximum of ±60° - **refer Figure 4**;
- Individual panels (2.3 m x 1.1 m) reach a maximum height above ground of 2.57 m at their full 60° tilt angle; and
- The trackers are oriented north-south and spaced 6.25m apart.

7.3 Receivers and Associated Impacts

The issues of concern assessed in this study in relation to daytime reflective glare and night-time illumination glare are detailed below – **refer Figure 5** for receivers of interest.

7.3.1 Aviation-Related Glint & Glare

Potential impacts on pilots during landing and air traffic control tower operations (if relevant).

7.3.2 Traffic Disability & Pedestrian Discomfort Glare

Potential impacts on motorist disability glare and pedestrian discomfort (relevant to pedestrian crossings).

7.3.3 Train Driver Disability Glare

Potential impacts on train operator's activities, eg reflections obscuring railway signals.

7.3.4 Industrial Critical Machinery Operators

Potential impacts on operators of critical industrial machinery, eg mining draglines.

7.3.5 Residential Nuisance Glare

Potential impacts on surrounding residences in relation to "nuisance" glare and light spill from night-time illumination (if relevant)

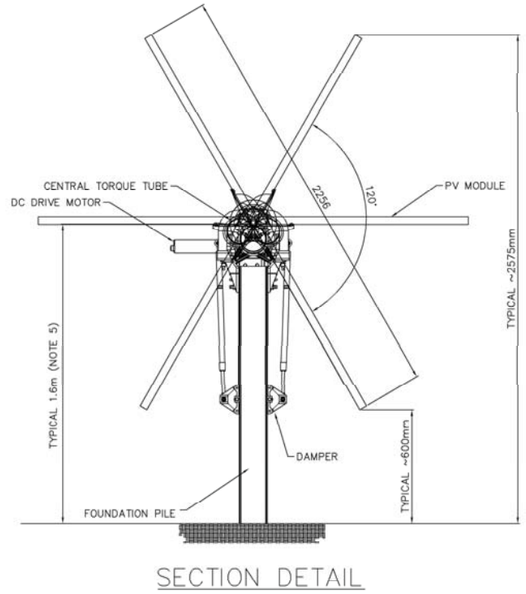


Figure 4 Glen Innes Solar Farm Single-Axis Trackers

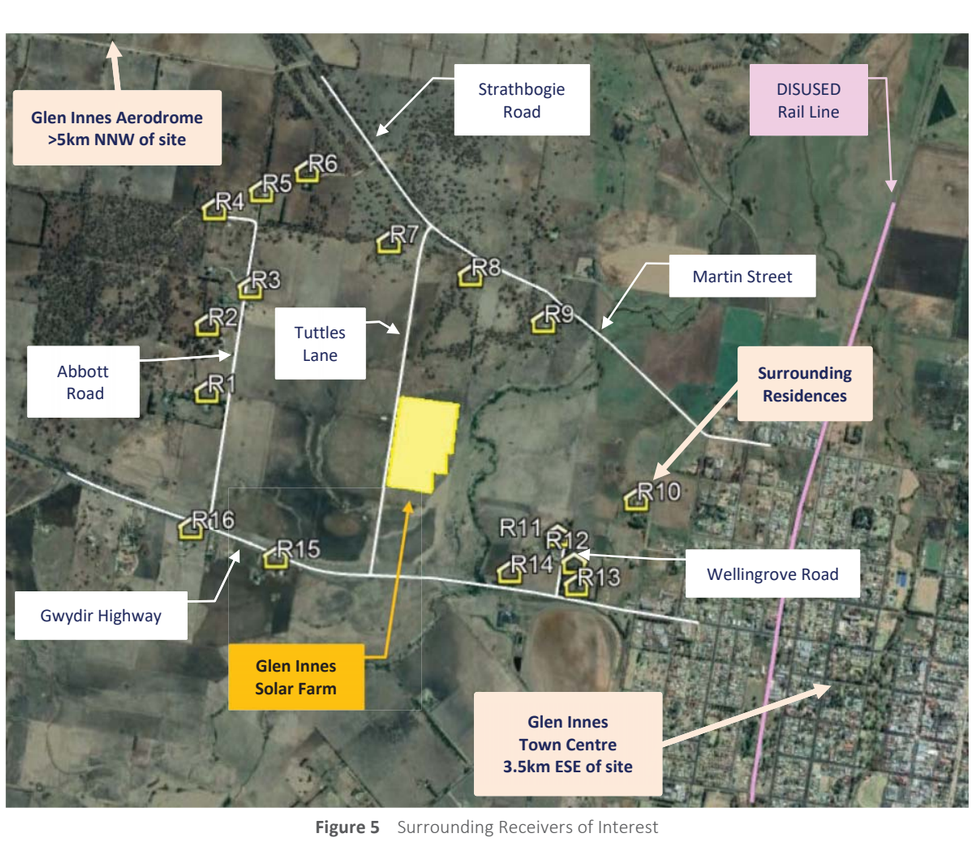


Figure 5 Surrounding Receivers of Interest

7.4 Glare Criteria

7.4.1 Aviation-Related Glint & Glare

In relation to the potential impact of solar PV systems on aviation activity, guidance is available from the US FAA which regulates and oversees all aspects of American civil aviation.

