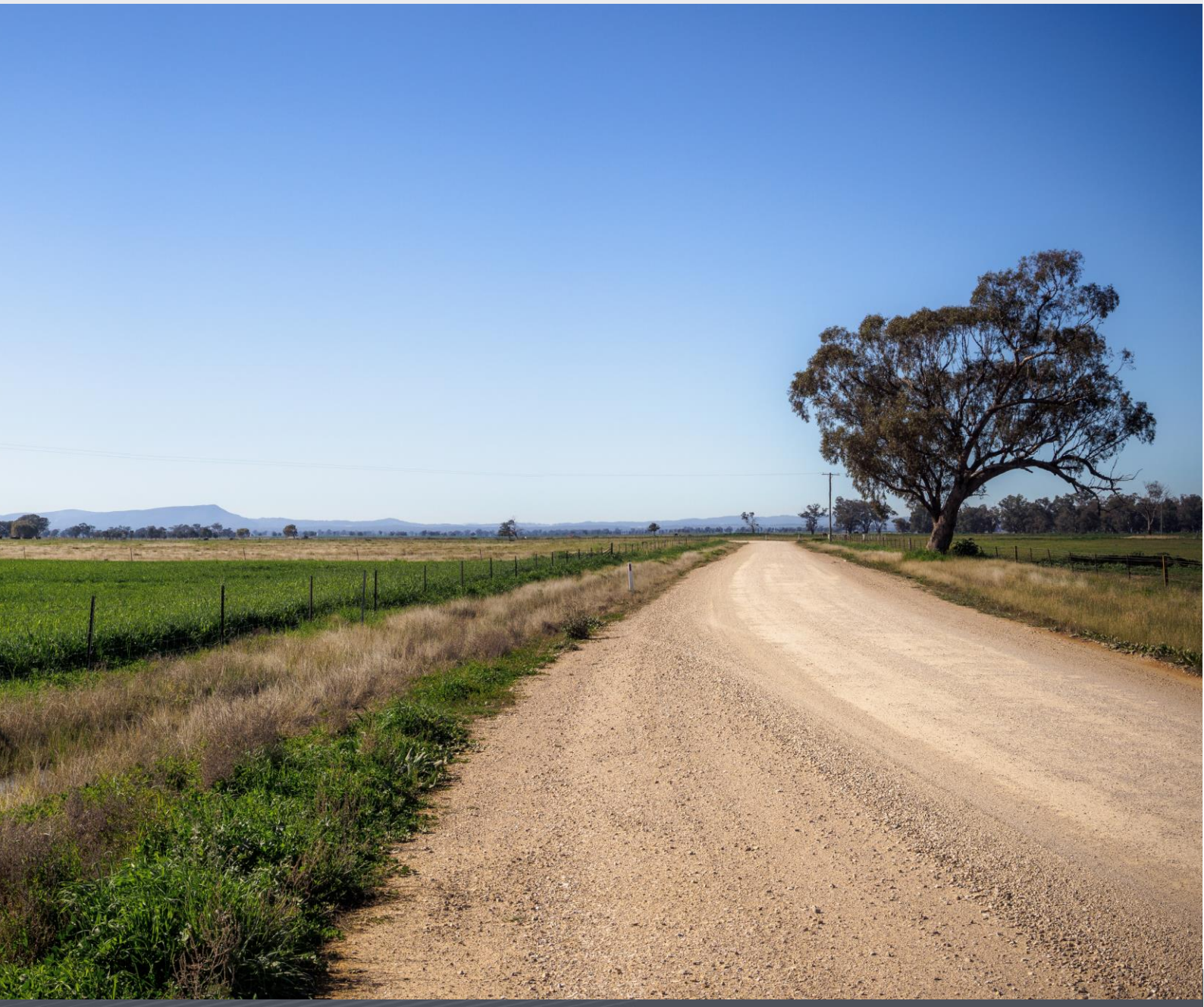
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Landscape and Visual Impact Assessment

Daroobalgie Solar Farm

Prepared for Pacific Hydro Australia Developments Pty Ltd
28 February 2022

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Executive Summary

This Landscape and Visual Impact Assessment (LVIA) has been prepared by SMEC Australia Pty Ltd on behalf of Pacific Hydro Australia Developments Pty Ltd. The LVIA will support a planning application to NSW Department of Planning, Industry and Environment (DPIE) for the Daroobalgie Solar Farm, located in central western New South Wales and consisting of a solar farm site, electricity transmission line (ETL) and switchyard site (the project).

The purpose of this report is to assess the potential landscape and visual impacts which may arise as a result of the project.

The landscape and visual baseline

This assessment examines the existing landscape and visual conditions of the area surrounding the project (both physical and statutory) to establish a baseline against which potential impacts of the project can be assessed.

A zone of theoretical visual influence (ZTVI) analysis was undertaken for the project to understand the potential extent of visibility of the solar farm site and associated infrastructure and to inform the definition of the study area.

The study area has been defined as all land within a radius of 10 km from the location of the solar farm site. This area captures the majority of the ZTVI mapping and is considered the zone in which the project may be observable, based upon their physical characteristics.

Relevant planning policies and legislation including the Forbes Local Environmental Plan (LEP) have been reviewed to understand any specific landscape or visual designations relating to the study area. This has been combined with a desktop study and field assessment to understand the various physical elements that combine to create the landscape and visual character. There are no specific planning controls or designations attributing any specific landscape or visual value within the study area.

The baseline assessment identified a total of three distinct landscape character types (LCTs) within the study area, including:

- Agricultural plains (LCT 1)
- Floodplain (LCT 2)
- Forbes-Newell Highway industrial corridor (LCT 3).

These identified LCTs formed the basis of the landscape impact assessment, with potential landscape impacts arising from the project assessed upon each of these LCTs.

Landscape impact assessment findings

Direct landscape impacts relate to impacts upon landscape character which may occur upon LCTs as a direct result of the presence of the project within an area of a specific landscape character. The potential for direct impacts upon landscape character is restricted to LCT 1. The expected landscape impacts upon this LCT are minor. These impacts can be mitigated through the provision of landscaping screening in appropriate locations around the perimeter of the main solar farm site and/or switchyard.

Whilst the presence of the project is a considerable change in character within a relatively restricted area of LCT 1, its presence is not expected to result in a fundamental change in landscape character as the defining characteristics of landscape (flat topography, pastures, remnant vegetation along watercourses and scattered native trees) will remain intact. Moreover, LCT 1 covers a broad extent of the landscape, and the project will occupy a relatively small proportion of the overall extent of the character type, thereby limiting the extent of influence the project exerts upon the broader LCT area.

Indirect landscape impacts relate to potential impacts which may occur upon LCTs which are adjacent to the project. As these landscape types fall outside of the project there is no potential for loss or removal of landscape elements such as trees or existing landform. Therefore, indirect impacts result when a project located within a given LCT indirectly affects the perceptions of adjacent LCT's. This is sometimes termed 'borrowed character'.

Indirect landscape impacts as a result from the project, upon LCT2 (floodplain), are expected to be negligible-minor due to the influence of intervening vegetation and the relatively small proportion of the overall field of view that the project will occupy.

Views towards the project experienced from within LCT3 (Forbes-New Highway industrial corridor), are typically limited by the inwardly focused visual nature of these locations (with views out typically restricted by intervening built form, topography and vegetation); the distance at which these locations are located from the project, and the influence of intervening vegetation screening views from the industrial estate, large lot residences and motorists towards the project.

Therefore, a negligible-minor impact is expected on the landscape character of LCT 3.

Visual impact assessment findings

Anticipated visual impacts, as a result from the project, have been assessed from 10 representative public viewpoints.

The landscape character of the study area (i.e. LCT 1) typically results in a commensurately uniform set of viewing conditions across the study area, with only minor variations occurring as a result of localised vegetative conditions. This, coupled with very little variation in the type of visual receptors whom will experience views from the majority of the study area (predominately local residents and agricultural workers), means that the major defining factor in the level of visual impact expected from individual representative viewpoints is the proximity of a particular viewpoint to the project.

Accordingly, the greatest levels of impact are expected from viewpoints in close proximity to the project, where the solar farm site will occupy the greatest proportion of the horizontal field of view, and where the PV cells themselves will form clearly discernible elements within a given view. These findings are reinforced by the assessment of representative public viewpoints in close proximity to the project, including:

- Viewpoint 4, at Troubalgie Road on the edge of the project (minor to moderate impacts).

The potential for visual impacts lessens with distance from the project, with the other public viewpoints assessed as only having negligible to minor potential impacts. From these viewpoints, the solar farm site typically appears as smaller element within the view and therefore exerts less influence upon the existing visual character. There is also an increased likelihood of intervening vegetation or topography screening direct views towards the solar farm site from these locations further away.

Whether or not these impacts are perceived as being adverse, positive, or neutral is considered to be subjective and influenced by the unique perspectives of individual receptors.

Cumulative impact assessment findings

Cumulative impacts have been assessed at both a local and regional scale. Given the relative isolation of the project relative to the nearest approved and operational solar farms, it is considered that regional scale cumulative impacts will be negligible. The spatial separation of a minimum of 25 km between this project and other proposed or operational solar farms within the broader region is considered to offer sufficient interval from sequential viewing within the wider landscape to eliminate any risk of regional scale cumulative.

Glare analysis findings

Glare analysis has been assessed upon visual receptors located at approximate 500 m intervals along adjacent roads to the east and west of the solar farm site, and key locations such as the Newell Highway, livestock exchange centre and residential dwellings. A software program specialising in glare analysis (ForgeSolar) was used to calculate glare results.

The assessment indicated that, for the assessed viewpoints, there is nil glare or glint experienced at any time throughout the year. These quantitative results are reinforced by the following physical factors:

- Reflectivity associated with photovoltaic cells is typically less than commonly found objects typical in rural landscapes and within the surrounding area (e.g. motor vehicles, steel roofing, water)
- In order for glare-related impacts to be experienced, a direct line of sight to the PV cells would be required. Vegetative screening is currently in place between the proposed solar farm site and receptors, except for along Troubalgie Road and Forest Road to the west of the site. This existing screening limits the availability of views and by extension limits the potential for glare-related impacts to be experienced from ground level by receptors

- The proposed use of a tracking system means that for the most part, the angle of reflection from the PV cells at the solar farm site will be relatively close to perpendicular to the surface of the cell itself. At times when the tracking system has reached the limit of its range of movement and the angle of incidence shifts away from the perpendicular (i.e. at sunrise and sunset) the light is expected to be reflected up and away from the ground. It is therefore assumed that, relative to ground level, light will typically be reflected up and away from the ground at or near to a minimum of 30° relative to the horizontal, and away from visual receptors on the ground.

Whilst not explicitly assessed within this report, the above findings are expected to be consistent for the other visual receptors within the project environs.

Potential for impact mitigation

The scale of the PV cells at the solar farm site (up to four metres in height)), means that on-site mitigation (i.e. within the boundary of the solar farm site itself) can be employed to effectively mitigate landscape and visual impacts upon the surrounding landscape and associated receptors. Strategic vegetative planting can be employed to screen views towards the project and therefore reduce visual impacts experienced by nearby receptors.

On-site solar farm site mitigation, if or as required, should focus upon screening the PV cells as well as elements such as the substation and ancillary buildings. Continuous buffer planting along the boundary of the project adjacent to sensitive receptors is considered an adequate measure to screen any potential visual impacts such as the PV cells from an external view. Additionally, ancillary buildings should, wherever possible, be constructed in an architectural style which reflects the overriding character of the rural landscape.

Notwithstanding this, it should be noted that the landscape and visual impacts prior to any mitigation being employed range from negligible to minor/moderate.

In the case of the representative Viewpoint 4 with an impact rating of minor to moderate impacts, it has been identified that the most significant visual impact is when viewed from locations along Troubalgie Road where the project is in close proximity to the boundary and where there is inconsistent existing vegetation of a sufficient scale to screen or fragment views. In addition, ancillary buildings and ETL infrastructure located on the north-western corner of the solar farm site are also considered the most significant visual impact when viewed from the locations along Troubalgie Road to the west towards its' intersection with Forest Road and Back Yamma Road, as well as residences located in close proximity to the road intersections.

It is recommended that a band of screen planting of shrubs two to four metres high with understorey native grasses generally along the site boundary to screen the PV arrays and associated infrastructure in locations between security fencing and boundary where there is no existing vegetation and where the arrays are immediately adjacent to viewpoints in the public domain. It is also recommended that additional tree planting in groups of two to three at random spacing of 15-20 m in north west corner of the site to fragment views to the ancillary buildings, switchyard, substation and ETL infrastructure should be adequate to mitigate against potential visual impact.

It should be noted that viewpoints from private property have not been assessed within this report, rather representative public viewpoints, considered indicative of the views that may be experienced from the immediate surrounding area, have been assessed in their place. Therefore, consultation with landowners will be required to determine the extent to which any off-site mitigation may be appropriate.

Night-time lighting assessment findings

The project will not incorporate permanent night lighting, therefore will not result in potential visual impacts to neighbouring properties. The only lighting proposed are security lighting and minimal lighting are proposed in each inverter station and substation and switchyard for maintenance purposes. This lighting would be managed and operated in accordance with *AS4228-1997 - Control of Obtrusive Effects of Outdoor Lighting* to ensure negligible light spill to the adjoining residences.

Terms and Definitions

Term	Meaning
electricity transmission line	A new 132 kilovolt transmission line approximately 8.5 kilometre long from the solar farm site to the switchyard site. Support structures are likely to be monopole structures 25-30 metre high
solar farm site	The solar farm site is approximately 300 hectares on land legally described as Lot 77 in Deposited Plan 750183
study area	Defined as the land within a radius of 10 kilometre surrounding the solar farm site
switchyard site	The 132 kilovolt switchyard site will connect the project to the existing TransGrid Transmission Line. It is expected to occupy a footprint of 90 metre long x 55 metre wide. Its tallest components are the landing gantries which will be approximately 12 to14 metre high
The project	The project is defined as the solar farm site, the electricity transmission line and switchyard site

Abbreviations and Acronyms

Term	Meaning
BESS	Battery energy storage system
DSF	Daroobalgie solar farm
ETL	Electricity transmission line
kV	Kilovolt
LCT	Landscape character type
LVIA	Landscape and visual impact assessment
MW	Megawatts
NSW	New South Wales
O&M	Operation and maintenance
PV	Photovoltaic
ZTVI	Zone of theoretical visual influence

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1 Introduction

1.1 Project description

The Daroobalgie Solar Farm (the project) comprises a solar farm site (consisting of approximately 420,000 solar photovoltaic (PV) panels and associated infrastructure), an electricity transmission line (ETL) and switchyard site The project will connect to an existing 132 kV powerline west of Newell Highway. The project will have an estimated capacity of approximately 100 megawatts (MW) and will provide enough electricity to power up to the equivalent of 34,000 homes each year.

1.1.1 Site and surrounds

The project is in the Forbes Shire Council Local Government Area (LGA) of central western New South Wales.

The proposed solar farm site is located approximately 11km northeast of Forbes. The site is approximately 300 hectares (ha) on land legally described as Lot 77 in Deposited Plan 750183. The solar farm site will be accessed via Troubalgie Road to the north of the proposed site.

The topography of the proposed solar farm site is generally uniform with an average elevation of 240 metres (m) above the Australian Height Datum (AHD). The land is largely cleared, having been highly modified by past disturbances associated with land clearing, cropping, and livestock grazing. A number of dams are present on the site and a natural watercourse runs to the east of the property boundary, intersecting the site in the southeast corner. Small ephemeral waterholes, known locally as gilgai, are present in some paddocks, predominately in the south eastern section of the site. These have been progressively ploughed and levelled by farming activities over time.

The surrounding land use is predominately agricultural, and the Forbes Central West Livestock Exchange is located on Back Yamma Road, 2.5 kilometre (km) to the west of the site. Back Yamma State Forest is situated seven kilometres to the east at an elevation of 340 m AHD, and the closest National Park is Goobang National Park, 30 km to the northeast. The Lachlan River runs approximately 3.5 km from the southern boundary of the site.

There are no residential dwellings within the proposed solar farm site, the nearest dwelling is located approximately 600 m to the northwest of the western boundary. There are eight existing dwellings within three kilometres of the solar farm site. The Newell Highway runs north-south, 5.5 km to the west of the proposed site.

The ETL connects the solar farm site to the switchyard site located near the existing Forbes-Parkes 132 Kilovolts (kV) transmission line. The ETL is approximately 8.5 km long and traverses a number of private properties and road reserves.

The switchyard site is located approximately 5.5 km north of Forbes on Lot 14 in Deposited Plan 750158. The switchyard site is adjacent to the existing Forbes-Parkes 132 kV transmission line located approximately 500 m west of the Newell Highway. It will be accessed from Daroobalgie Road. There are several residential dwellings near the switchyard site, the nearest dwelling is located approximately 255m to the north of the northern boundary.

The project and its relative location to Sydney and other regional areas in NSW is shown in Figure 1. An indicative layout of the solar farm site is shown in Figure 2. Figure 3 shows the solar farm site, ETL easement and switchyard site.