- FAA, "*Technical Guidance for Evaluating Selected Solar Technologies on Airports*", Federal Aviation Administration, Washington, D.C., Version 1.1, April 2018.

In support of the above, the FAA contracted Sandia Labs to develop their **Solar Glare Hazard Analysis Tool** (SGHAT) software as the standard tool for measuring the potential ocular impact of any proposed solar facility. SGHAT utilises the Solar Glare Ocular Hazard Plot to determine and assess the potential for glare.

A sample SGHAT Ocular Hazard Plot is shown in **Figure 6.** The analysis contained in this plot is derived from solar simulations that extend over the ENTIRE CALENDAR YEAR in 1-MINUTE intervals, sunrise to sunset.

The SGHAT criteria state that a proposed solar facility should satisfy the following:

- Airport Traffic Control Tower (ATCT) cab: NO Glare
- Final approach paths for landing aircraft: Glare to NOT exceed "Low Potential for After-Image"

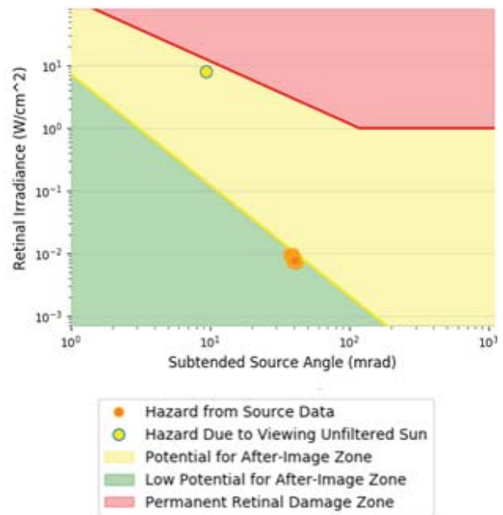


Figure 6 Example SGHAT Plot

In **Figure 6**, the following is noted:

- SGHAT ocular impact is a function of both the "retinal irradiance" (ie the light seen by the eye) and "subtended source angle" (ie how wide an arc of view the light appears to be arriving from).
- The occurrence of glare is shown in the plot as a series of **orange** circles, one circle for each minute that a reflection is visible.
- SGHAT ocular impact falls into three categories:
- GREEN:
  low potential to cause "after-image"
- YELLOW:
  potential to cause temporary "after-image"
- RED:
  potential to cause retinal burn (permanent eye damage)
- "After Image" can occur for example when a photo with flash is taken in front of a person who then sees spots in front of their eyes for a few seconds. A more extreme example of "after-image" occurs when staring at the sun.
- The SGHAT plot also provides an indication of the relative intensity of the sources of light itself (ie the sun) – refer the **green** circle in the plot.
- Finally, in relation to PV Solar facilities, it is important to note that a "RED" category outcome is **not possible**, since PV modules DO NOT FOCUS reflected sunlight.

7.4.2 Motorist Disability & Pedestrian Discomfort Glare

The criteria commonly used by Australian Local Government Authorities to assess the acceptability or otherwise of potential adverse reflections from glazed façade systems onto surrounding roadways and pedestrian crossings utilise the so-called **Threshold Increment** (TI) Value of the reflection condition, defined in AS/NZS 4282:2019 as:

"the measure of disability glare expressed as the percentage increase in contrast required between an object and its background for it to be seen equally well with a source of glare present. Note: Higher values of TI correspond to greater disability glare."

The TI Value is calculated as the ratio of "veiling" luminance (eg from a reflection) to the overall average background ("adaptation") luminance, with the necessary constant and exponent parameters provided in AS 1158.2:2005.

The formula for calculating the TI Value is …

TI = 65 Lv / Ltb0.8, where:

- Lv = veiling luminance from a source of interest (eg reflection) – Cd/m2
- Ltb = so-called "adaptation" luminance (total background) – Cd/m2

For (Motorist) Traffic Disability Glare, the TI Value should remain:

- Below 10 for major roads
- Below 20 for minor roads

For Pedestrian Discomfort Glare, the TI Value should remain:

- Below 2 at critical locations such as pedestrian crossings
- Below 3 for other locations

7.4.2 Rail Operators Reflective Glare

Almost all Australian Rail Authorities have guidelines covering glare in general (ie not specific to solar PV panel glare) aimed at avoiding discomfort/distraction to train operators and obscuring train signals. Most guidelines refer either to Table 2.10 of AS 1158.3.1 for the TI Value criterion and/or Table 3.2 of AS 1158.4 for the Cd (Candela) criterion associated with the control of glare.

For Rail Traffic Disability Glare, the relevant AS1158 criteria are:

- The TI Value should remain below 20
- The Cd Value at 70˚ incidence should remain below 6,000.

7.4.3 Residential "Nuisance" Glare

There are currently no national or state guidelines in Australia governing the acceptability or otherwise of residential nuisance glare specific to solar PV.

Existing guidance from state governments that exists in relation to solar panels typically covers installation audits and compliance checks.

Accordingly, to assist in addressing residential nuisance glare, reference has been made of the concepts used for TI Value pedestrian discomfort glare acceptability criteria outlined in the preceding sections.

7.4.4 Industrial Critical Machinery Operations

There are currently no (Australian) national or state guidelines governing the acceptability or otherwise of reflective glare for industrial site critical operations (eg dragline operations). Instead, the concepts used for the TI Value acceptability criteria can assist when dealing with this issue.

7.4.5 Night-Time Illumination Glare

The effect of light spill from outdoor lighting impacting on residents, transport users, transport signalling systems and astronomical observations is governed by AS 4282-2019.

The adverse effects of light spill from outdoor lighting are influenced by a number of factors:

- The topology of the area. Light spill is more likely to be perceived as obtrusive if the lighting installation is located higher up than the observer. Lighting installations are usually directed towards the ground and an observer could hence have a direct view of the luminaire.
- The surrounding area. Hills, trees, buildings, fences and general vegetation have a positive effect by shielding the observer from the light installation.
- Pre-existing lighting in the area. Light from a particular light source is seen as less obtrusive if it is located in an area where the lighting levels are already high, eg in cities. The same lighting installation would be seen as far more bothersome in a less well-lit residential area.
- The zoning of the area. A residential area is seen as more sensitive compared to commercial areas where high lighting levels are seen as more acceptable.

The Project is located outside the Glen Innes township area and has the potential to impact on surrounding residential properties – refer **Figure 5**. As these properties are not located within township environs proper, they would therefore be classed as being in a residential area with "Dark Surrounds" - refer AS 4282-2019.

It is noted that night-time lighting is not currently incorporated into the Project.

If at some point of time in the future such lighting is incorporated into the facility, the following criterion will apply:

- Light spill from the Project onto the facades of any surrounding residential dwellings should be kept below 1 lux during relevant curfew hours.

Finally, it has been known for some time that night-time artificial lighting has the potential to disrupt the natural behaviour of nocturnal fauna species such as arboreal mammals, large forest owls and microbats. Biodiversity associated with the Project is discussed in the Flora and Fauna Assessment Report prepared for the Project. As far as is known, no adverse eco-lighting issues are apparent.

7.5 Glare Impact Assumptions

7.5.1 Project Site Solar Angles

One of the challenging issues encountered with daytime solar panel glare is the varying nature of the reflections, whose duration will vary with time of day and day of the year as the sun's rays follow variable incoming angles between the two extremes of the summer and winter solstices.

Any solar glare analysis must take into account the complete cycle of annual reflection variations noted above.

The potential range of incoming solar angles at the Project site relevant to daytime glare is shown in **Figure 7** with relevant critical angles summarised in **Table 5**.

Table 5 Key Annual Solar Angle Characteristics

Day of Year	Summer Solstice	Equinox	Winter Solstice
Sunrise	4:58 am	5:59 am	6:49 am
Sunset	6:53 pm	6:01 pm	4.54 pm
Daily Azimuth Range	±117° E/W	±91° E/W	±63° E/W
Max Altitude	83.6°	60.8°	36.8°

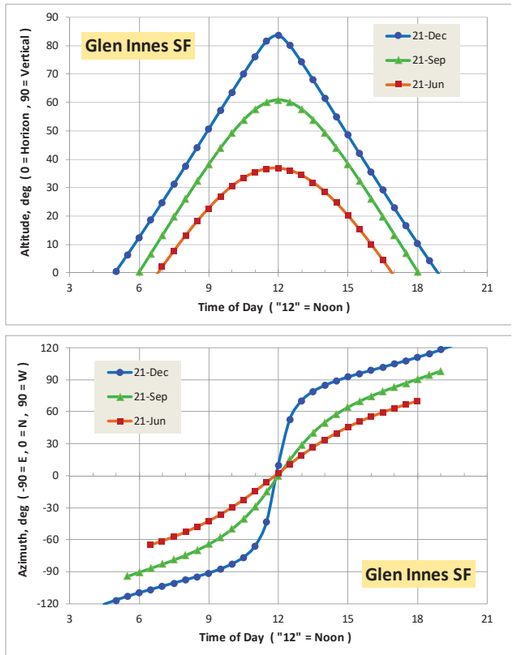


Figure 7 Project Site Solar Angle Variations

7.5.6 Project Site Panel Reflection Angles

The project will use single-axis tracking panels with a north-south axis of rotation). In "plan" view, reflections from the Project's panels will be directed as shown in **Figure 8** for a representative area of panels, with the direction of reflected rays shown for typical mid-summer days. As a result of the tracking motion of the solar panels throughout the day, reflections will generally be directed upwards and hence not visible by ground-based receivers at roughly the same elevation as the facility.