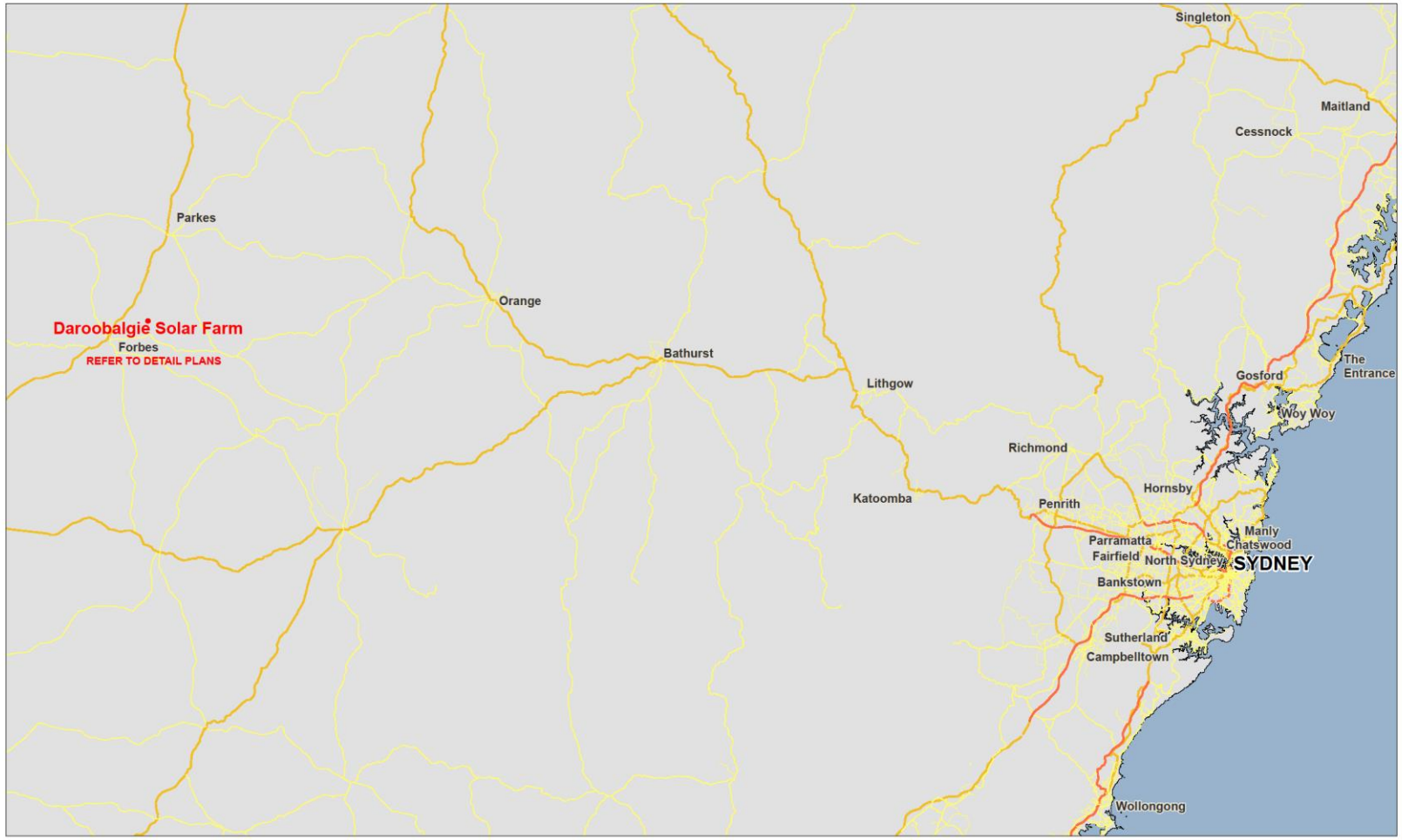


Figure 1 The project and its location to Sydney and other major towns in NSW

1.1.2 Project infrastructure

Proposed project infrastructure will comprise:

- A network of PV solar panel arrays and Power Conversion Units (PCUs) (DC-AC inverters)
- Battery energy storage system (BESS) with embedded storage of approximately 40 MW/160 megawatt-hour (MWh)
- Electrical collection systems, substation and control room
- Temporary construction compound
- Operations and Maintenance (O&M) facility, including demountable offices, amenities, equipment sheds, storage and parking areas
- Internal access roads
- Perimeter security fencing
- An approximate 8.5 km long, 132 kV transmission line
- A 132 kV switchyard to connect to TransGrid infrastructure.

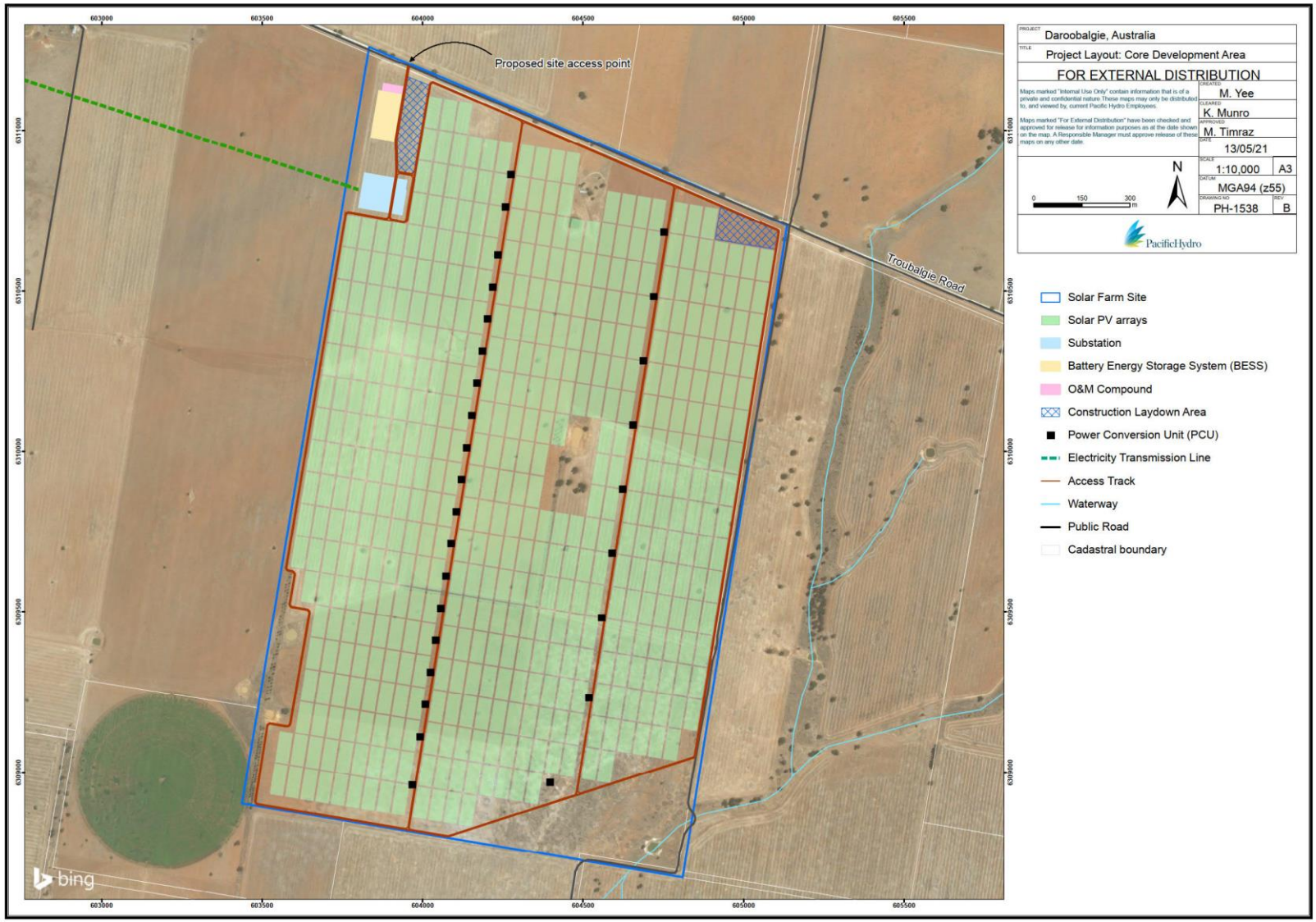


Figure 2 The proposed solar farm site

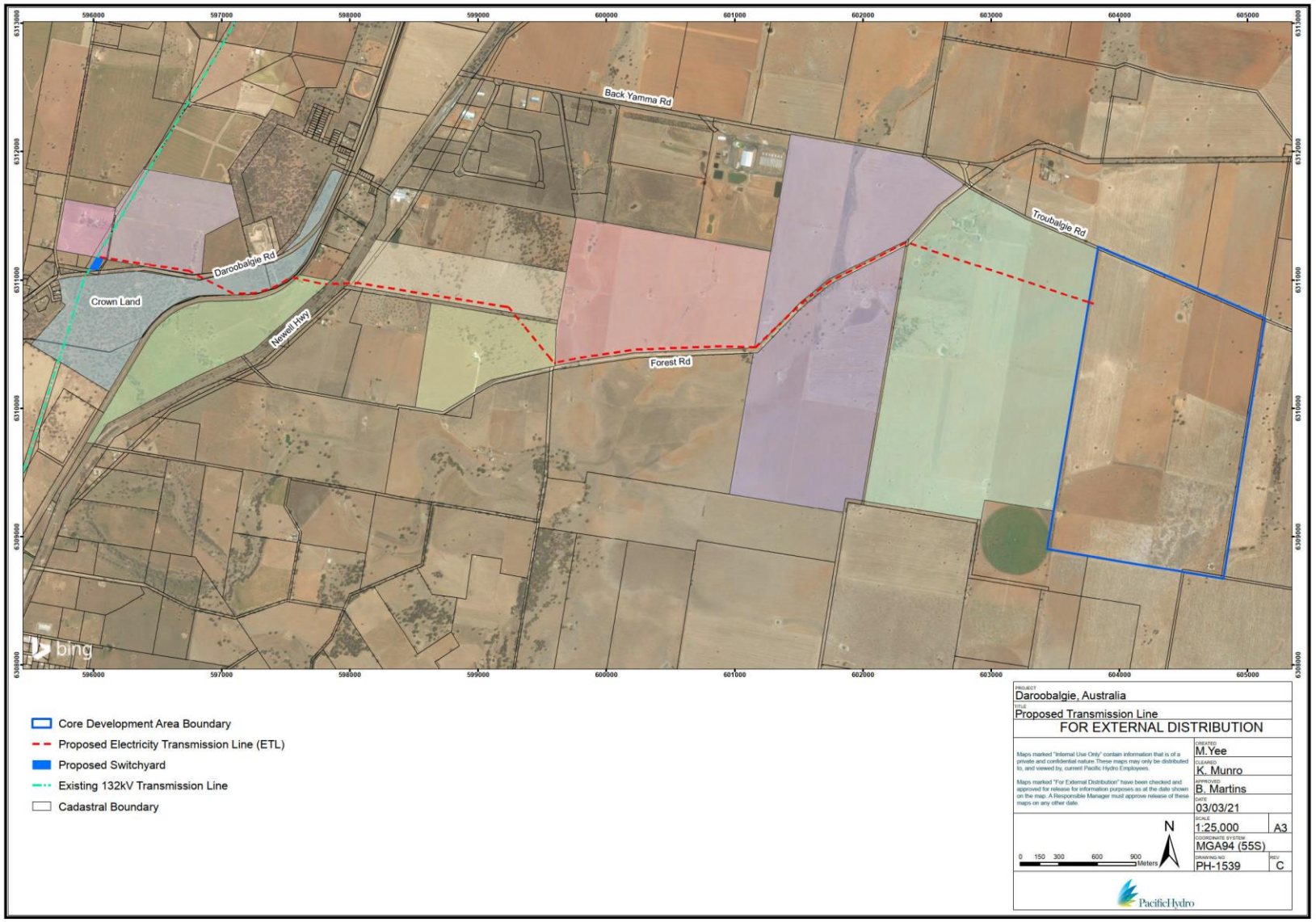


Figure 3 The proposed solar farm site, ETL easement and switchyard site

1.1.3 Indicative project configuration

Table 1 below summarises the physical component configurations for the project

Solar farm site configuration		
Land allocated to PV cells and access tracks (approximately)	265 ha	
Temporary Site Office and Lay Down Area (approximately)	3.4 ha	
Substation with battery storage area, plus Operations and Maintenance facility footprint (approximately)	5.7 ha	
Tallest components within solar farm site (approximately)	Landing gantries (12-14 m)	
Total area	300 ha	
Solar farm site photovoltaic modules		
Type	Crystalline silicon	
Length (approximately)	2.256 m	
Width(approximately)	1.133 m	
Top surface	Anti-reflective coating	
Quantity	Approximately 420,000	
Solar farm site trackers		
Type	Fixed-tilt or Horizontal single-axis	
Maximum rotation angle	±60°	
Typical tracker height	1.4-2.0 m	Dependent on hydrology – modules to stay above 1% AEP flood level (300 mm)
Maximum module height	Up to 4 m	Dependent on hydrology – modules to stay above 1% AEP flood level (300 mm)
Electricity transmission line easement		
Length (approximately)	8,500 km	
Width (approximately)	45 m	
Switchyard site configuration		
132kV switchyard site (approximately)	0.5 ha	
Tallest components within switchyard site (approximately)	Landing gantries (12-14 m)	
Total switchyard site area (approximately)	16.09 ha	

Table 1 Summary of the project and major components at the solar farm and switchyard site

1.1.4 Physical dimensions and arrangement of solar panels

The panel module proposed and used as the basis of the glint and glare analysis is 72 cell crystalline silicon module with anti-reflective coating. Dimensions for individual PV cells are provided in Figure 4. The actual module may differ following equipment procurement, selection of a construction partner and as detailed design progresses.

In order to maximise electricity production, it is also understood that the PV cells will be installed on a single tracking system that rotates about a north-south aligned axis to follow the sun +/-60° from the horizontal, with the aim being to have the panels oriented as close to perpendicular to the incoming sun as is possible.

These tracking systems will be arranged in rows running in a north-south direction, covering a total area of approximately 265 ha. Further details on the PV cell and associated tracking system dimensions are provided within Figure 4.

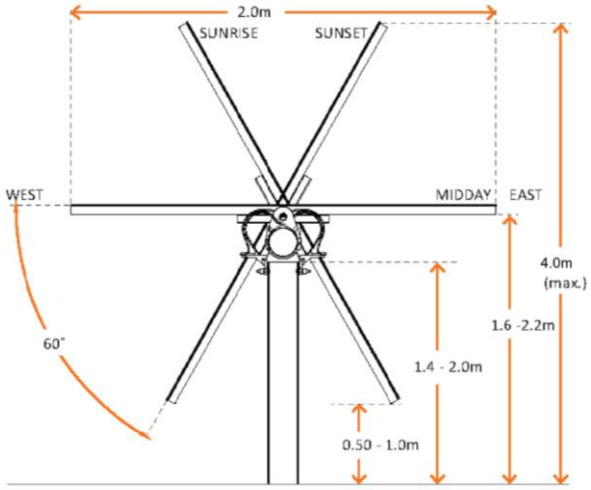


Figure 4 Photovoltaic cell design on tracking system

1.2 Planning secretary's environmental assessment requirements

Project Secretary's Environmental Assessment Requirements (SEARs) were issued on 19 December 2019. The SEARs relating to landscape and visual assessment are shown below in Table 2.

Table 2 SEARs – Landscape and visual assessment

Requirement	Where addressed in this report
Including an assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners.	This LVIA has undertaken an assessment of the likely visual impacts (Section 8) associated with the proposed solar farm and associated ancillary infrastructure, as well as assessment of potential impacts resulting from glare, reflectivity and night lighting (Section 10 & 11) This report also includes a draft landscape mitigation plan.

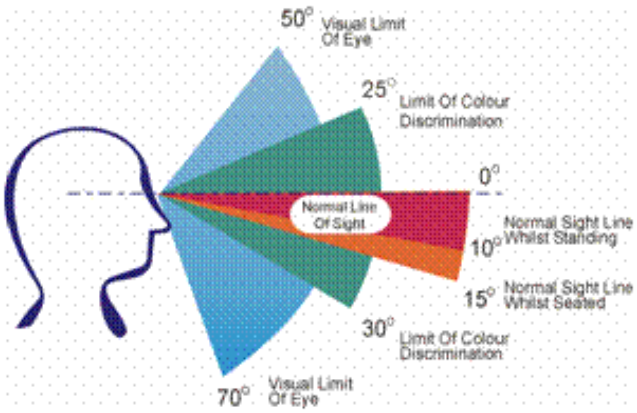
Note that consultation with landowners was not undertaken to inform this LVIA; however, consultation with landowners, including disseminating the results of this LVIA was undertaken by the proponent, Pacific Hydro, prior to lodgement of the EIS.

2 Zone of Theoretical Visual Influence

2.1 Viewshed determination

The extent of the LVIA assessment is determined by the distance at which it is considered that the project will become either indiscernible to the human eye, or will occupy such a small proportion of the visual field of view that impacts could be considered negligible. This distance is directly related to the size of the project and the viewing properties of the typical human eye.

Figure to the right illustrates the typical vertical field of view properties of the human eye. When standing, the human eye can discern detail within a typical 10° vertical field of view.



Typical vertical field of view of the human eye (Image source: Panero & Zelnik)

The study area for this LVIA assessment has been defined as the point at which a component of the project occupies less than 5% of the vertical field of view of the human eye. For the purpose of assessing visual impacts, the Zone of Theoretical Visual Influence (ZTVI) has been identified for each component of the project, being the solar farm site, ETL and switch yard site and is shown in Figure 5 and Figure 6 below.

Within the ZTVI mapping, publicly accessible areas have been identified as near sensitive receptors, representing worst-case viewpoints. Given that the relatively flat topography of the immediate area surrounding the project would not conceal views of the project, a broader geographical extent has been included to understand landscape character in a broader sense and to assess potential landscape impacts.

The study area has therefore been defined as the land within a radius of 10 km surrounding the solar farm site (refer to Figure 5 and Figure 6). This area captures the majority of the ZTVI mapping and includes the town of Forbes and also Ashburnham Road which is the highest elevation within the vicinity of the project and therefore more likely to capture views of the project. The Zone of Theoretical Visual Influence study does not take into account the screening effect that existing vegetation or built form may have. These errors will be rectified on field visits with digital photographs taken at the site.

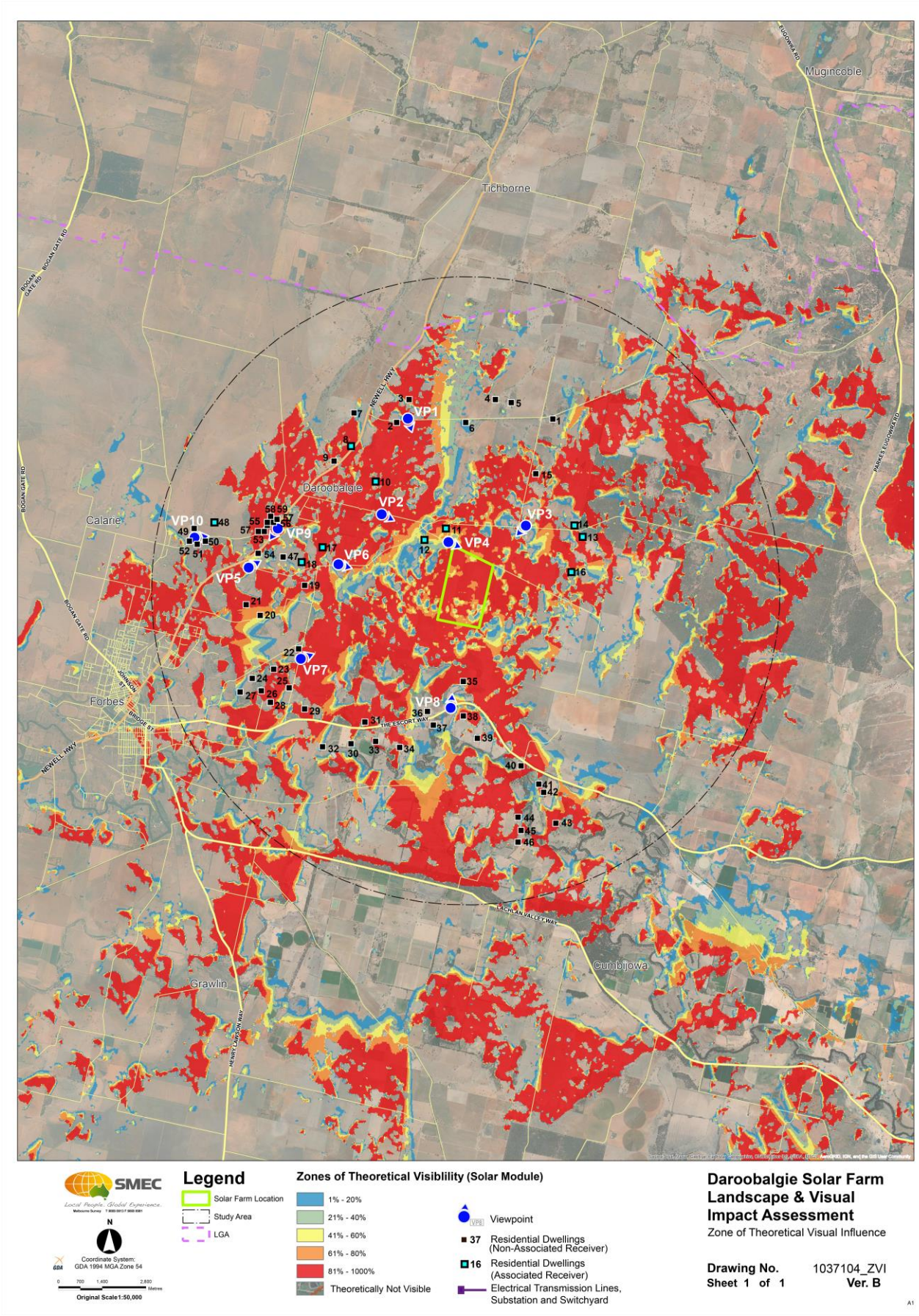


Figure 5 ZTVI (Solar farm site only)

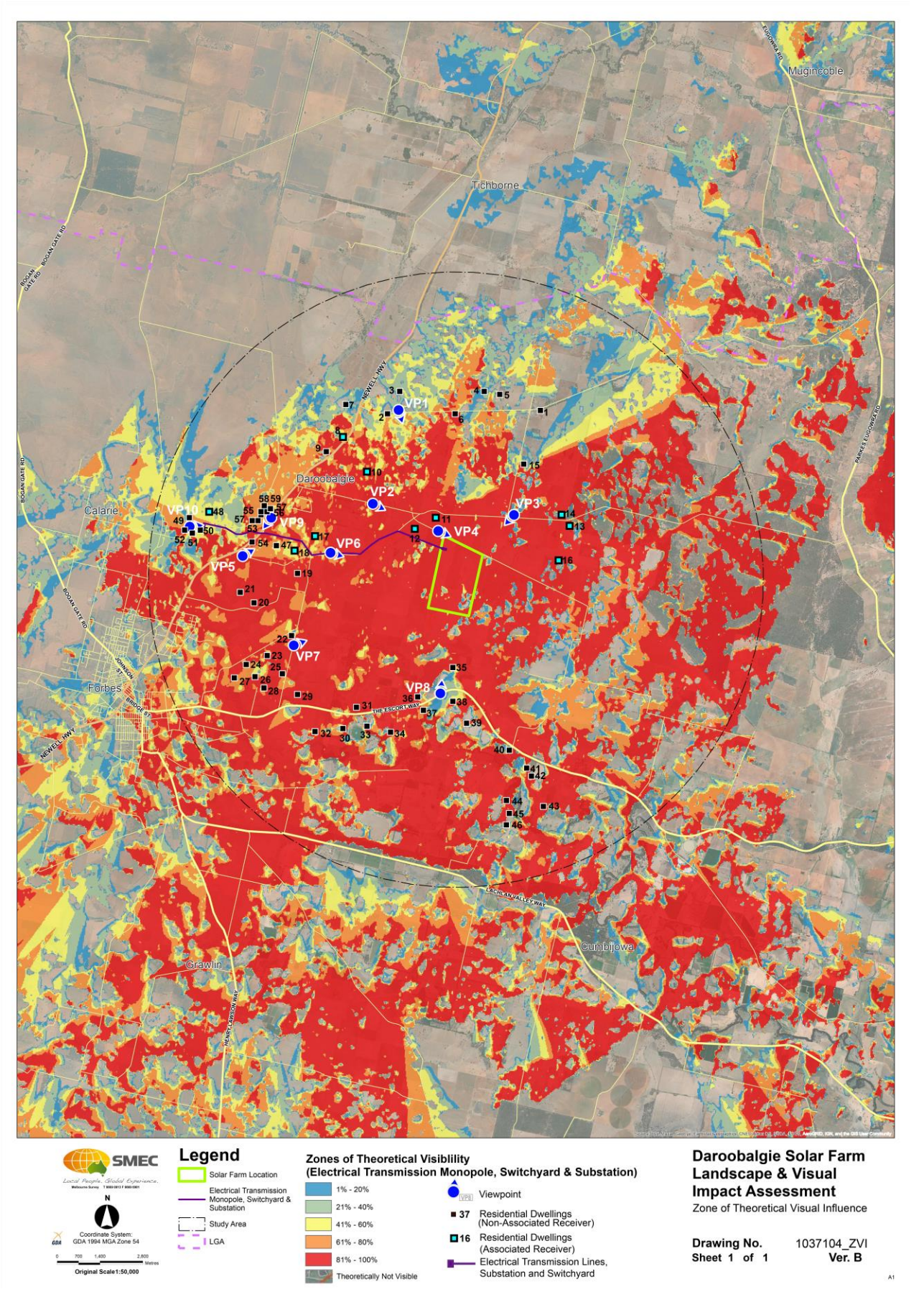


Figure 6 ZTVI (Solar farm site, ETL easement and switchyard site site)

3 Legislation, Planning and Policy

3.1 Legislation, planning and policy context

This section summarises the key planning designations, policies and guidance relating to landscape and visual amenity within the study area at the Federal, State and Local level.

The emphasis of this assessment is to identify elements outlined within legislation, policy and planning documents relevant to the landscape and visual character and identity of the study area. Accordingly, this section describes key designations and issues noted in policy that are directly relevant to landscape and visual amenity values as well as those that are considered to be indirectly relevant to landscape and visual amenity to a significant degree. Although many of the designations and policies do not strictly relate to maintaining and enhancing landscape character and visual amenity, their intentions potentially influence and affect the landscape and visual resources within the study area. The relevant designations, policies and guidelines are discussed below.

The discussion of relevance to the current assessment considers the following key issues:

- Whether the purpose of the designation is related to the protection/management of landscape and/or visual values
- Whether the project has the potential to directly or indirectly affect the identified landscape/visual values.

Depending on the nature of the specific values, the extent of this influence may be affected by factors such as proximity, the presence of intervening landform that may restrict visibility, levels of use etc. It is noted that whether a designation falls inside or outside of the study area is not of primary relevance to the consideration of potential for landscape/visual impacts since the visibility of project components may extend beyond this boundary; hence the establishment of a distinct study area as described previously.

3.2 Federal legislation

There is no Federal legislation relevant to the landscape and visual assessment for the project.

3.3 State legislation and policies

3.3.1 NSW Renewable Energy Action Plan

The NSW Renewable Energy Action Plan (2013) outlines 24 actions under 3 goals that detail the government's intention to work closely with NSW communities and the renewable energy industry to increase renewable energy generation in the state at the least cost to the consumer.

The Plan outlines the intent to advance NSW's renewable energy sector by using existing technologies to modernise the current NSW energy system and to advance within the National Electricity Market. The expectation to increase renewable energy capacity is based on delivering a more resilient system through our abundant natural resources and creating a skilled workforce.

The strategic actions within the Plan focus on how renewable energy generation targets will be met and the processes in which the market will grow to meet these targets.

The Plan does not include any input or strategic advice which relates to the visual assessment for this project.

3.3.2 NSW Electricity Infrastructure Investment Act 2020

*The NSW Electricity Infrastructure Investment Act 2020 (*The Act*)* is an Act to co-ordinate investment in new generation, storage and network infrastructure in New South Wales. The objects of the Act are to:

- Improve the affordability, reliability, security and sustainability of electricity supply
- Co-ordinate investment in new generation, storage, network and related infrastructure
- Encourage investment in new generation, storage, network and related infrastructure by reducing risk for investors
- Foster local community support for investment in new generation, storage, network and related infrastructure
- Support economic development and manufacturing
- Create employment, including employment for Aboriginal and Torres Strait Islander people

- Invest in education and training
- Promote local industry, manufacturing and jobs
- Promote export opportunities for generation, storage and network technology.

The Act enables the NSW Electricity Infrastructure Roadmap (2020).

3.3.3 NSW Electricity Infrastructure Roadmap

In 2020, the NSW Government released its updated NSW Electricity Infrastructure Roadmap. The Roadmap provides a coordinated framework to deliver a modern electricity system for NSW and transition the NSW electricity sector into one that is cheaper, cleaner and more reliable. Together, the Act and Roadmap commit the NSW Government to:

- Declaring five Renewable Energy Zones (REZs) in the Central West Orana, Illawarra, New England, South West and Hunter-Central Coast regions. These Zones will deliver an intended network capacity of 12 gigawatts
- Establishing an Electricity Infrastructure Investment Safeguard to deliver new generation, long duration storage and firming capacity. A Consumer Trustee will be appointed to run competitive processes to offer Long Term Energy Service Agreements while protecting the interests of NSW consumers
- Establishing an Electricity Infrastructure Jobs Advocate and NSW Renewable Energy Sector Board to ensure the use of locally manufactured and supplied goods and services, and maximise the engagement of suitably qualified local workers
- Establishing a Transmission Development Scheme that will de-risk REZ investment.

The project is not currently within a REZ; however, it is nearby to the indicative location of the Central West Orana REZ.

3.3.4 Central West and Orana Regional Plan 2036

The Central West and Orana Regional Plan 2036 is the NSW Government's strategy for guiding land use planning decisions for the region for the next 20 years.

Under Direction 9: Increase renewable energy generation, the action plan includes:

- Identify locations with renewable energy generation potential and access to the electricity network
- Facilitate small-scale renewable energy projects using bioenergy, solar, wind, small-scale hydro, geothermal or other innovative storage technologies through local environment plans
- Promote best practice community engagement and maximise community benefits from all utility-scale renewable energy projects.

The Plan does not include any input or strategic advice which relates to the visual assessment for this project.

3.4 Local Environmental Plan

The project falls entirely within the local government area (LGA) of the Forbes Shire Council. The study area also includes land which falls under the jurisdiction of the adjoining LGA of Parkes Shire Council.

The planning zones covering the project are shown in Figure 7. The full policies, zoning designations and overlays referred to herein are available within the relevant Planning Scheme of each LGA.

3.4.1 Forbes Local Environmental Plan 2013

The project is located within the Forbes LGA and is subject to the provisions of *Forbes Local Environmental Plan 2013 (LEP)*. The aims of the Forbes LEP are to:

a) Encourage and manage ecologically sustainable development in Forbes
b) Reinforce the existing urban character of Forbes as the urban focus
c) Reinforce the rural character of Forbes while promoting sustainable development
d) Protect the agricultural land of Forbes for continued agricultural production while allowing for planned expansion at the urban fringe
e) Promote Forbes as a premier tourist-destination building on its unique heritage and environmental attributes as well as sporting and leisure facilities

f) Protect, enhance and conserve the natural environment, including the Lachlan River, Lake Forbes, wetlands, native vegetation, environmentally sensitive land and other natural features that provide habitat for fauna and flora, provide scenic amenity and that may prevent or mitigate land degradation

g) Provide a range and variety of housing choices to cater for the different needs and lifestyles of residents.

The solar farm site and switchyard site are located on land zoned RU1 - Primary Production under the *Forbes Local Environmental Plan 2013 (LEP).* Objectives of zone RU1 are to:

- Encourage sustainable primary industry production by maintaining and enhancing the natural resource base
- Encourage diversity in primary industry enterprises and systems appropriate for the area
- Minimise the fragmentation and alienation of resource lands
- Minimise conflict between land uses within this zone and land uses within adjoining zones
- Provide opportunities for intensive and extensive agriculture in appropriate locations consistent with the environmental capability of the land.

  The ETL traverses land zoned RU1 – Primary Production, IN1 – General Industrial, SP2 – Infrastructure (Newell Highway and Stockinbingal -Parkes railway crossing) and Crown Land (travelling stock route).

3.4.2 Forbes Community Strategic Plan

The Forbes Community Strategic Plan (CEP) *(2018-2028)* seeks to provide a statement of vision, long term goals and community priorities which will guide the future transformation of the region. The Plan has been developed based on six key directions. These include

- Community and Culture;
- Local Economy;
- Natural Environment;
- Rural and Urban Landuse;
- Infrastructure and Services;
- Government and Representation.

One of the Strategies outlined under Natural Environment is as follows:

- NE7 - Identify and develop appropriate sustainable energy supply options, such as wind and solar power generation.

One of the Strategies outlined under Rural and Urban Landuse is as follows:

- RU1 - Ensure that strategic land use planning for the Shire acknowledges the importance of our rural character and agricultural activities.

There are no specific references to the landscape and visual values of the subject site and study area except for the above strategies.

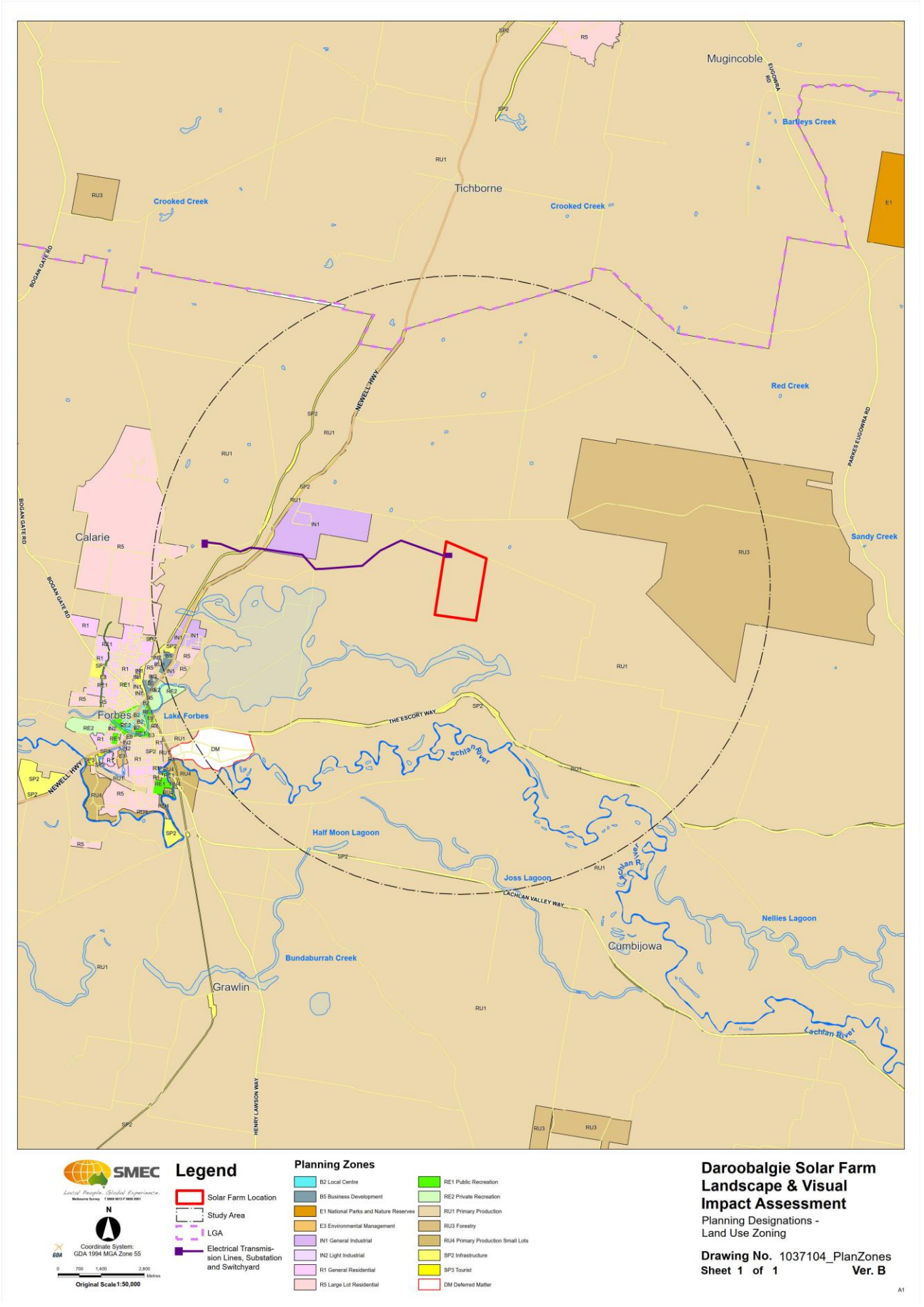


Figure 7 Planning Designations – Land Use Zoning

4 Existing Landscape and Visual Landscape and Character

4.1 Regional landscape context

The project is located in the Forbes LGA within the rural area of Daroobalgie. Regionally, Daroobalgie is associated with the Central West Region of NSW. The project is located in an area that traditionally is rich farmland used for grazing and crop-growing. The ETL connects the solar farm site to the switchyard site near the existing Forbes-Parkes 132 kV transmission line. The ETL is approximately 8.5 km long and traverses a number of private properties and road reserves.