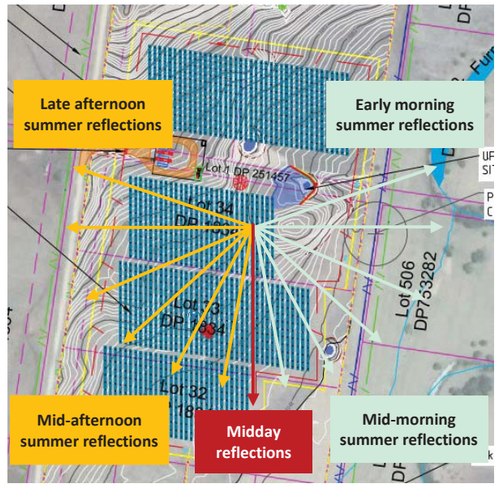


Figure 8 Potential Summer Reflection Angles

7.5.7 Solar Panel Reflectivity

Solar PV panels are designed to capture (absorb) the maximum possible amount of light within the layers below the front (external) surface. Consequently, solar PV panels minimise reflections which are a function of:

- the angle at which the light is incident onto the panel (which will vary depending on the specific location, time of day and day of the year), and
- the index of refraction of the panel surface and associated degree of diffuse (non-directional) versus specular (directional or mirror-like) reflection. Typical values of the refractive index "n" range from n = 2.0 (fresh, flaky snow) to n = 1.3 (standard solar glass).

Figure 9 shows the reflectivity off typical solar panel surfaces and the still surface of a lake as a function of incidence angle.

The reflectivity of the PV panels assumed in this study is the same as that shown for the standard solar glass shown in **Figure 9.**

- When an oncoming solar ray strikes the surface of a solar PV panel close to perpendicular to the panel surface (i.e. low "incident" angle), the reflectivity percentage is minimal (less than 5% for all solar panel surface types).
- It is only when an incoming solar ray strikes the panel at a large "incidence" angle, i.e. almost parallel to the panel, that reflectivity values increase. When this happens, reflections become noticeable and potentially at "glare" level for all solar panel surface types.
- However, for very high incidence angle, it would almost always be the case that the observer (motorist, train driver, pedestrian, etc) would perceive reflections coming from virtually the same direction as the incoming solar rays themselves. Such a condition would not constitute a glare situation as the intensity of the incoming solar ray itself would dominate the field of vision perceived by the observer.

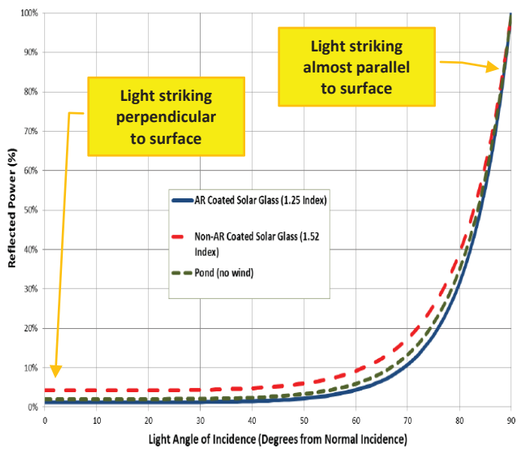


Figure 9 Typical Reflectivity v Incidence Angle

7.5.8 Operational Tracking Axis Configurations

Current single-axis tracking systems, as would be used for this project, are capable of operating in a number of different panel position modes. Possible options are shown in **Figure 10.**

- **"A": Fixed Tilt Mode:** in this mode, all panels are assumed to remain at a user-defined fixed angle all day long, eg horizontal, 15°East, 10°West, etc;
- **"B": Normal Tracking Mode:** in this mode, panels move between maximum tilt angles once the sun is above the relevant altitude angle (eg an altitude angle of 30° for ±60° single-axis trackers). They remain at the maximum tilt angles at all other times, switching over during the night;
- **"C": Normal Tracking Mode / Fixed Tilt Stowed:** in this mode, panels move during the day in "normal tracking": mode, but then move (instantaneously) to any user-defined fixed tilt angle at all other times, eg 0° (horizontal);
- **"D": "Real-World Back-Tracking":** in this mode, panels move during the day in "normal tracking": mode, but then gradually move to a horizontal position, thereby minimising shading of one panel array from adjacent arrays – the example shown is from an operating solar farm.