The switchyard site is located approximately 5.5 km north of Forbes on Lot 14 in Deposited Plan 750158. The switchyard site is adjacent to the existing Forbes-Parkes 132 kV transmission line located approximately 500m west of the Newell Highway. It will be accessed from Daroobalgie Road.

4.2 Study area landscape context

4.2.1 Landform (refer to Figure 8)

The topography of the area surrounding the project is flat to a gently undulating land form consistent with Central West NSW landscapes. The elevation of the plain rises gently from the south to the north, ranging from approximately 280 m AHD in the north of the study area to approximately 240 m AHD in the south.

Long range views from the site to the east provide the scenic back drop of Mt Coonambro (650 m AHD). Bald Hills to the west rises to 305 m AHD.

4.2.2 Hydrology (refer to Figure 8)

The Lachlan River is the main river located near the project, with its nearest point 3.4 km to the south of the proposed solar farm site. The river is situated south of The Escort Way.

Lake Forbes is a body of water that branches off the Lachlan River and meanders through Forbes and feeds into a large body of semi-wet low-lying floodplains and wetlands northeast of the town.

A number of dams are present on the solar farm site and within the area surrounding the project. A watercourse traverses through the southeast corner of the proposed solar farm site. Small ephemeral waterholes, known locally as *Gilgai*, are present in some paddocks. These have been progressively ploughed and levelled by farming activities over time.

4.2.3 Land use (refer to Figure 7)

Land use surrounding the project is typically farming land with large rural residential properties. The proposed solar farm site and switchyard site are predominantly cleared farming land with stands of scattered trees, consistent with its history as a working rural property. The ETL traverses a number of private properties and road reserves.

The commercial centre of the town of Forbes, is situated approximately 11 km to the southwest of the solar farm site. The town of Parkes is located 22 km north and Eugowra village is about 30 km to the southwest of the project.

Forbes is the only town present within the study area. With the population of 8,432 [2016 census], Forbes is a major urban centre positioned on the Newell Highway halfway between Melbourne and Brisbane.

Prominent transport corridors of the region include:

- The Stockinbingal–Parkes railway line is a goods line that travels from Stockinbingal to Parkes
- The Newell Highway is the prominent feature in the landscape however visual connectivity is limited due the extent of vegetation and warehouses between the site and the highway

Daroobalgie (7.5 km north of Forbes), is classed as a locality and has a few residential properties at the Daroobalgie Road and Newell Highway intersection. Other land use in the locality include the Forbes Waste Depot, Go Kart track, motocross track and several large-scale warehouses and the Forbes Central West Livestock Exchange. Disused abattoir and meat freezing works buildings beside the Stockinbingal–Parkes railway line reflects Daroobalgie's historical meat production (abattoir, freezing works, boiling down works) industries.

Back Yamma State Forest covers an area of about 4,400 ha and is located to the northeast of the study area. The state forest has been used for single track and fire trail riding, country mountain bike racing and camping.

4.2.4 Vegetation (refer to Figure 9)

The landscape typical of the region is predominately cleared, open grazing land with scattered groupings of remnant native trees. Retained vegetation is also common along water courses, roadsides and along the perimeters of paddocks and property boundaries. Land surrounding the site has been predominantly cleared for rural paddocks and associated residential use, with some native and exotic vegetation plantings associated with the residential lots.

Remnant vegetation throughout the area is derived from a community of Floodplain Transition Woodlands and Riverine Plain Grasslands. Refer Ecological Vegetation Classes map on Figure 9 (Source: Central West/Lachlan Region State Vegetation Type Map, Datasets SEED NSW).

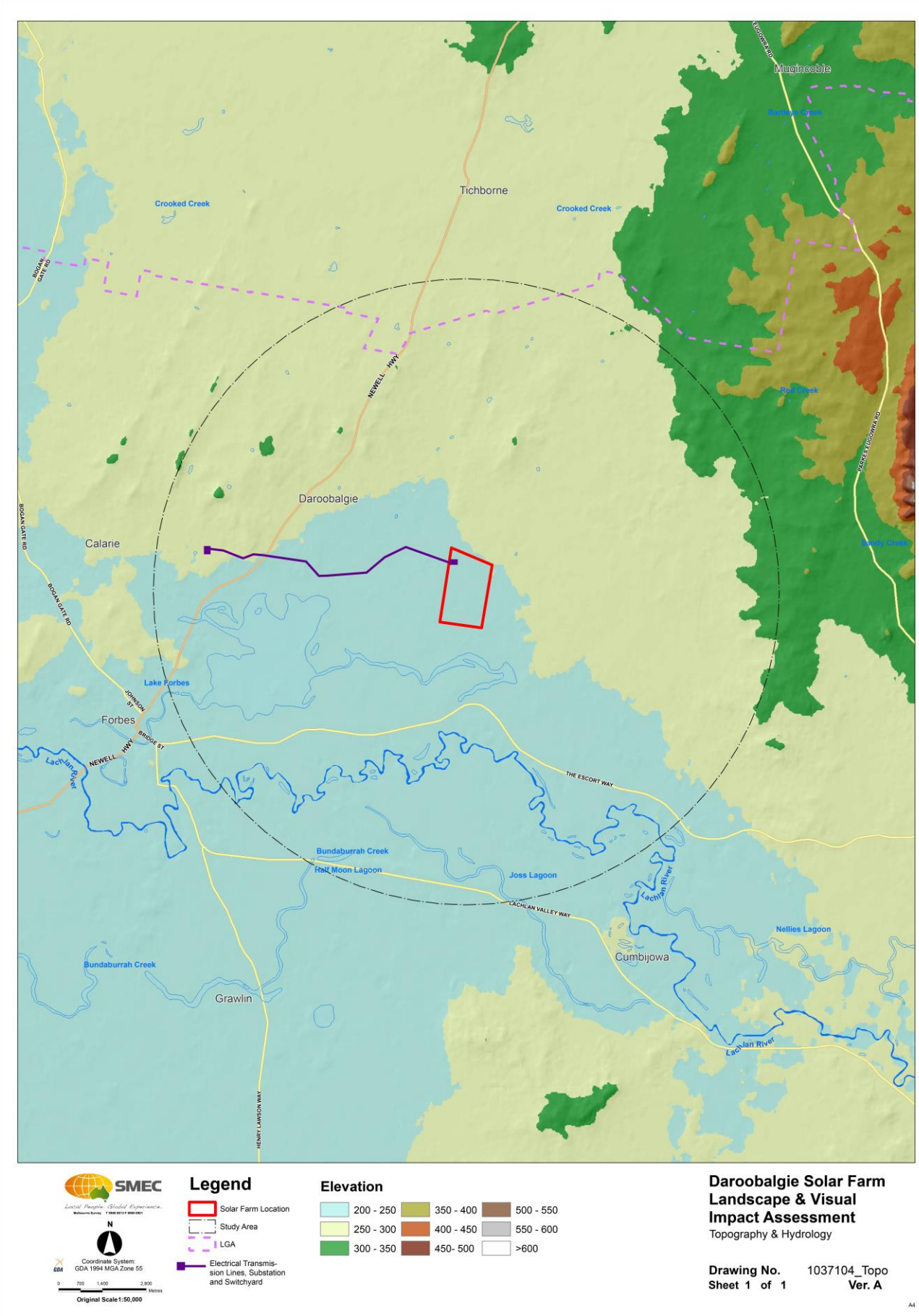


Figure 8 Topography & Hydrology

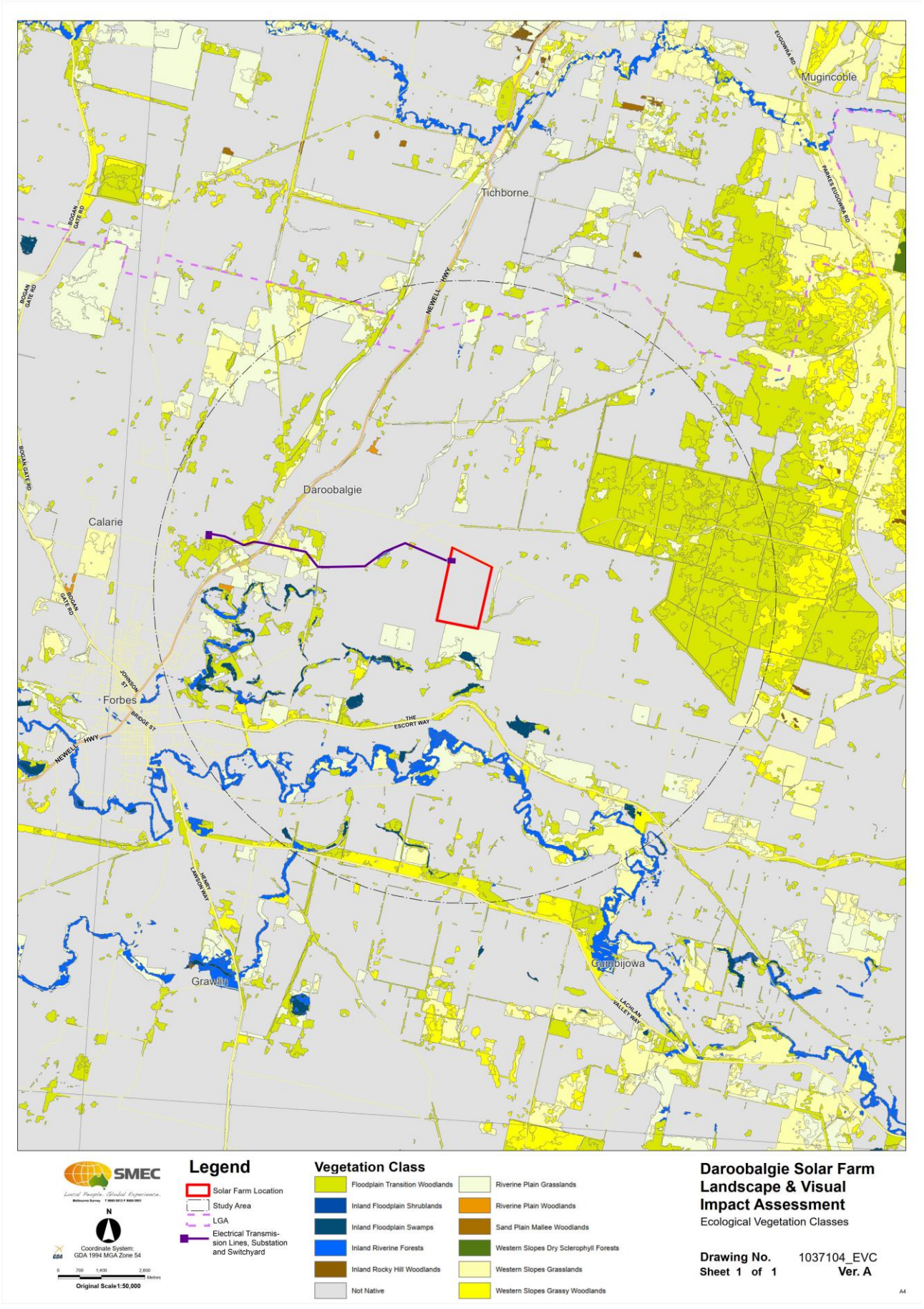


Figure 9 Ecological Vegetation Classes

5 Landscape and Visual Impact Assessment Methodology

The potential landscape and visual impacts associated with the project have been assessed in the following ways:

- Landscape impacts are assessed against each of the identified Landscape Character Types (LCTs) (refer Section 6 and 7, and the characteristics considered as being of central importance to the overriding character of each. These characteristics have been identified based upon an assessment of existing legislation and planning policy (refer Section 2), as well as site work
- Visual impacts are assessed from a series of representative public viewpoints. These viewpoints, and the rationale behind their selection, are outlined within Section 8.

Impacts have been assessed during the operational phase of the project only. The impact assessment has been undertaken based upon the anticipated conditions approximately seven to 10 years post-construction.

5.1 Sensitivity and magnitude of change

The landscape and visual impact assessment methodology is explained in detail within Appendix A. Broadly summarised, it involves the assessment of two key factors, sensitivity and magnitude of change.

5.1.1 Sensitivity

5.1.1.1 Landscape sensitivity

The sensitivity of a landscape is judged based on the extent to which it is considered able to absorb change of a particular type and scale without adverse effects on its character. Sensitivity varies according to the type of development and the nature of the landscape, including:

- Its inherent landscape value (its condition, perceptual qualities, cultural importance, and any specific values that may apply, such as landscape planning designations)
- The likely congruency of the proposed change (i.e., the extent to which the proposal may fit or be 'visually absorbed' into the scale, landform, land use, pattern, texture of the existing landscape).

5.1.1.2 Visual sensitivity

The sensitivity of the viewers at the viewpoints is considered to be dependent upon factors including:

- The importance (scenic quality) of the view
- Viewer exposure, typically assessed by measuring the number of viewers exposed to the resource change and the type and duration of viewer activity
- The nature of the visual receptor (type and volume of sensitive receptors or viewers) experiencing the view
- Landscape and visual sensitivity are described as being negligible, low, medium, or high, and are applied as outlined within Table 26 (Landscape Impacts) and Table 27 (Visual Impacts) of Appendix A.

Landscape and visual sensitivity ratings associated with the project are outlined within section 7 & 8.

5.1.1.3 Magnitude of change

The magnitude of change affecting a landscape or visual receptor depends on the nature, scale and duration of the particular change that is expected to occur. It describes the extent of change and identifies elements which are removed or added, changed in colour or texture, and the compatibility of new elements with the existing landscape. Visual modification can result in an improvement or reduction in visual amenity.

Magnitude of change is described as being barely perceptible, noticeable, considerable or dominant, and is applied as outlined within Table 26 (Landscape Impacts) and Table 27 (Visual Impacts) of Appendix A.

The magnitude of change associated with both landscape and visual changes expected to result from this project are outlined within Section 6.

5.2 Determination of impact significance

The impact significance ratings have been determined through a combination of the sensitivity and magnitude of change assessments, in accordance with the scale defined within Table 26 (Landscape Impacts) and Table 27 (Visual Impacts) of Appendix A. Using the rationale outlined within these tables, a judgement is made regarding the significance of the impact.

Both landscape and visual impacts are rated as *major, moderate, minor* or *negligible*, and can be adverse (negative), beneficial (positive), or neutral (subjective). There is often a gradual transition between levels of significance, and where impacts lie on the borderline they may be described, for example, as *minor to moderate*.

Impacts which are graded as being *moderate* to *major* are those which should be given greatest consideration, relative to other levels of landscape and visual impacts, in decision making. *Minor* to *moderate* levels of impact are of progressively reducing importance, but nonetheless important.

The landscape and visual impact significance ratings associated with the project are outlined within Section 6.

6 Landscape Character Types

Based upon the assessment of the natural and cultural influences that shape the landscape and visual context of the study area, a number of Landscape Character Types (LCTs) have been identified.

Each LCT represents a relatively homogenous character based on the consideration of the following attributes:

- Landscape value (e.g., landscapes designated for their scenic or landscape importance or valued recreational function)
- Landscape elements that contribute to defining character e.g., pasture, crops, drainage channels, river/creek corridors, bushland, mature bushland corridors alongside roads, cultural plantings (e.g., planting along property entrance drives) etc.
- Landscape character attributes (including scale, fine-grained and perceptual characteristics such as the sense of remoteness, tranquillity and/or its perceived rural character).

The LCTs are defined in *Figure 10* and detailed descriptions and impact assessments follow.

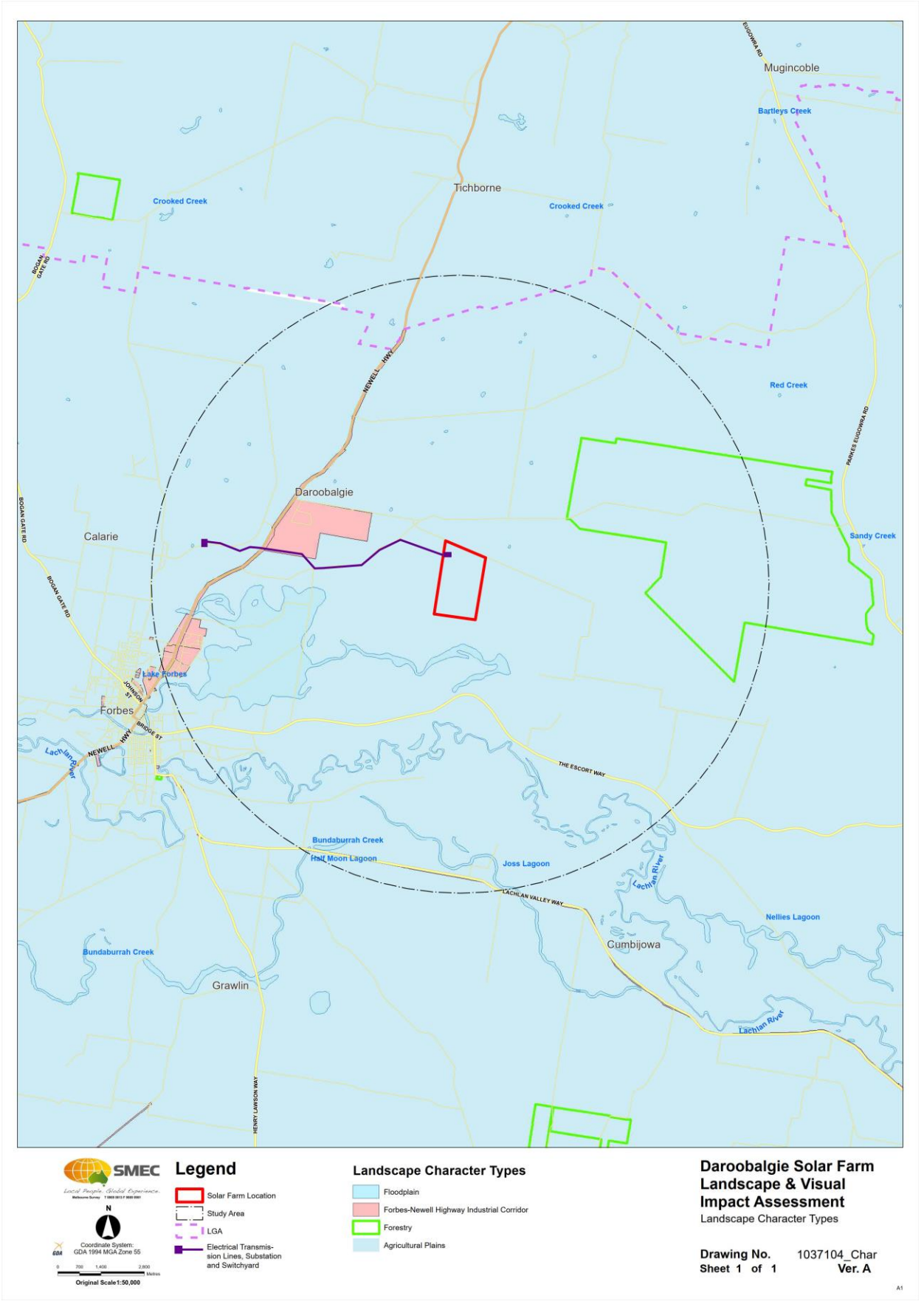


Figure 10 Landscape Character Types

6.1 Landscape Character Type 1: Agricultural plains

LCT 1: Agricultural Plains spans the majority of the study area.