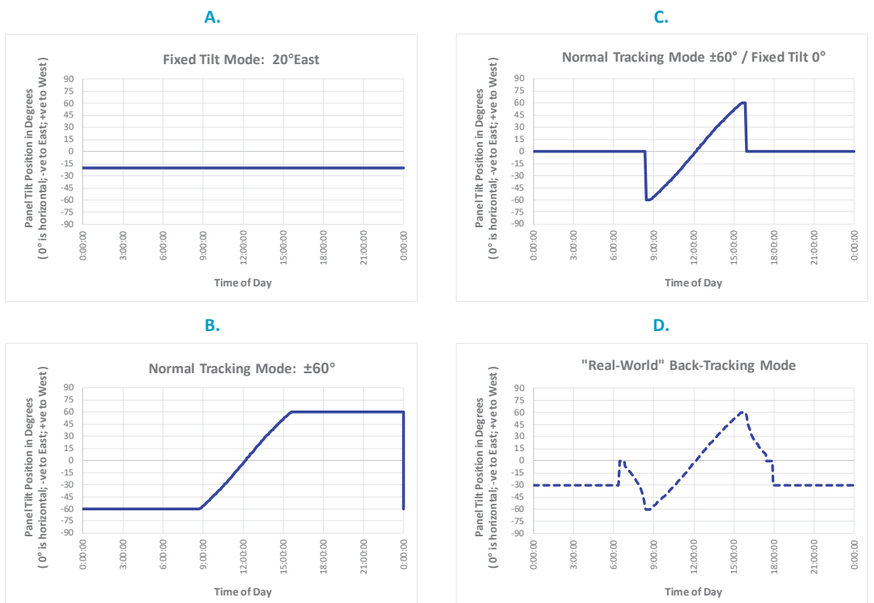


Figure 10 Single-Axis Tracking Mode Options

7.6 Glare Impact Assessment

7.6.1 Aviation Glint & Glare

As can be seen in **Figure 5**, the nearest airfield to the Project site is Glen Innes Aerodrome (more than 5km north-northwest of the site). Inverell and Inverell North Airports are 52km and 56km west-southwest of the site respectively.

Due to the distances involved (refer above) and the possible angles of reflections from the Project's solar PV panels (refer **Figure 8**) in relation to the pilot line of sight on landing approach in the case of Glen Innes Aerodrome, potential glare conditions for aircraft on any possible approach paths for all the nearest airports are deemed non-existent.

Helicopter flight paths can be highly variable and landing approach paths often vary in relation to an airfield's standard runway glide paths. However, again, due to the distances involved, potential glare conditions for any possible helicopter landing approach paths are deemed non-existent.

Accordingly, a quantitative analysis (eg using Sandia Labs SGHAT) is not deemed necessary to assess the potential for adverse and unacceptable glare (and glint) conditions.

7.6.2 Aerial Spraying / Crop Dusting

Given the surrounding agricultural land usage in the vicinity of the Project site, it is possible that aerial spraying might take place within several kilometres of the Project. There are no "standard" aircraft flight paths associated with such aviation activity.

SLR has previously undertaken quantitative analyses using the SGHAT software tool of such activities, for the following scenario:

- Assume potential flight paths whereby an aircraft is flying horizontally towards a Project site from any direction and at an elevation of 200 ft (60 m) above local ground level;
- Assume that the aircraft can get as close as 1 km to the nearest part of the Project's solar array; and
- Assume that solar panels track the sun during the day, tilting from 60 east to 60 west, about a horizontal axis oriented north-south.

When run for a full year of potential incoming solar angles at latitudes similar to the Project site (hence similar incoming solar angles), the resulting SGHAT Ocular Plots showed that the potential for aviation glare was negligible. This was primarily due to the low incidence angle of reflected rays (regardless of the time of the year) arising from the tilting action of the tracking systems.

7.6.3 Motorist Disability & Pedestrian Discomfort Glare

The "major" and "minor" thoroughfares in the immediate vicinity of the Project (refer **Figure 5**) are:

MAJOR (TI Values should be less than 10)

- Gwydir Highway – eastbound, westbound

MINOR (TI Values should be less than 20)

- Abbotts Road – northbound, southbound
- Tuttles Lane – northbound, southbound
- Wellingrove Road - northbound
- Martin Street - westbound

Important factors influencing the potential for traffic disability glare include:

- Any difference in elevation between the motorist and the solar panel array;
- Obstructions by intervening terrain, vegetation and topography; and
- The difference between the line of sight of a driver (i.e. in the direction of the road) and the line of sight relative to incoming reflections. Significant TI values can only occur when this difference is small. In some cases, such reflections become essentially non-visible to the motorist, eg east moving traffic on Martin Street.

TI calculations have been made for the roadways surrounding the Project site. The results, shown in **Table 6,** indicate the following:

- TI Values registered for all carriageways were zero at all times of the year for the "±60° Normal Tracking" mode, where reflections are directed upwards for all incoming solar angles, all year round.
- • Low TI Values are possible if the panels are left in a FIXED TILT mode both eastwards and westwards at a low angle to the horizontal – this applies to traffic moving both east and west along Gwydir Highway (especially east-moving traffic) and traffic moving northwards along Tuttles Lane.

In the FIXED TILT mode cases examined, the relevant Motorist Traffic Disability Glare criteria and Pedestrian Discomfort Glare criteria are satisfied, as a result of:

- The difference in the driver line of sight and the angle of incoming solar reflection

Table 6 Roadway TI Value Calculation Results

Roadway	TI Values	Comment
Gwydir Highway	Max 8	If panels left tilted slightly, east or west (highest values for east moving traffic)
Abbotts Road	**nil**	All year round
Tuttles Lane	Max 3	If panels left tilted slightly westwards
Wellingrove Road	**nil**	All year round
Martin Street	**nil**	All year round

7.6.4 Train Driver Disability Glare

Figure 5 shows the disused stretch of rail line that once ran between Armidale and Wallangarra via Glen Innes.

It is also noted that the corridor currently available to a future proposed East Coast High Speed Rail Link and the currently planned corridor for the Melbourne to Brisbane Inland Rail Line are nowhere near Glen Innes.

Accordingly, there is no potential for train driver glare for the proposed solar facility.

7.6.5 Industrial Critical Machinery Operators

There are no industrial operations in the vicinity of the Project (e.g. mining operations) and none planned (mining or otherwise), with the kind of machinery where the relevant operators have the potential to experience reflective glare from the Project, eg elevated cabins in draglines, etc.