6.1.1 Key characteristics

LCT 1:

- Typically characterised by open landscape with long range views to the ranges of Mt Coonambro to the east
- Includes scattered residential dwellings and ancillary farm buildings at very low densities
- Remnant native vegetation occurs throughout the area typically at the edges of agricultural paddocks, along riparian corridors, and along roads
- Back Yamma State Forest is a larger areas of remnant vegetation classed under Forestry (RU3). These are often viewed on the horizon and form the perimeter of grassed and/or cropped plains
- The patterns of the landscape often appear as a patchwork of different colours and textures, dependent upon the nature of the farming occurring within any given area and the time of year
- The overriding impression is that of a highly modified landscape, with human intervention on the landscape often visible and clearly evident.

The typical landscape character of the study area is shown in Figure 11.



Figure 11 LCT1: Agricultural pasture - typical character

6.1.2 Agricultural fields

Within LCT 1:

- There are a wide range of agricultural land uses within the study area, including cropping and grazing
- Broadacre fields are of varying patchwork appearance dependent on the nature of the farming occurring within any given area and the time of year
- Landform is open landscape with simple patterns and little variation in topography.

Typical agricultural fields within LCT 1 are shown in Figure 12, Figure 13 and Figure 14.



Figure 12 Broadacre crop



Figure 13 Canola, a prominent crop in the Central West Region



Figure 14 Remnant vegetation within agricultural fields

6.1.3 Farming infrastructure

Farming infrastructure characteristic of LCT1 includes:

- Smaller silos on farming properties (Figure 15)
- Farming sheds and equipment located on properties (Figure 16).



Figure 15 Silos are characteristic landscape features of the study area



Figure 16 Farm sheds are characteristic landscape features of the study area

6.1.4 Rural residences

Rural residences within LCT 1 include:

- Residences that are sparsely distributed and located within the open landscape
- Residences that are accompanied by associated structures (sheds, yards, water tank, silos, fences) in close proximity of the dwelling(s)
- Other associated features such as tree clusters in close proximity to residences acting as wind breaks or privacy screening.

6.1.5 Remnant vegetation

Remnant vegetation within LCT 1 includes:

- Within cropping lands (Figure 17), the patches of remnant vegetation are often, but not always, associated with riparian corridors
- Roadside native vegetation (Figure 18) within the study area are sparse, but higher concentration generally located to the north along local roads such as Ashburnham Road, Kooringle Road and Back Yamma Road
- There are often areas of tree clusters within agricultural fields and within the proximity of sheds and dwellings
- Vegetation varies from Lignum scrubs to tall eucalypt trees.



Figure 17 Stands of native vegetation within cropping areas



Figure 18 Roadside remnant vegetation and boundary planting, Kooringle Road

6.1.6 Access roads

Access roads within LCT 1 include:

- Sealed and unsealed roads
- Local roads are generally straight
- Wide road verges with gravel or dirt edge, wide grassed area and often containing remnant native vegetation.

Some examples of these are shown in Figure 19, Figure 20 and Figure 21.



Figure 19 Sealed road with wide grassed verge - Ashburnham Road



Figure 20 Local access road – Troubalgie Road



Figure 21 Gravel road verges on Back Yamma Road

6.1.7 Back Yamma State Forest

Back Yamma State Forest is within LCT 1 and includes:

- Unsealed road marks the entrance of the state forest
- Vegetation class is prominently Floodplain Transition Woodland
- Uniform stands of vegetation cover within the forest. These are often viewed on the eastern horizon and form the perimeter of grassed and/or cropped plains.



Figure 22 Entrance to Back Yamma State Forest

6.2 Landscape Character Type (LCT 2): Floodplain

6.2.1 Location

The LCT 2: Floodplain is to the south of the study area and consists of the low-lying Lake Forbes floodplain and Lachlan River riparian zone. The Lake Forbes floodplain is largely situated to the northeast of Forbes township. This area spans from Forest Road in the north to Escort Way to the south and west of Fairview Road to the east. Lachlan River riparian zone is situated between Escort Way and Lachlan Valley Way to the south.

6.2.2 Key characteristics

Key characteristics of LCT 2: floodplain include:

- Higher coverage of vegetation compared to the cleared Agricultural Plains (LCT1)
- Dense corridor of vegetation indicating location of waterways and wetlands
- A natural watercourse runs to the east of the Site's boundary drains into the LCT2's floodplain to the south
- The riparian corridors (Figure 23) associated with these waterways are typically home to higher densities of remnant native vegetation when compared to the surrounding agricultural land
- Views are often punctuated by vegetation.

Representative images of the landscape characteristics of LCT 2 are shown in Figure 23, Figure 24, Figure 25, Figure 26, Figure 27, Figure 28 and Figure 29.



Figure 23 Vegetation line riparian corridor north of Woolshed Road

6.2.3 Agricultural fields

Agricultural fields prominent within LCT 2 include:

- The cropping land are generally located on low-lying plains surrounded by riparian vegetation
- The patches of remnant vegetation are often, but not always, associated with riparian corridors
- Cropping land sizes are generally smaller on Lake Forbes floodplain
- Views are often punctuated by vegetation.

6.2.4 Floodplain vegetation

Floodplain vegetation characteristic of LCT 2 includes:

- Remnant pockets of vegetation located along waterways and wetlands.



Figure 24 Looking north from Littles Road and Sandhills Road Intersection



Figure 25 River red gum forest on Lakes Forbes floodplain

6.2.5 Riparian corridors

Riparian corridors characteristic of LCT 2 include:

- The floodplain is traversed by numerous creeks and small wetlands. The flow of these depend on seasonal rainfall, with many of the creeks left dry in the summer months and flooding when high rainfall. There are various named creeks and streams and other un-named tributaries within the study area
- Lachlan River (further to the south of the solar farm site), is typically narrow, with views out from the waterway to the surrounding landscape typically restricted by the riparian vegetation
- The riparian corridors associated with Lachlan River are typically home to higher densities of remnant native vegetation when compared to the surrounding agricultural land
- North of the Lachlan River and its distributaries to the south of the solar farm site support a relatively intact corridor of wetlands including Lake Forbes, river red gum forest, and associated lignum shrub lands.



Figure 26 Looking south from Littles Road and Sandhills Road Intersection



Figure 27 Paddock and vegetation lined Lachlan River at the background



Figure 28 Gilgai, a small, ephemeral water body and Lachlan River at the background



Figure 29 View from The Escort Way

6.3 Local Character Type (LCT) 3: Forbes-Newell Highway industrial corridor

6.3.1 Location

LCT 3: Forbes-Newell Highway industrial corridor is across two areas to the north of Forbes township and falls within the study area as land use zoned under the Forbes LEP as IN1 (General Industrial), with some smaller pockets of R5 (Large lot residential), B5 (Business Development) and SP2 (Infrastructure). The lots to the east and west of the Newell Highway are predominantly comprising warehouses, large retail and manufacturing facilities, those further to the north are bounded by cleared land zoned for IN1. The study area in the locality of Daroobalgie included in this LCT are situated around the Daroobalgie Road intersection as well as western section of Back Yamma Road. These corridors located along the Newell Highway are known as Landrace Industrial Estate and Central West Industrial Park.

Dominant elements in this LCT are warehouses, large retail businesses, manufacturing plants, the Forbes Central West Livestock Exchange, large lot dwellings, electrical substation and overhead powerlines.

6.3.2 Key characteristics

Key characteristics of LCT 3: Forbes-Newell Highway industrial corridor include:

- Grain silos manufacturers, large block factories, large retail and service stations typically located alongside the Newell Highway
- Other prominent roadside facilities include motorist rest areas and heavy vehicle inspection bays.

Examples of these are shown in Figure 31 and Figure 38.

6.3.3 Industrial

Industrial elements of LCT 3 include:

- Built forms are varied
- Newell Highway is the main transport corridor through the precinct

- Electrical infrastructure traversing through industrial areas, including overhead transmission lines and a substation
- Local streets and access roads are usually sealed. Roadside vegetations are not consistent due to the presence of overhead powerline.



Figure 30 Industrial estate



Figure 31 Silo manufacturing facility and the Newell Highway



Figure 32 Forbes Central West Livestock Exchange- Back Yamma Road, Daroobalgie

6.3.4 Large lot residential

Large lot residential areas characteristic of LCT 3 include:

- Residential dwellings are located on the local streets on south eastern sections of the precinct bounded by Lake Forbes floodplain to the east, Newell Highway to the west and light industrial to the north and south
- Brahman Street is home to these dwellings generally single storey with large yards on the east side
- Electrical transmission lines traverse through easement between dwellings
- Views out from the dwellings are typically towards the floodplains to the east due to higher elevation of 254 AHD but views are limited by riparian vegetation.



Figure 33 Residences at Brahman Street



Figure 34 Electrical lines traverse through easement

6.3.5 Transmission line

Transmission lines are a key characteristic of LCT 3 and include:

- Transmission line corridors tend to pass through large scale and open landscape areas
- Transmission lines are connected to Forbes Substation located at the south west corner of the LCT, to the west of Wyndham Ave and the Newell Highway.



Figure 35 Transmission lines along eastern boundary of the Newell Highway corridor



Figure 36 Transmission lines along Back Yamma Road

6.3.6 Transport corridor

Landscape character of transport corridors within LCT 3 include:

- Remnant native vegetation along the Newell Highway corridor is varied, with occasional breaks offering views to the agricultural plains to the east and west
- Roadside facilities include motorist rest areas and heavy vehicle inspection bays.



Figure 37 The Newell Highway corridor lined with remnant vegetation



Figure 38 Northbound rest area and the Newell Highway

7 Landscape Impact Assessment

This section provides an assessment of anticipated impacts on each of the LCTs identified in Section 6, undertaken in accordance with the methodology outlined within Appendix A.

Given that the purpose of this assessment is to assess the potential impacts associated with the existing baseline conditions, all discussions and judgements made on the magnitude of change and associated impact ratings are made relative to the existing landscape.

7.1 Direct impacts

Direct landscape impacts relate to impacts upon landscape character which may occur upon LCTs as a direct result of the presence of the project within an area of a particular landscape character.

7.1.1 LCT1: Agricultural plains

Table 3 Landscape Impact Assessment – LCT1

Landscape Sensitivity (refer Table 26)	**Magnitude of Landscape Change (refer Table 26)**
The Agricultural Plain is a landscape which has been highly modified from its natural, pre-European state. Human modifications are clearly evident through widespread clearance of native vegetation and via the presence of roadways, dwellings, ancillary agricultural buildings and domestic scale electricity infrastructure. As such, it is considered to have some capacity to absorb the type of change envisaged by this project. Whilst it is not considered to be of any specific scenic value, some receptors likely place value upon its openness and typically low built form density. There are no specific planning controls attributing special value to this landscape. Overall, this Landscape Character Type is considered to be of **low** sensitivity.	The height of the PV cell at up to 4m will mean that the views of the solar farm site are likely only at close range where no screening vegetation is present. The associated infrastructure within the site such as ETL monopole and landing gantries reach to approximately 30m high and 12-16m respectively. However, these elements are relatively small in extent and scale compared to PV cells site coverage. It is considered that the ZTVI is a relatively small portion of what is a widely distributed and expansive LCT. Furthermore, the visual prominence of the solar farm site, ETL and switchyard will reduce with increased distance from the project itself, such that they are barely perceptible towards the periphery of the viewshed. Within closer range to the project, infrastructure such as the PV cells and associated infrastructure will have an evident change in landscape characteristics; however, the extent of this considerable change is considered minor in relation to the expansive extent of this LCT. Supporting project infrastructure is still considered to be of a scale and form that is commensurate with the existing built form typology of the rural landscape and can be adequately absorbed by the landscape. Overall, the magnitude of change is considered to be a **noticeable change.**
Expected Landscape Impact Rating (refer Table 26)	
MINOR	

7.2 Indirect impacts

Indirect landscape impacts relate to potential impacts which may occur upon LCTs which are adjacent to the project.

As these landscape types fall outside of the project area there is no potential for loss or removal of landscape elements such as existing trees or existing landform. Therefore, indirect impacts result when a project located within a given LCT indirectly affects the perceptions of adjacent LCT's.

This is sometimes termed 'borrowed character.' An example of this may be where changes in landscape character within one LCT are visible from an adjacent LCT and therefore can indirectly affect perceptions of landscape character within.

The potential (or lack thereof) for indirect landscape impacts upon adjacent LCTs is described below.

7.2.1 LCT2: Floodplain

Table 4 Landscape Impact Assessment – LCT2

Landscape Sensitivity (refer Table 26)	Magnitude of Landscape (refer Table 26)
The floodplain within the study area has a higher concentration of vegetation associated with the floodplain and associated waterways. Views are often punctuated by vegetation. Some receptors likely place value upon the floodplain's enclosed nature of vegetation coverage and uniform foliage texture. There are no specific planning controls attributing special value to this landscape. As such, they are considered to have some capacity to absorb the type of change envisaged by this project, particularly given that the modifications are occurring outside of the footprint of LCT2 itself. Overall, the landscape sensitivity is assessed as **low**.	LCT2 is experienced in two ways – it is viewed from afar, across a foreground of LCT1 (Agricultural Plains), as well as experienced from within. When viewed from afar, the solar farm site, ETL and switchyard will have much less visual mass relative to the vegetation associated with floodplain and thus are not expected to compete visually with the landform and associated vegetation. Moreover, there is a limited area from which the project would form part of views towards LCT2. When viewed from within LCT2, and in particular from the local access roads, views toward the solar farm site, ETL and switchyard are expected to occupy a small proportion of the horizontal and vertical fields of view, often only through the gaps of existing vegetation, minimising their ability to indirectly impact upon the character of this LCT. Overall, the magnitude of change on the LCT is considered to be **barely perceptible**.
Expected Landscape Impact Rating (refer Table 26)	
NEGLIGIBLE TO MINOR	

7.2.2 LCT3: Forbes-Newell Highway industrial corridor

Table 5 Landscape Impact Assessment – LCT3

Landscape Sensitivity (refer Table 26)	Magnitude of Landscape Change (refer Table 26)
The industrial precinct(s) within the study area are highly modified landscapes, with a high prevalence of built form and infrastructure visible within these areas, particularly in along the Newell Highway. However, none of the built forms and infrastructure contribute to the scenic quality. As such, they are considered to have capacity to absorb the type of change envisaged by this project, particularly given that the modifications are occurring outside of the footprint of LCT3 itself. Overall, this Landscape Character Type is considered to be of **low** sensitivity.	The screening effect of built form and vegetative coverage within the precinct associated with LCT3 means that the solar farm site, ETL and switchyard are expected to be largely screened from within the precinct. Some views may be available from the periphery of the precinct due to the nature of elevation; however, these are expected to be somewhat limited, of short duration and not considered of central importance to the overriding character of LCT3. Visual impacts upon specific viewpoints associated with many of the precinct are explored within Section 6.1. Overall, the magnitude of change on the LCT is considered to be **barely perceptible**.
Expected Landscape Impact Rating (refer Table 26)	
NEGLIGIBLE TO MINOR	

7.3 Summary

A summary of the landscape impact ratings for LCT1, LCT2 and LCT3 is provided in Table 6.

Table 6 Summary of landscape impact ratings

LCT	Description	Landscape Sensitivity	Magnitude of Landscape Change	Landscape Impact Rating
LCT1	Agricultural Plains	Low	Noticeable change	**Minor**
LCT2	Floodplain	Low	Barely perceptible	**Negligible to minor**
LCT3	Forbes-Newell Highway industrial corridor	Low	Barely perceptible	**Negligible to minor**

8 Representative Public Viewpoint Assessment

8.1 Viewpoint selection

Ten representative public viewpoints were identified within the study area and are shown in Figure 39. Photographs, descriptions and impact assessment for each are provided in subsequent sections. Photo montages of the project from selected viewpoints are provided within Appendix B.

These viewpoints were selected based upon a three-stage process.

8.1.1 Identification of zone of theoretical visual influence

A ZTVI analysis (based on a maximum PV cell height of four metres) was undertaken to provide a preliminary representation of the likely 'worst case' visual of the project. These ZTVI analyses is illustrated in Figure 5. ZTVI analysis for associated infrastructure such as substation, ETL monopoles and switchyard is illustrated in Figure 6.