7.6.6 Residential Nuisance Glare

The nearest residential receivers to the Project are identified in **Figure 5.**

- They surround the site at varying distances from the nearest respective site boundary.
- Their ground elevations reflect the gentle undulations of the surrounding topography, with small hillocks located around the site, eg just to the north. The terrain slopes upwards to the west, relevant to Gwydir Highway residences located west of the Project site.

There are no formal criteria governing residential reflective nuisance glare from solar facilities.

Accordingly, SLR has carried out TI Value calculations for the receivers discussed above, to gain an understanding of the potential for nuisance glare conditions from the project. The results are shown in **Table 7**.

Table 7 Residential TI Value Calculations Results

Receivers	TI Values	Comment
R1, R2	Up to ~2	If panels left tilted slightly westwards (near horizontal)
R3 to R9	**nil**	All year round
R10 to R14	Up to ~2	If panels left tilted slightly east
R15 to R16	Up to ~5	If panels left tilted slightly west

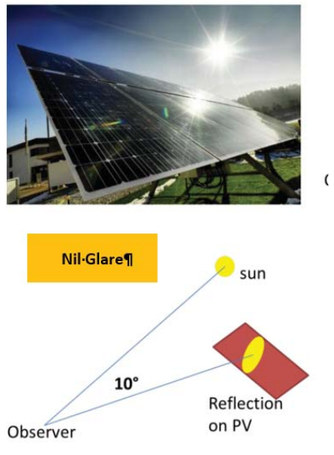


Figure 11 Nil Glare Condition for Residential Nuiscance Glare

The results indicate the following:

- For the standard operational "±60° Normal Tracking" mode, the TI Values were NIL at all receivers;
- For any modes involving panels being left in a near horizontal FIXED TILT mode eastwards or westwards, reflections will be potentially visible at residences to the east and west of the site, especially those to the west which are at a higher elevation than the solar array.
- For the most part, this would not constitute a glare condition because these reflections occur either early in the morning or late in the afternoon when visible reflections would be in the same line of sight as the solar rays (ie the sun) themselves - as is shown in **Figure 11**.

In the above analysis, no account was taken of the potential "shielding" benefit to surrounding residences from the trees lying between a property and the Project site.

To minimise the potential for visible reflections to occur at the site, it is recommended that solar panels be left with a slight eastwards tilt (say minimum 5°) when not in normal tracking mode (eg for maintenance).

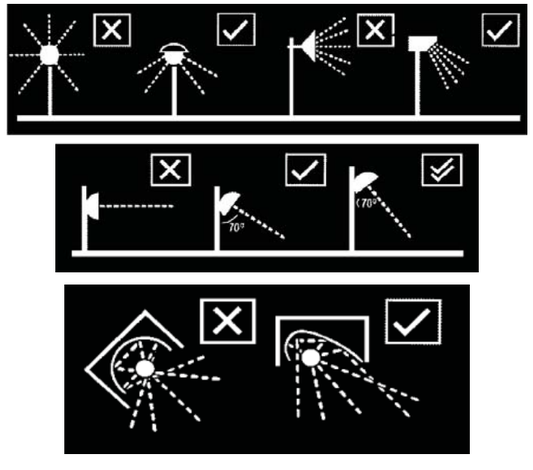


Figure 12 Luminance Design Features that Minimise Light Spill

7.6.7 Night-Time Illumination Glare

Although presently not fully defined, it is assumed that an area within the Glenn Innes Solar Farm Project site will be set aside for an Operation and Maintenance building, power conversion unit, fire access routes and egress, etc, and that some of these may need to be operational 24/7.

Although night-time illumination is not presently planned for the Project, it may be required in the future for some of the above relevant areas and, as such, is addressed in principle in this assessment.

The only potential for any future night-time illumination glare would be associated with the nearest thoroughfares and residential and other sensitive receivers to the Project.

Consideration has also been given to the potential for adverse eco-lighting impacts on nocturnal fauna habitats in close proximity to the Project site, especially within any close-by native vegetation areas. On the basis of the Flora and Fauna Assessment Report carried out for the Project, there are no such habitats close to the Project site.

The recommendations set out below are therefore made in the event that future 24/7 lighting is incorporated into the Project, to achieve the best lighting performance (taking into account safety considerations) while having a minimal impact on the surrounding properties, carriageways and nocturnal fauna.

In terms of any future potential night-time lighting, the adopted goal of limiting night-time light spill to no more than 1 lux falling on the nearby residential facades during curfew hours will be easily achieved given the distances to the nearest residential and other receivers.

Accordingly, the potential for any future nuisance glare will be non-existent.

AS4282-1997 Control of the Obtrusive Effect of Outdoor Lighting sets out general principles that should be applied when designing outdoor light to minimise any adverse effect of the light installation.

- Direct lights downward as much as possible and use luminaires that are designed to minimise light spill, e.g. full cut-off luminaires where no light is emitted above the horizontal plane, ideally keeping the main beam angle less than 70°.
- Less spill-light means that more of the light output can be used to illuminate the area and a lower power output can be used, with corresponding energy consumption benefits, but without reducing the illuminance of the area – refer **Figure 12**.
- Do not waste energy and increase light pollution by over-lighting.
- Wherever possible use floodlights with asymmetric beams that permit the front glazing to be kept at or near parallel to the surface being lit.

7.7 Glare Assessment Conclusion

7.7.1 Aviation-Related Potential Glare

There will be nil impact from the Project in relation to aviation-related glare.

7.7.2 Motorist "Traffic Disability" Glare

Primarily due to the selection of the single-axis tracking system for the mounting of the ground-based array panels and line of sight of drivers relative to the solar array, solar reflections from the proposed facility will comply with National criteria for road traffic disability glare.

7.7.3 Rail Traffic "Disability" Glare

There is no potential for rail traffic disability glare at the site.

7.7.4 Residential Nuisance Glare

Reflections from the proposed facility may be visible at surrounding residences, especially those located to the west of the site which are at higher elevations than the Project site.

Although the TI Values calculated for this occurrence are minimal and would not be considered to constitute a glare condition, a recommendation has been made to minimise this occurrence:

If panels need to be left in a horizontal or near horizontal position when not in normal tracking mode (eg for maintenance), it is recommended that panels be left with an eastwards tilt of at least 5°.

7.7.5 Night-Time Illumination Glare

Although presently not incorporated into the Project, consideration has been given to the future potential for night-time lighting related to equipment and/ or buildings, fire access routes and egress, etc.

Recommendations have been made to ensure that the potential for any future possible night-time illumination glare will be non-existent.

8. LANDSCAPE CONCEPT

8.1 LANDSCAPE PLAN

LEGEND

Existing trees

3-4m wide buffer with shrub planting (native species) outside of security fence and within the lease boundary

PLANTING SCHEDULE

SHRUBS			
SPECIES	COMMON NAME	APPROX. HEIGHT	POT SIZE
Acacia decora	Western Silver Wattle	Up to4m	150mm
Dodeonaea viscosa	Stocky Hop Bush	Up to 4m	150mm
Lomandra longifolia	Mat Rush	1m	50mm
Notelaea microcarpa	Velvet mock olive	Up to 2m	50mm



0 10 20 30 50 100m

SCALE 1:2500 @ A3

ASIA PACIFIC OFFICES

BRISBANE

Level 2, 15 Astor Terrace

Spring Hill QLD 4000

Australia

T: +61 7 3858 4800

F: +61 7 3858 4801

CANBERRA

GPO 410

Canberra ACT 2600

Australia

T: +61 2 6287 0800

F: +61 2 9427 8200

DARWIN

Unit 5, 21 Parap Road

Parap NT 0820

Australia

T: +61 8 8998 0100

F: +61 8 9370 0101

GOLD COAST

Level 2, 194 Varsity Parade

Varsity Lakes QLD 4227

Australia

M: +61 438 763 516

MACKAY

21 River Street

Mackay QLD 4740

Australia

T: +61 7 3181 3300

MELBOURNE

Level 11, 176 Wellington Parade

East Melbourne VIC 3002

Australia

T: +61 3 9249 9400

F: +61 3 9249 9499

NEWCASTLE

10 Kings Road

New Lambton NSW 2305

Australia

T: +61 2 4037 3200

F: +61 2 4037 3201

PERTH

Ground Floor, 503 Murray Street

Perth WA 6000

Australia

T: +61 8 9422 5900

F: +61 8 9422 5901

TOWNSVILLE SOUTH

12 Cannan Street

South Townsville QLD 4810

Australia

T: +61 7 4722 8000

F: +61 7 4722 8001

WOLLONGONG

Level 1, The Central Building

UoW Innovation Campus

North Wollongong NSW 2500

Australia

T: +61 2 4249 1000

AUCKLAND

Level 4, 12 O'Connell Street

Auckland 1010

New Zealand

T: 0800 757 695

NELSON

6/A Cambridge Street

Richmond, Nelson 7020

New Zealand

T: +64 274 898 628

WASTE MANAGEMENT PLAN

Establishment of Solar PV Power Generation Plant

208 West Furracabad Road, Glen Innes NSW 2370

PREPARED FOR PROVIDENCE ASSET GROUP | DECEMBER 2020

SLR

KDC

This page has been left blank intentionally

Address: Tuttles Lane (208 West Furracabad Road), Glen Innes NSW 2370

Proposal: Establishment of Solar PV Power Generation Plant

OBJECTIVES FOR THE WASTE MANAGEMENT ON THIS SITE

- To minimise resource requirements and construction waste through reuse and recycling; and the efficient selection and ordering of resources.
- To ensure the waste management systems are compatible with the relevant waste collection services.

The management of waste is addressed in this WMP in the following sections, according to the stages of the development:

- Site preparation and construction; and
- Ongoing operation.

1 SITE PREPERATION AND CONSTRUCTION STAGE

Construction waste will be separated on site by builder's contractors and builder's laborer's during the construction stage.

The site manager will erect a sign on site for waste areas and will inform the builder's staff where material is to be collected for recyclingand will set aside on site an area to store the recyclable materials for transportation to local recycling plants. The site manager and/or builder will impose the execution of the waste separation policy on a regular basis and to have on-going checks.