The methodology for producing these analyses is outlined within Appendix A. It should be noted that the outputs of these plans are limited, and do not consider the screening effect of intervening vegetation, topography or built form, and therefore provide an exaggerated indication of the theoretical extent of visibility of the PV cells and ancillary infrastructure. They were therefore used primarily to guide the desktop studies and site visit work.

8.1.2 Desktop studies

A desktop study was undertaken of the study area in order to identify potential visual receptors likely to be impacted upon by the project. This included an assessment of existing planning designations and background reports, heritage protection, public open spaces, public gathering nodes, and clusters of residential properties. A preliminary list of potential representative public viewpoints was established for subsequent ground proofing on-site.

8.1.3 Site visit

A one-day and two half-days site visits were undertaken on the 23 July 2020, 14 and 15 April 2021 respectively and attended by one landscape architect.

During the site visit, the representative viewpoints were confirmed and an assessment was made of each potential representative public viewpoint against the known extent of the project.

The resultant identified viewpoints are considered to be representative of:

- The variety of landscape types within the study area
- The range of public views and the types of viewers likely to be affected by the project.

It is important to note that viewpoints for this study have been taken only from accessible public land. Once the viewpoint had been selected, panoramic photographs were taken at eye level from the viewpoints towards the site. Photographs were taken with a digital SLR camera through a 50 millimetre lens to best represent the perspective of the human eye. The visual impact of the viewpoint was then assessed both on site and with the topographic and aerial information to ensure accuracy. Viewpoint photographs and analysis has been included in the following Section 8.2 to 8.10. The findings of the viewpoint analysis have been quantified and are summarised in Table 17.

8.1.4 Impact assessment components

The PV cells within the proposed solar farm site are the primary components that have been assessed for visual impact, based on the proposed layout with known area coverage and height.

The electrical components including the design and layout of the solar farm site, switchyard and the (ETL running from the solar farm site to switchyard are indicative only, and whilst subject to detailed design,generally reflect a 'worst-case' scenario. As such, the viewshed analysis is based on overall heights and the estimated maximum sizes of these components (Monopole 30 m high; switchyard 90 m long x 55 m wide, highest components 14 m high; the substation at the solar farm site: 140 m long x 40 m wide, highest components 14 m high) therefore, only demonstrating 'worst-case' scenario. However, we have assessed the impact of the solar farm site, switchyard and ETL in the viewpoints where these are expected to be visible. It is expected that power lines, as they are not solid structures, would not likely form major visual components within the landscape and are fitting to the existing visual character of the study area.

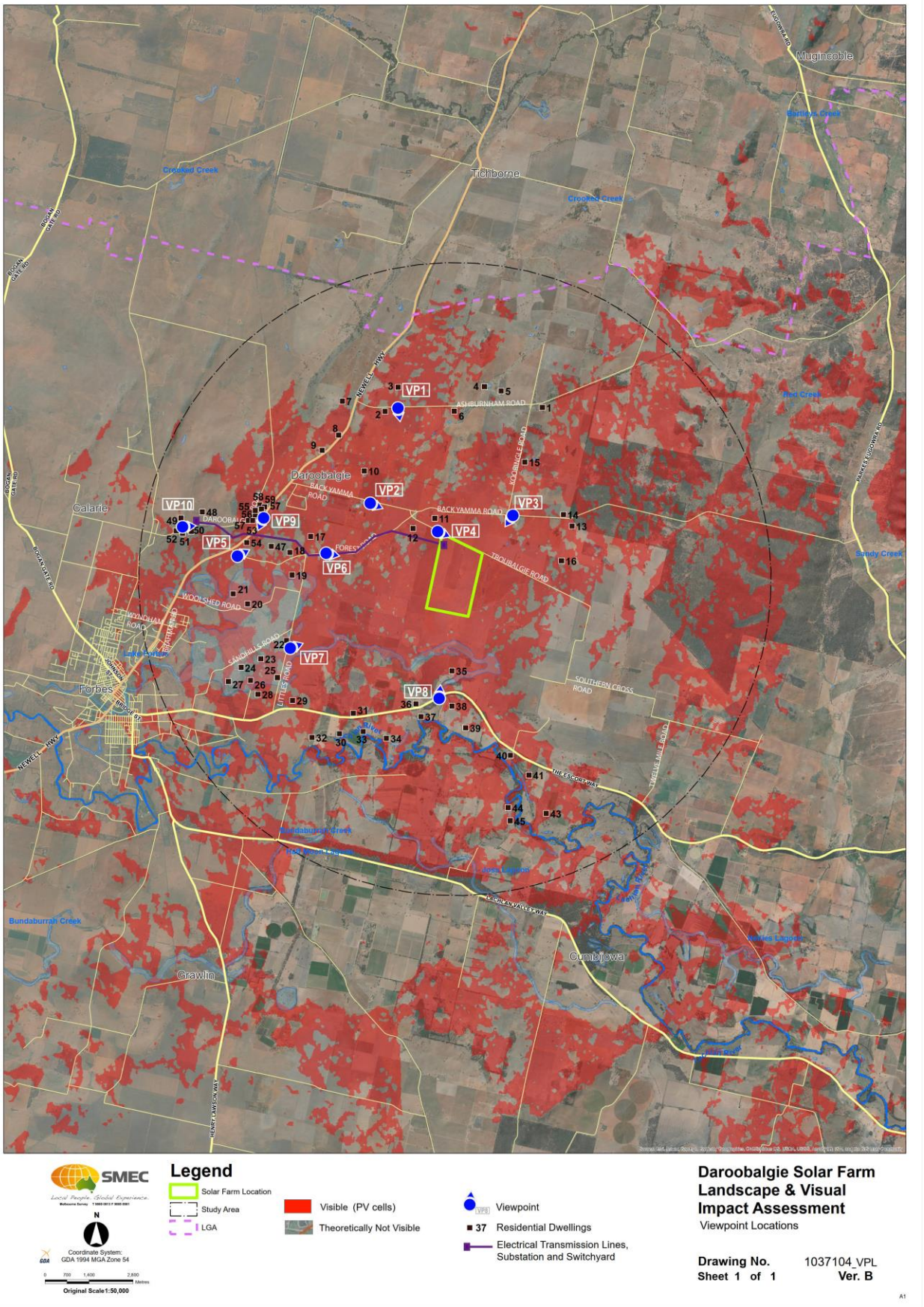


Figure 39 Representative Public Viewpoint Locations

8.2 Viewpoint 1 - Ashburnham Road



Figure 40 Viewpoint 1: Existing View



Figure 41 Viewpoint 1: Proposed project layout

Table 7 Visual Impact Assessment - Viewpoint 1

Location	Elevation	Distance to the Project	Viewing Direction
Coordinates: 33°17'53.21"S 148° 5'51.38"E	268 m	Approximately 4.2 km	Southeast
Residences relevant to the viewpoint			
Residences 2, 3, 4, 5, 6, 7			
Existing viewing conditions			
The viewpoint is located north of Daroobalgie on Ashburnham Road, looking southeast towards the project. Located mid-range distance within the study area, it is considered representative of the view experienced by residences and vehicles (trucks and cars), travelling in this location. The foreground consists of the road nature strip and farm fence. The mid-ground is dominated by a view of broadacre cropping fields. The visible background landscape mainly consists of native vegetation. The Forbes Central West Livestock Exchange is visible to the right of this view.			
Visual Sensitivity (refer Table 27)		**Magnitude of Visual Change (refer Table 27)**	
This view is experienced predominantly by local residents. The most sensitive visual receptors are expected to be local residents, whom have a familiarity with the local area and whom will experience this view more often. Overall, this viewpoint is considered to be of up to **low** visual sensitivity.		The project is expected to be barely visible on the horizon to people specifically looking from this location. Given this viewpoint is approximately 4.2 km from the boundary of the site, the PV cells, ancillary facilities and ETL infrastructure will form relatively small elements within the overall view. Overall, the magnitude of change is considered to be **barely perceptible**.	

Expected Visual Impact Rating (refer Table 27)
NEGLIGIBLE TO MINOR

8.3 Viewpoint 2 - Back Yamma Road



Figure 42 Viewpoint 2: Existing View



Figure 43 Viewpoint 2: Proposed project layout

Table 8 Visual Impact Assessment - Viewpoint 2

Location	Elevation	Distance to the Project	Viewing Direction
Coordinates: 33°19'30.20"S 148° 5'24.52"E	245.5 m	Approximately 2.55 km	Southeast
Residences relevant to the viewpoint			
Residences 8,9,10			
Existing viewing conditions			
This view is located on the outskirts of the industrial estate, east of the Forbes Central West Livestock Exchange, on Back Yamma Road looking southeast towards the project. This view from the roadside is considered 'worst-case' scenario of the views that will be experienced from the estate and residences. The foreground and mid-ground are dominated by a view of broadacre cropping fields. The visible background landscape consists of native vegetation which follows a watercourse towards Forest Road to the south of this view.			
Visual Sensitivity (refer Table 27)		**Magnitude of Visual Change (refer Table 27)**	
This view is experienced predominantly by local residents and traders, with occasional exposure to visitors to the Back Yamma State Forest. The most sensitive visual receptors are expected to be local residents, whom have a strong familiarity with the local area and whom will experience this view more often. Visitors are likely to be transient and with less interest in their surroundings.		From this location only the PV cells located on the northern half of the solar farm site would be partially visible through smalls gaps in the vegetation. The rest of the solar farm site is not expected to be visible due to the existing vegetation screening by the band of trees located along the watercourse. Given this viewpoint is approximately 2.55 km from the boundary of the solar farm site, the PV cells will form relatively small elements within the overall view, therefore would not contrast with the surrounding agricultural character.	

Overall, this viewpoint is considered to be of **low** visual sensitivity.	The ETL infrastructure closest to the viewpoint are transmission line monopoles along Forest Road. These structures are 1.2 km away from this view would be partially visible among the bands of trees and it is expected to blend with the existing view. Overall, the magnitude of change is considered to be **barely perceptible**.
Expected Visual Impact Rating (refer Table 27)	
NEGLIGIBLE TO MINOR	

8.4 Viewpoint 3 – Intersection of Kooringle and Back Yamma Roads



Figure 44 Viewpoint 3: Existing View



Figure 45 Viewpoint 3: Proposed project layout

Table 9 Visual Impact Assessment - Viewpoint 3

Location	Elevation	Distance to the Project	Viewing Direction
Coordinates: 33°19'35.24"S 148° 8'16.46"E	255 m	Approximately 1.5 m	Southwest
Residences relevant to the viewpoint			
Residences 1, 13, 14, 15, 16			
Existing viewing conditions			
The viewpoint is located on the intersection of Kooringle Road and Back Yamma Road, looking towards the PV cells lined along the northern and eastern boundaries of the solar farm site. It is considered representative of the worst-case views towards the project from the residences on the eastern end of Back Yamma Road and further north on Kooringle Road. The foreground consists of the road nature strip and farm fence. The foreground and mid-ground is dominated by a view of broadacre cropping fields. Transmission poles cross the background running parallel to the road. The background landscape consists of a line of native vegetation which follows a local road.			
Visual Sensitivity (refer Table 27)		**Magnitude of Visual Change (refer Table 27)**	
This view is experienced by local residents and farm workers, with occasional experience by seasonal visitors to Back Yamma State Forest. The most sensitive visual receptors are expected to be local residents, whom have a strong familiarity with the local area and whom will experience this view more often. There is a low density of visual receptors at this viewpoint. Overall, this viewpoint is considered to be of **low** visual sensitivity.		The PV cells associated with the project are expected to be visible in the background of this view. Given the proximity of this viewpoint to the solar farm site, the PV cells and associated infrastructure would form less discernible elements within the view under most conditions and would provide low level of contrast with the existing agricultural character. The ETL infrastructure are 2.3 km away from this view and will form relatively small elements within this view. Overall, the magnitude of change is considered to be a **barely perceptible**.	
Expected Visual Impact Rating (refer Table 27)			
NEGLIGIBLE TO MINOR			

8.5 Viewpoint 4 - Troubalgie Road



Figure 46 Viewpoint 4: Existing View



Figure 47 Viewpoint 4: Proposed project layout

Table 10 Visual Impact Assessment - Viewpoint 4

Location	Elevation	Distance to the Project	Viewing Direction
Coordinates: 33°19'54.69"S 148° 6'45.01"E	247 m	Approximately 0.03km	Southeast
Residences relevant to the viewpoint			
Residences 11,12			
Existing viewing conditions			
The viewpoint is located on Troubalgie Road, looking east-southeast towards the project from nearer to the solar farm site's corner where the substation is proposed. It is considered representative of the worst-case views towards the project from the nearby dwellings and the road. The immediate foreground consists of the road nature strip and farm fence to the broadacre crops in the middle ground. Scattered trees and windrows are visible on the horizon, silos on a neighbouring property are visible to the right of the image.			
Visual Sensitivity (refer Table 27)		**Magnitude of Visual Change (refer Table 27)**	
This view is experienced by local residents and farm workers. The most sensitive visual receptors are expected to be one local resident less than 1km from the project, whom have a strong familiarity with the local area and whom will experience this view more often. There is a low density of visual receptors at this viewpoint. Overall, this viewpoint is considered to be of up to **low** visual sensitivity.		The PV cells associated with the project are expected to be visible above the horizon of this viewas well as associated infrastructure including the BESS, substation and O&M facility which will be visible in the centre of the view. Vertical elements of the ETL in the form of transmission lines and monopoles will run from the substation and dominate the mid-ground of this view. Given the close proximity of this viewpoint to the solar farm site, flat topography of the site and no natural vegetation screening, the project would form clearly discernible elements within the view under most conditions and would provide high level of contrast with the existing agricultural character. Overall, the magnitude of change is considered to be a **considerable change.**	
Expected Visual Impact Rating (refer Table 27)			
MINOR TO MODERATE			

8.6 Viewpoint 5 – Intersection of Newell Highway andForest Road



Figure 48 Viewpoint 5: Existing View



Figure 49 Viewpoint 5: Proposed project layout

Table 11 Visual Impact Assessment - Viewpoint 5

Location	Elevation	Distance to the Project	Viewing Direction
Coordinates: 33°20'29.94"S 148° 2'40.84"E	243 m	Approximately 6.35 km	Northeast
Residences relevant to the viewpoint			
Residences 20, 21 and residences located along Newell Highway between Woolshed Road and Forest Road			
Existing viewing conditions			
This view is from the western end of Forest Road, at its intersection with the Newell Highway, looking east north east towards the project. It is considered representative of worst-case scenario views from the highway and the dwellings bounded by Forest Road, Woolshed Road and eastern side of Newell Highway. The foreground view is of the highway and road wide grassed nature-strip, groups of trees along both sides of the highway and existing transmission lines running along eastern boundary of the Newell Highway corridor. To the left of the Newell Highway, bands of vegetation visible on the horizon follow property boundaries and a railway line, forming a continuous screen to views beyond.			
Visual Sensitivity (refer Table 27)		**Magnitude of Visual Change (refer Table 27)**	
This is a typical view experienced by local residents and farm workers who use Forest Road as an entry point from the Newell Highway. The most sensitive visual receptors are expected to be local residents, whom have a strong familiarity with the local area and		The project is expected to be barely visible on the horizon and through the gaps of existing vegetation to people looking towards the solar farm from this location. Given this viewpoint is approximately 6.35 km from the boundary of the solar farm site, the PV cells, ancillary infrastructure within the	

whom will experience this view more often. There is a low density of visual receptors at this viewpoint. This is also a typical view experienced by the motorists using the Newell Highway travelling north. The view towards the project is perpendicular to the direction of travel along the Newell Highway, meaning that a passing motorist travelling north or south would have to look away from their usual line of sight to experience the view. Overall, this viewpoint is considered to be to **low** visual sensitivity.	solar farm site will form relatively small elements through the gaps of vegetation. The ETL infrastructure closest to the viewpoint are transmission line monopoles traverse through the vegetation along the horizon and crossing the Newell Highway. These structures would be partially visible through smalls gaps in the vegetation and it is expected to blend with the existing view. The switchyard to the left of this view are screened by existing vegetation and would not be visible. Overall, the magnitude of change is considered to be a **barely perceptible change**.
Expected Visual Impact Rating (refer Table 27)	
NEGLIGIBLE TO MINOR	

8.7 Viewpoint 6 - Forest Road



Figure 50 Viewpoint 6: Existing View



Figure 51 Viewpoint 6: Proposed project layout

Table 12 Visual Impact Assessment - Viewpoint 6

Location	Elevation	Distance to the Project	Viewing Direction
Coordinates: 33°20'26.80"S 148° 4'38.04"E	240 m	Approximately 3.40 km	East
Residences relevant to the viewpoint			
Residences 17,18, 19, 47			
Existing viewing conditions			

This view is from Forest Road looking east towards the project. The view is considered representative of the worst-case view from rural residences located to the north and south of Forest Road.

The foreground and midground is agricultural plans with some roadside patchy vegetation at the centre of the view. The background is of expansive flat agricultural plains, in which the Forbes Central West Livestock Exchange at Back Yamma Road can be seen through the gaps of the trees towards the left of the viewpoint.

Visual Sensitivity (refer Table 27)	Magnitude of Visual Change (refer Table 27)
This view is experienced predominantly by local residents. The most sensitive visual receptors are expected to be local residents, whom have a familiarity with the local area and whom will typically experience this view more often. There is a low density of visual receptors at this viewpoint. Overall, this viewpoint is considered to be of **low** visual sensitivity.	The PV cells associated with the project would be barely visible in the background. It is expected that this view would show the solar farm site as a small block through gaps of the existing vegetation in the centre of this view. The solar farm site is viewed from a moderate distance, and as such will form a relatively minor proportion of the overall view. It is expected to blend with the existing view. The ETL infrastructure would be highly prominent at this location. The proposed ETL will be visible in the foreground to the left of this view. Given the proximity of the monopole structures to the viewpoint and flat topography of the site, these structures would form clearly discernible elements within the view under most conditions and would provide some level of contrast with the existing agricultural character. However, the existing view is highly modified and already includes some built structures in the form of the Livestock Exchange buildings and existing ETLs in the area, and such is considered to have some capacity to accommodate the proposed ETL. Overall, the magnitude of change is considered to be a **noticeable change.**
Expected Visual Impact Rating (refer Table 27)	
MINOR	

8.8 Viewpoint 7 - Littles Road



Figure 52 Viewpoint 7: Existing View



Figure 53 Viewpoint 7: Proposed project layout

Table 13 Visual Impact Assessment - Viewpoint 7

Location	Elevation	Distance to the Project	Viewing Direction
Coordinates: 33°22'6.71"S 148° 3'57.56"E	240 m	Approximately 4.57 km	North East
Residences relevant to the viewpoint			
Residences 22,23,24,25,26,27,28,29			
Existing viewing conditions			
This view is from near the intersection of Woolshed Road and Littles Road, looking north-east towards the project. The view is considered representative of the worst-case view of nearby dwellings to the southwest of Littles Road. The foreground and midground is an open paddock with patches of Lignum scrubs. The background along the horizon offers an open view towards the solar farm site and the Mt Coonambro Range. The background to the left and right of this viewpoint has long bands of native trees that follow small watercourses.			
Visual Sensitivity (refer Table 27)	**Magnitude of Visual Change (refer Table 27)**		
This view is experienced by low numbers of local residents to the area. The most sensitive visual receptors are expected to be local residents, whom have a familiarity with the local area and whom will typically experience this view more often. Visitors are likely to be transient and with less interest in their surroundings. Overall, this viewpoint is considered to be of **low** visual sensitivity.	The PV cells and associated infrastructure within the solar farm site would be barely visible on the horizon. It is expected that this view would show the solar farm site as a small block where the PV cells are located. The ETL infrastructure where visible from this viewpoint is viewed from a moderate distance of 3.6 km to 5.7 km, and as such will form a relatively minor proportion of the overall view. It is expected to blend with the existing view. Overall, the magnitude of change is considered to be a **barely perceptible change**.		
Expected Visual Impact Rating (refer Table 27)			
NEGLIGIBLE TO MINOR			

8.9 Viewpoint 8 - The Escort Way



Figure 54 Viewpoint 8: Existing View



Figure 55 Viewpoint 8: Proposed project layout

Table 14 Visual Impact Assessment - Viewpoint 8

Location	Elevation	Distance to the Project	Viewing Direction
Coordinates: 33°22'46.37"S 148° 7'6.50"E	243 m	Approximately 2.75 km	North
Residences relevant to the viewpoint			
Residences 30,31,32,33,34,35,36,37,38,39,40,41,43,44,45			
Existing viewing conditions			
This view is from The Escort Way, looking north towards the project. The view is considered representative of the worst-case view of road users and dwellings located to the north and south sides of The Escort Way. The foreground is the existing vegetation that lines The Escort Way and midground is an open paddock. Bands of vegetation visible on the horizon follow a small seasonal creek that meanders towards the right of this view in the midground, forming a continuous screen to views beyond.			
Visual Sensitivity (refer Table 27)	**Magnitude of Visual Change (refer Table 27)**		
This view is experienced by low numbers of local residents and road users in the area. The most sensitive visual receptors are expected to be local residents, whom have a familiarity with the local area and whom will typically experience this view more often. Overall, this viewpoint is considered to be of **low** visual sensitivity.	The PV cells and associated infrastructure associated with the project would not be visible on the horizon due to intervening vegetation along the waterway and small rise to the west in the midground The ETL infrastructure where visible from this viewpoint is viewed from a moderate distance of 4.7 km to 5.2 km, and as such will form a relatively minor proportion of the overall view. It is expected to blend with the existing view. Overall, the magnitude of change is considered to of **barely perceptible change.**		
Expected Visual Impact Rating (refer Table 27)			
NEGLIGIBLE TO MINOR			

8.10 Viewpoint 9 - Newell Highway



Figure 56 Viewpoint 9: Existing View



Figure 57 Viewpoint 9: Proposed project layout

Table 15 Visual Impact Assessment - Viewpoint 9

Location	Elevation	Distance to the Project	Viewing Direction
Coordinates: 33°20'5.69"S 148° 3'9.37"E	250 m	Approximately 5.75 km	South
Residences relevant to the viewpoint			
Residences located along Newell Highway between Daroobalgie Road and Forest Road			
Existing viewing conditions			
This view is from the Newell Highway, looking south towards the ETL. The view is considered representative of the worst-case view of road users travelling south and small number of dwellings bounded by Daroobalgie Road, and western side of Newell Highway. The foreground is the existing vegetation that lines the Newell Highway. Existing transmission lines and poles are visible through the gaps of trees. Bands of vegetation visible on the horizon follow a property boundary, forming a continuous screen to views beyond.			
Visual Sensitivity (refer Table 27)		**Magnitude of Visual Change (refer Table 27)**	
This view is experienced by local residents and road users in the area. The most sensitive visual receptors are expected to be local residents, whom have a familiarity with the local area and whom will typically experience this view more often. This is also a typical view experienced by the motorists using the Newell Highway travelling south. Motorist's view to the project is perpendicular to the direction of travel along the Newell Highway, meaning that a passing motorist travelling south would have to look away from their usual line of sight to experience the view. Motorist's duration of view towards the transmission lines would likely be short. Overall, this viewpoint is considered to be of **low** visual sensitivity.		The solar farm site t is expected to be barely visible on the horizon and through the gaps of existing vegetation to people specifically looking from this location. Given this viewpoint is approximately 5.75 km from the boundary of the solar farm site, the PV cells, ancillary facilities with the site will form relatively small elements within the overall view. Due to close proximity, the proposed ETL would be prominent at this location. However, the compatibility with the existing overhead powerlines would mean that any additional elements would not detract from visual amenity of the viewpoint. Furthermore, the ETL monopoles would only be partially visible on the horizon due to intervening vegetation along the road and the property boundary. From this location the proposed switchyard is screened by existing vegetation and would not be visible. Overall, the magnitude of change is considered to of **barely perceptible change**.	
Expected Visual Impact Rating (refer Table 27)			
NEGLIGIBLE TO MINOR			

8.11 Viewpoint 10 - Daroobalgie Road



Figure 58 Viewpoint 10: Existing View



Figure 59 Viewpoint 10: Proposed project layout

Table 16 Visual Impact Assessment - Viewpoint 10

Location	Elevation	Distance to the Project	Viewing Direction
Coordinates: 33°20'8.37"S 148° 1'43.89"E	250.5 m	Approximately 8 km	east
Residences relevant to the viewpoint			
Residences along Calarie and Daroobalgie Roads			
Existing viewing conditions			
This view is from the Daroobalgie Road, looking east towards the switchyard site where it will be situated to connect to existing TransGrid Transmission lines. The view is considered representative of the worst-case view towards the switchyard site and ETL lines from nearby residences located along Daroobalgie Road and Calarie Road. The foreground is bands of existing vegetation that line both sides of Daroobalgie Road and open paddock.			
Visual Sensitivity (refer Table 27)		**Magnitude of Visual Change (refer Table 27)**	
This view is experienced by low numbers of local residents. The most sensitive visual receptors are expected to be local residents, whom have a familiarity with the local area and whom will typically experience this view more often from their dwellings. Overall, this viewpoint is considered to be of **low** visual sensitivity.		The solar farm site is not expected to be visible, however the switchyard will be partially visible through the gaps of the existing vegetation, to be sited behind the existing transmission lines. The existing view is highly modified and already includes some vertical elements in the form of transmission poles, and as such is considered to have capacity to accommodate the switchyard site. Given the close proximity of this viewpoint and flat topography, the proposed switchyard site would form clearly discernible elements within the view under most conditions and would provide some level of contrast with the existing agricultural character. However, due to a higher concentration and denser	

	vegetation within most residential property and along the roads, views are often punctuated by vegetation. Therefore, the visibility to the switchyard site would be limited. View to the ETL and monopoles that will line the north side of Daroobalgie Road would be limited due to intervening vegetation along the road and the property boundary. Furthermore, the compatibility with the existing overhead powerlines would mean that any additional elements would not detract from visual amenity of the viewpoint. Overall, the magnitude of change is considered to be **barely perceptible change**.
Expected Visual Impact Rating (refer Table 27)	
NEGLIGIBLE TO MINOR	

8.12 Summary

Table 17 provides a summary of the ten (10) Representative Public Viewpoint Assessments and associated Impact Ratings.

The greatest levels of impact are expected from representative public viewpoint 4 (minor to moderate). This is? relatively close to the project and therefore forms a noticeable change in visual character when compared to the existing conditions.

The landscape character of the study area (LCT 1) typically results in a commensurately uniform set of viewing conditions across the study area, with minor variations occurring as a result of localised vegetation. This, coupled with very little variation in the type of visual receptors whom will experience views (predominately local residents and workers being the most sensitive due to their familiarity with their surroundings and the frequency with which they experience views), means that the major defining factor in the level of visual sensitivity expected from individual representative viewpoints is the proximity of that viewpoint to the project.

Table 17 Summary of Representative Viewpoint Assessments

Viewpoint No.	Location	Distance to Solar Farm Site	Distance to nearest ETL	Distance to switchyard site	Visual Sensitivity	Magnitude of Visual Change	Visual Impact Rating
1	Ashburnham Road	4.2 km	3.85 km	7.34 km	LOW	BARELY PERCEPTIBLE	**NEGLIGIBLE TO MINOR**
2	Back Yamma Road	2.55 km	1.15 km	5.48 km	LOW	BARELY PERCEPTIBLE	**NEGLIGIBLE TO MINOR**
3	Intersection of Kooringle and Back Yamma Roads	1.5 km	2.39 km	9.8 km	LOW	BARELY PERCEPTIBLE	**NEGLIGIBLE TO MINOR**
4	Troubalgie Road	0.03 km	0.4 km	7.8 km	LOW	CONSIDERABLE CHANGE	**MINOR TO MODERATE**
5	Intersection of Newell Highway and Forest Road	6.35 km	0.58 km	1.40 km	LOW	BARELY PERCEPTIBLE	**NEGLIGIBLE TO MINOR**
6	Forest Road	3.40 km	0.22 km	4.27 km	LOW	NOTICABLE CHANGE	**MINOR**

Viewpoint No.	Location	Distance to Solar Farm Site	Distance to nearest ETL	Distance to switchyard site	Visual Sensitivity	Magnitude of Visual Change	Visual Impact Rating
7	Littles Road	4.57 km	3.42 km	4.88 km	LOW	BARELY PERCEPTIBLE	**NEGLIGIBLE TO MINOR**
8	The Escort Way	2.75 km	4.75 km	9.43 km	LOW	BARELY PERCEPTIBLE	**NEGLIGIBLE TO MINOR**
9	Newell Highway	5.75 km	0.14 km	1.90 km	LOW	BARELY PERCEPTIBLE	**NEGLIGIBLE TO MINOR**
10	Daroobalgie Road	8 km	0.35 km	0.31 km	LOW	BARELY PERCEPTIBLE	**NEGLIGIBLE TO MINOR**

9 Cumulative Impacts

9.1 Introduction

It is important to not only consider the project in isolation, but also the manner in which it may be perceived in conjunction with other solar farm projects in the local or regional area. Cumulative visual impacts can arise as a result of:

- The presence of multiple solar farms within an area (not necessarily visible together – sometimes termed 'sequential viewing'), which result in changes to receptor perceptions of an area as a result of repeated /frequent exposure to solar farms within a landscape
- Simultaneous views of multiple solar farms from publicly accessible or private viewing locations.

9.2 Operational, approved and planned solar farms within central west NSW

Solar farms within 10 km are generally discussed within an LVIA assessment; however, the closest solar farm to proposed Daroobalgie Solar Farm, is Parkes Solar Farm located 25 km away. Table 18, Table 19 and Table 20 below outline the current operational, approved and planned solar farms in proximity to the Daroobalgie Solar Farm.

The data below has been sourced from Forbes Shire Council, Parkes Shire Council and NSW Planning Major Projects *https://www.planningportal.nsw.gov.au/major-projects* (accessed 30-March-21).

Table 18 Operational Solar Farms in proximity to Daroobalgie Solar Farm

Solar Farm	Size	Location	Distance to the Project
Parkes	66 MW	Parkes, NSW	25 km
Goonumbla	70 MW	Parkes, NSW	26 km
Manildra	46 MW	Manildra, NSW	58 km
Molong	39 MW	Molong, NSW	78 km
Jemalong	50 MW	Jemalong, NSW	43 km

Table 19 Approved Solar Farms in proximity to Daroobalgie Solar Farm (not Operational)

Solar Farm	Size	Location	Distance to the Project
Quorn Park	80 MW	Parkes, NSW	27 km
West Wyalong	135 MW	West Wyalong, NSW	90 km

Table 20 Planned Solar Farms in proximity to Daroobalgie Solar Farm (not Operational)

Solar Farm	Size	Location	Distance to the Project
Peninsular	130 MW	Paytens Bridge	25 km

9.3 Local and regional scale cumulative impacts

At a regional scale, cumulative impacts would be greatest (and perhaps unacceptable) in instances where solar farms are repeatedly located in proximity to high numbers of receptors (e.g. along major road corridors), with little separation between separate solar farm projects. Given the nearest solar farm is >25km relative to the project, it is considered that regional scale cumulative impacts will be negligible.

10 Glare Analysis

10.1 Angle of reflection

The angle of reflection of sunlight hitting the PV cells is directly related to the angle of incidence (shown as *r* in Figure 60) of a sun's rays hitting the cell surface. The position of the sun relative to the solar panels, and by extension the angle of reflection, will vary by the time of day and season of the year.

The amount of light reflected by a surface typically increases with a greater angle of incidence (i.e. increased *r* angle shown in Figure 60).

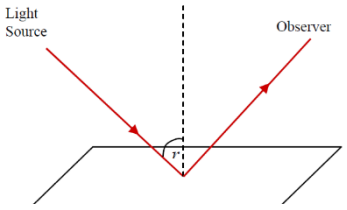


Figure 60 Angle of reflection

10.2 Reflectivity

PV cells are designed to absorb light in order to maximise energy production, and accordingly reflect only a portion of the sunlight that falls on them. A review of various technical studies by PV cell manufacturers indicates that whilst the level of reflection is dependent upon the amount of light available (driven by geographic location, time of year, cloud cover and cell orientation), reflectivity levels associated with PV cells are typically much less than those of other common materials including paint and standard glass (such as that found in a car windscreen)[1].

At the extreme of 80° angle of incidence of the light source (when reflectance levels are approaching their maximum), metallic paints reflect back more than 70% and 80% of the incident light, depending on the colour, while an ordinary car windshield reflects 45% on average. In the visible range and the same angle, PV cells have optimum optical characteristics and the average reflectivity level was measured below 30% for most wavelengths[2].

The proposed PV cells include an Anti-Reflective Coating.

10.3 Methodology

A software program specialising in glare analysis (ForgeSolar) was used to calculate glare results, based on input of the following parameters (in accordance with the panel properties as outlined within Section 1.1.3):

- PV cells located at a height of four metre above ground level, consisting of solar glass with anti-reflection surface treatment
- Single-axis tracking rotation aligned on a north-south axis with a range of +/- 60° from vertical.

An assumption has been made that once the panels reach their maximum tracking angle, they remain in this position until the sun has set.

Impacts were assessed against visual receptors travelling along the Newell Highway, local access roads in close proximity to the project, and key locations such as residential receptors as shown in Figure 61. A viewing height of 1.5 m was assigned to each visual receptor travelling within a car and 1.76 m to each residential receptor within a dwelling.

[1] *C Protogeropoulos and A Zachariou. PHOTOVOLTAIC MODULE LABORATORY REFLECTIVITY MEASUREMENTS AND COMPARISON ANALYSIS WITH OTHER REFLECTING SURFACES. Paper submitted to the 25th European Photovoltaic Solar Energy Conference, 2010.*

[2] *C Protogeropoulos and A Zachariou. PHOTOVOLTAIC MODULE LABORATORY REFLECTIVITY MEASUREMENTS AND COMPARISON ANALYSIS WITH OTHER REFLECTING SURFACES. Paper submitted to the 25th European Photovoltaic Solar Energy Conference, 2010.*

The analysis software calculates the potential minutes of glare on observation receptors at different times of the day, with results indicating the type of glare, if any, and the amount of potential to cause flash blindness. The software classifies glare into three levels of ocular (eye) hazard, being:

- Green Glare: indicates the presence of glare however only a low potential for temporary after-image or flash blindness
- Yellow Glare: indicates the presence of glare however with a moderate potential for temporary after-image or flash blindness
- Red Glare: indicate the presence of glare with a high potential for permanent eye damage if observed.

Glare hazard is not the same for every person and therefore is difficult to define. Factors that may alter glare hazard include optical parameters (light intensity, angle of reflectance etc.), ocular/eye parameters (pupil diameter, focal length etc.) and size/distance from the glare source.

The glare analysis produced by the software does not account for physical obstructions between the receptor and the PV cells, including buildings, tree cover and geographical obstructions. Therefore, a worst-case scenario is calculated.

Refer to Appendix C for ForgeSolar Glare Analysis results.