Stockpiles shall be located and managed appropriately to prevent sediment runoff and ensure minimal environmental impact from the building site.

A suitable all-weather vehicular access points shall be provided for the construction phase, and all sediment and erosion control devices implemented on site prior to commencement of construction works.

Type of waste generated	Estimates Volume in m^3 or area m^2 or weight in tonne (t)	Reuse and Recycling		Disposal
		On-Site	Off-Site	
Excavated Material	<10m^3	Possible reuse of soil onsite.	Un-recyclable excavated material to be disposed at local waste facility.	
Metal (Ferrous) Eg. Steel	3t		Sent to local metal recycler by contractor.	
Metal (Non-ferrous) Eg. Aluminium	<1t		Sent to local metal recycler by contractor.	
Packaging (Wood) Eg. Pallets, dunnage	39.5t		Reuse by logistics contactor. Broken directed to recycler.	
Packaging (Other) (Plastic, cardboard etc)	4.8t		Cardboard/paper sent to recycler by contractor.	Disposed of at local waste facility by contractor
Green Waste	<8t		Directed for green waste reuse by local recycler.	
Other waste e.g. pvc plastics, paint, paper / cardboard	<2t	-		Disposed of at local waste facility by contractor

2 OPERATION STAGE

Staff will separate general waste and recyclables within the waste storage / management area. A minimum of two separate bins (general and recycle bins) will be located within the waste area. Waste and recycling bins will be clearly labelled and identifiable. The bins and waste storages areas will be cleaned by staff with protective gloves as required.

Type of waste generated	Estimated Volume per week	Reuse and Recycling		Disposal
		On-Site	Off-Site	
Food and General Waste	20L			Disposed of at local landfill by waste contractor on an as needs basis
Recyclable Waste	20L			Disposed of at local recycle plant by waste contractor on an as needs basis
Green Waste	20L			Disposed of at local recycle plant by waste contractor on an as needs basis

WASTE MANAGEMENT PLAN

Establishment of Solar PV Power Generation Plant

208 West Furracabad Road, Glen Innes NSW 2370

PREPARED FOR PROVIDENCE ASSET GROUP | DECEMBER 2020

SLR

KDC

This page has been left blank intentionally

Address: Tuttles Lane (208 West Furracabad Road), Glen Innes NSW 2370

Proposal: Establishment of Solar PV Power Generation Plant

OBJECTIVES FOR THE WASTE MANAGEMENT ON THIS SITE

- To minimise resource requirements and construction waste through reuse and recycling; and the efficient selection and ordering of resources.
- To ensure the waste management systems are compatible with the relevant waste collection services.

The management of waste is addressed in this WMP in the following sections, according to the stages of the development:

- Site preparation and construction; and
- Ongoing operation.

1 SITE PREPERATION AND CONSTRUCTION STAGE

Construction waste will be separated on site by builder's contractors and builder's laborer's during the construction stage.

The site manager will erect a sign on site for waste areas and will inform the builder's staff where material is to be collected for recyclingand will set aside on site an area to store the recyclable materials for transportation to local recycling plants. The site manager and/or builder will impose the execution of the waste separation policy on a regular basis and to have on-going checks.

Stockpiles shall be located and managed appropriately to prevent sediment runoff and ensure minimal environmental impact from the building site.

A suitable all-weather vehicular access points shall be provided for the construction phase, and all sediment and erosion control devices implemented on site prior to commencement of construction works.

Type of waste generated	Estimates Volume in m^3 or area m^2 or weight in tonne (t)	Reuse and Recycling		Disposal
		On-Site	Off-Site	
Excavated Material	<10m^3	Possible reuse of soil onsite.	Un-recyclable excavated material to be disposed at local waste facility.	
Metal (Ferrous) Eg. Steel	3t		Sent to local metal recycler by contractor.	
Metal (Non-ferrous) Eg. Aluminium	<1t		Sent to local metal recycler by contractor.	
Packaging (Wood) Eg. Pallets, dunnage	39.5t		Reuse by logistics contactor. Broken directed to recycler.	
Packaging (Other) (Plastic, cardboard etc)	4.8t		Cardboard/paper sent to recycler by contractor.	Disposed of at local waste facility by contractor
Green Waste	<8t		Directed for green waste reuse by local recycler.	
Other waste e.g. pvc plastics, paint, paper / cardboard	<2t	-		Disposed of at local waste facility by contractor

2 OPERATION STAGE

Staff will separate general waste and recyclables within the waste storage / management area. A minimum of two separate bins (general and recycle bins) will be located within the waste area. Waste and recycling bins will be clearly labelled and identifiable. The bins and waste storages areas will be cleaned by staff with protective gloves as required.

Type of waste generated	Estimated Volume per week	Reuse and Recycling		Disposal
		On-Site	Off-Site	
Food and General Waste	20L			Disposed of at local landfill by waste contractor on an as needs basis
Recyclable Waste	20L			Disposed of at local recycle plant by waste contractor on an as needs basis
Green Waste	20L			Disposed of at local recycle plant by waste contractor on an as needs basis