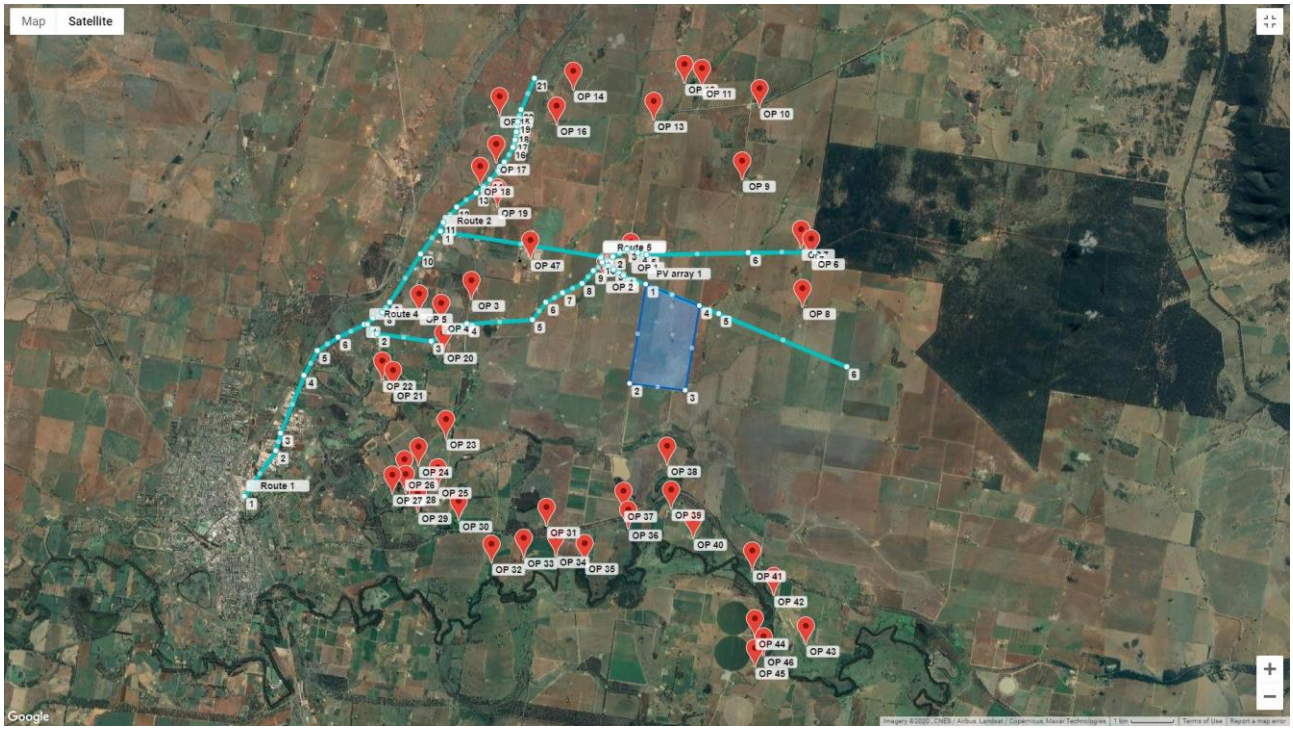


Figure 61 Input of the Solar farm site location and receptors into glare analysis software program (ForgeSolar)

10.4 Visual receptors and sensitivity to glare

There is a frequent use of the western section of Back Yamma Road (north west of the site), by a low number of users including locals, trucks, traders of livestock and visitors to Back Yamma State Forest. There is frequent use of Newell Highway (west of the site) which is a major highway. Views towards the project will be in the peripheral view of motorists travelling both north and southbound at a distance of over5km. The table below lists likely visual receptors and rates their likely sensitivity based on their activity or occupation of the area.

Table 21 Visual Receptors and Sensitivity to Glare

Land Use	Typical Receptor	Sensitivity to glare or glint
Back Yamma Road	Residents, livestock and agricultural workers, visitors	High. Given drivers require focus and visual clarity when driving, there is high sensitivity for reasons of safety.

Land Use	Typical Receptor	Sensitivity to glare or glint
Newell Highway	Motorists	High. Given drivers require focus and visual clarity when driving, there is high sensitivity for reasons of safety.
Troubalgie Road	Residents and agricultural workers	High. Given drivers require focus and visual clarity when driving, there is high sensitivity for reasons of safety
Forest Road	Residents and agricultural workers	High. Given drivers require focus and visual clarity when driving, there is high sensitivity for reasons of safety
Dwellings	Residents	Medium-High. Depending on the week (weekend or working day); seasonal (late afternoon sun during Summer months) and depending the duration residents are at home or working on the field.
Livestock Exchange	Traders	Medium. Depending the duration of the trading session.

10.5 Results

The assessment calculated zero minutes or 'no glare' predicted upon the any of the receptors within the study area as shown in Figure 61. Refer to Appendix C for full results.

10.5.1 Calculation results

Table 22 Glare Analysis Results

PV area	Tilt	Orientation	"Green" glare (low potential to cause flash blindness) Min.	"Yellow" glare (moderate potential to cause flash blindness) Min.
PV1	Single tracking	Single tracking	0	0

10.5.2 Glare analysis summary

Based upon the glare analysis, preliminary risk assessment, and with consideration of the assumptions outlined herein, the risk of glint and glare related impacts being experienced by receptors as a result of this project (as indicated in Figure 61) is considered nil due to the following factors and findings:

- Reflectivity associated with photovoltaic cells is typically less than commonly found objects within the surrounding area (e.g. motor vehicles, steel roofing, water)
- In order for glare-related impacts to be experienced, a direct line of sight to the photovoltaic cells is required. Vegetative screening is frequently in place between the location of the proposed solar farm site and receptors. This screening limits the availability of views and by extension limits the potential for glare-related impacts to be experienced from ground level by receptors.
- Screen planting is proposed on the solar farm and switchyard site

- The proposed use of a tracking system means that for the most part, the angle of reflectance from the photovoltaic cells will be relatively close to perpendicular to the surface of the cell itself. At times when the tracking system has reached the limit of its range of movement and the angle of incidence shifts away from the perpendicular (i.e. at sunrise and sunset) the reflected light will be reflected up and away from the ground. It is therefore assumed that, relative to ground level, reflected light will typically be reflected up and away from the ground at or near to a minimum of 30° relative to the horizontal.

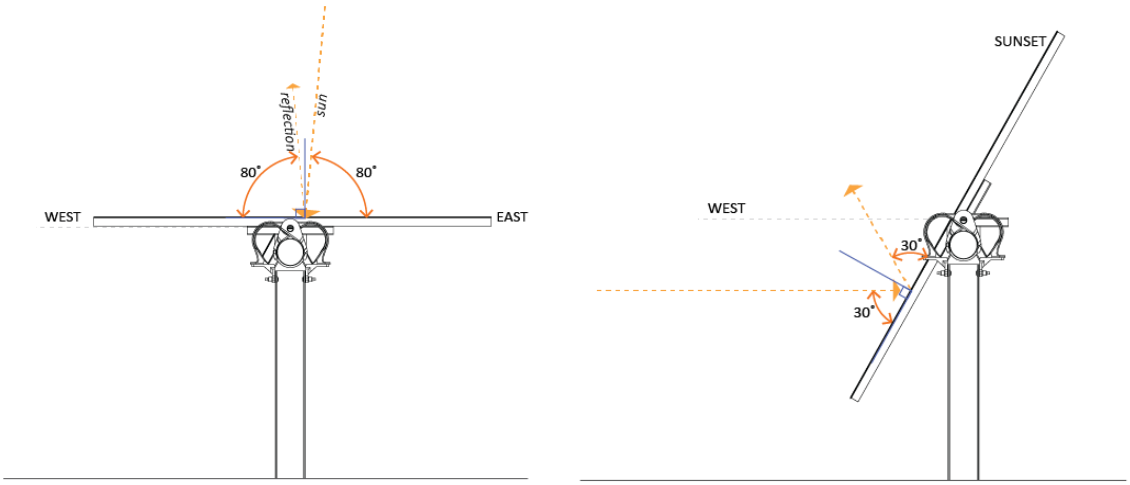


Figure 62 Typical daytime (left) and sunset/sunrise (right) reflection scenarios illustrating direction of reflection and associated glare

- The above qualitative findings are reinforced by the quantitative assessment undertaken using ForgeSolar assessment software which indicates that, for the assessed viewpoints as indicated in Figure 61, there is nil glare or glint experienced at any time throughout the year
- Whilst not explicitly assessed within this report, the above findings are expected to be consistent for the other visual receptors within the project environs.

11 Night Lighting Assessment

The solar farm site won't be permanently lit, with night lighting at the site to be limited to lighting for CCTV security cameras and security lighting at the O&M building.. If required, such lighting should be focused inward and it does not result in light spill impacting the surrounding area. Any lighting installed should be in accordance with *AS4228-1997 - Control of Obtrusive Effects of Outdoor Lighting*. Given the locations of neighbouring dwellings (Refer Figure 39) there is minimal potential for lighting impacts on the residences.

12 Summary of Findings

Following is a summary of the landscape and visual impacts which would potentially arise as a result of the Daroobalgie Solar Farm. Whether or not these impacts are perceived as being adverse, positive, or neutral is subjective and influenced by the unique perspectives of individual receptors.

12.1 Landscape impacts

The potential for direct impacts upon landscape character is restricted to LCT 1 (Agricultural Plains). The expected landscape impacts are outlined within Table 23.

Table 23 Summary of Landscape Impacts

LCT	Description	Visual Sensitivity	Magnitude of Landscape Change	Visual Impact Rating
LCT1	Agricultural Plains	Low	Noticeable change	**Minor**

The presence of the solar farm and associated infrastructure within LCT1 is not expected to result in a fundamental change in landscape character as the defining characteristics of the landscape (flat topography, pastures, riparian corridors, remnant vegetation and scattered native trees) will remain intact.

Indirect landscape impacts as a result of the project, upon LCT2 (floodplain), are expected to be negligible-minor due to the dense screening from the vegetation present within the floodplain and riparian corridor and the relatively small proportion of the field of view occupied by the PV cells and ETL from the distance approximately more than 1.5km.

Views towards the project experienced from within LCT3 (Forbes-Newell Highway industrial corridor), are typically limited by the inwardly focused visual nature of the industrial corridor and its existing built form, minimising the potential impacts upon landscape character within.

12.2 Visual impacts

The anticipated visual impacts, as a result from the project, have been assessed from ten representative public viewpoints. The expected landscape impacts are outlined within Table 24.

Table 24 Summary of Visual Impacts

Viewpoint No.	Location	Distance to Solar Farm Site	Distance to nearest ETL	Distance to switchyard site	Visual Sensitivity	Magnitude of Visual Change	Visual Impact Rating
1	Ashburnham Road	4.2 km	3.85 km	7.34 km	LOW	BARELY PERCEPTIBLE	**NEGLIGIBLE TO MINOR**
2	Back Yamma Road	2.55 km	1.15 km	5.48 km	LOW	BARELY PERCEPTIBLE	**NEGLIGIBLE TO MINOR**
3	Intersection of Kooringle and Back Yamma Roads	1.5 km	2.39 km	9.8 km	LOW	BARELY PERCEPTIBLE	**NEGLIGIBLE TO MINOR**
4	Troubalgie Road	0.03 km	0.4 km	7.8 km	LOW	CONSIDERABLE CHANGE	**MINOR TO MODERATE**
5	Intersection of Newell Highway and Forest Road	6.35 km	0.58 km	1.40 km	LOW	BARELY PERCEPTIBLE	**NEGLIGIBLE TO MINOR**
6	Forest Road	3.40 km	0.22 km	4.27 km	LOW	NOTICABLE CHANGE	**MINOR**

Viewpoint No.	Location	Distance to Solar Farm Site	Distance to nearest ETL	Distance to switchyard site	Visual Sensitivity	Magnitude of Visual Change	Visual Impact Rating
7	Littles Road	4.57 km	3.42 km	4.88 km	LOW	BARELY PERCEPTIBLE	**NEGLIGIBLE TO MINOR**
8	The Escort Way	2.75 km	4.75 km	9.43 km	LOW	BARELY PERCEPTIBLE	**NEGLIGIBLE TO MINOR**
9	Newell Highway	5.75km	0.14 km	1.90 km	LOW	BARELY PERCEPTIBLE	**NEGLIGIBLE TO MINOR**
10	Daroobalgie Road	8 km	0.35 km	0.31 km	LOW	BARELY PERCEPTIBLE	**NEGLIGIBLE TO MINOR**

The consistent landscape character of the study area (LCT 1 Agricultural Plains) typically results in a commensurately uniform set of viewing conditions across the study area, with minor variations occurring as a result of the varying extent localised vegetation. This, coupled with little variation in the type of visual receptors whom will experience views (local residents and workers predominating and also being the most sensitive due to their familiarity with their surroundings and the frequency with which they experience views), means that the major defining factor in the level of visual impact expected from individual representative viewpoints is the proximity of the viewpoint to the solar farm site PV cells.

The greatest levels of impact are expected from representative public viewpoint 4 (minor to moderate). This is close to the project, meaning that the PV Cells and/or associated infrastructure are clearly noticeable within the views and, in occupying a large proportion of the view, form a considerable change in visual character when compared to the existing conditions.

The potential for visual impacts lessens with distance from the project, with the other public viewpoints assessed as only having negligible to minor potential impacts. From these viewpoints, the PV cells or associated infrastructure typically appear as smaller elements within the view or are screened from view and therefore exert less influence upon the existing visual character.

12.3 Cumulative impacts

Given the relative isolation of the project relative to the nearest approved / planned solar farm projects (~25 km), the potential for simultaneous or sequential viewing to be experienced is negligible. Therefore, it is considered that both local and regional scale cumulative impacts will be negligible.

12.4 Glare analysis

The modelling results as calculated from the 'ForgeSolar' software, indicates that no glare is expected to be experienced from the project.

12.5 Night lighting

The only lighting proposed are lighting for CCTV security camera and maintenance purposes and security lighting at the O&M building. This night lighting would be inwardly focused and does not result in light spill impacts to neighbouring properties.

13 Potential for Mitigation

13.1 On-site mitigation

The scale of the PV cells (up to four metres in height) means that on-site mitigation (i.e. within the boundary of the solar farm site itself) can be employed to effectively mitigate landscape and visual impacts upon the surrounding landscape and associated receptors. Strategic vegetative planting can be employed to screen views towards the project and therefore reduce visual impacts experienced by nearby receptors.

On-site mitigation, if or as required, should focus upon screening the PV panels as well as elements such as substations, and the switchyard. Continuous buffer planting along the boundary of the solar farm site in the direction of sensitive receptors is considered an adequate measure to screen the PV panels from external view. Additionally, ancillary buildings should wherever possible be constructed in an architectural style which reflects the overriding vernacular of the rural landscape. Materials and colours utilised in ancillary buildings, battery storage and associated infrastructure should be non-reflective and should be painted in neutral colours to ensure that visual impacts are minimised.

In the case of the Daroobalgie Solar Farm, it has been identified that the most significant visual impact when viewed from the public domain is from locations along Troubalgie Road where solar farm is in close proximity to the boundary and where there is little existing vegetation of a sufficient scale to screen or fragment views. In addition, ancillary buildings and ETL infrastructure located on the north western corner of the solar farm site will also be the most significant visual impact when viewed from the locations along where Troubalgie Road runs west to intersect with Forest Road and Back Yamma Road. A landscape mitigation plan has been prepared (Appendix D) and details the location and type of planting recommended at the solar farm site. The plan suggests a total planting zone of approximately five metres wide or equivalent to two rows of native shrubs mix, is positioned between the property boundary and the security fencing in locations where there is no existing vegetation and where the arrays or ancillary infrastructure are immediately adjacent to viewpoints in the public domain.

In the case of the switchyard site at Daroobalgie Road, it has been identified that the most significant visual impact would be when viewed in close proximity to the site from Daroobalgie Road and where there is no roadside vegetation to screen views from the users of the road. A landscape mitigation plan for the switchyard site (Appendix D) details the location and type of planting recommended.

To ensure that the screen planting integrates into the existing landscape character, the screening should be planted with a mix of endemic tree and shrub species and the tree planting layout should be planted in groups of two to three at random spacing of 15-20 m to match the landscape character of the remnant vegetation as described in Section 6.1.5.

To ensure that the screen planting is successful all landscape works should be maintained regularly for a period of 24 months. Maintenance should generally include the removal of weeds and replacement of dead or non-performing plants.

13.2 Off-site mitigation

Viewpoints that may warrant such mitigation include nearby residential dwellings with direct views towards the project, from which views cannot be adequately screened by screen planting within the boundary of the project itself. In the context of this project however, it is considered that the most effective screening method would be to employ on-site boundary screening within the solar farm site itself. As such, off-site screening should only be employed where this is not feasible or adequate and it has been requested by the residential owner..

If or where appropriate, off-site mitigation should be focused in locations where sensitive receptors are expected to experience views frequently or for long durations, such as from dwellings or outdoor gathering/entertaining spaces.

It should be noted that viewpoints from private properties have not been assessed within this report, rather, representative public viewpoints, considered indicative of the views that may be experienced from the immediate surrounding area, have been assessed in their place. Consultation with land owners to date have not identified a need for off-site mitigation however this will be considered if requests for off-site screening from impacted landholders are received...

13.3 Mitigation for glare

Dwellings, roads and the Forbes Central West Livestock Exchange have views towards the project's PV cells, however based upon the analysis, these locations are unlikely to experience solar glare. Refer to Section 10 for glare analysis results.

Should mitigation for glare be required however, the vegetative screening suggested above is considered adequate. By eliminating a direct line of site to the PV cells, associated glare is also screened.

14 References

C Protogeropoulos and A Zachariou (2010), *Photovoltaic module laboratory reflectivity measurements and comparison analysis with other reflecting surfaces. Paper submitted to the 25th European Photovoltaic Solar Energy Conference, 2010.*

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Western Australian Planning Commission (2007), *Visual Landscape Planning in Western Australia; a manual for evaluation, assessment, siting and design.*

Appendix A Detailed Study Methodology

Introduction

There is no accepted national or state level published guidance on landscape and visual amenity impact assessment specific to Australia. Therefore, the industry typically refers to guidance from elsewhere to produce a method for producing landscape and visual assessments. The method for this assessment has been developed with reference to current accepted practice as derived from:

- The Landscape Institute (LI) and the Institute of Environmental Management and Assessment (IEMA), UK (2002) Guidelines for Landscape and Visual Impact Assessment, Second Edition.

Other relevant guidance notes and documentation considered include:

- Western Australian Planning Commission (2007) Visual Landscape Planning in Western Australia; a manual for evaluation, assessment, siting and design.
- The United State Department of Agriculture Forestry Service (1995), Landscape Aesthetics: A Handbook of Scenery Management.
- The Landscape Institute, UK (2009) Landscape Institute Advice Note 01/11: Use of photography and photomontage in landscape and visual assessment.
- Scottish Natural Heritage and the Countryside Agency, UK (2006) Topic Paper Six: Techniques and Criteria for Judging Capacity and Sensitivity.

The resultant landscape and visual impact assessment method recognises the full range of natural and cultural components of the landscape. It is therefore necessary to identify the elements of the project that could negatively or positively affect these landscape and visual values, identify the components of the landscape that would be affected, and then develop visual and landscape strategies to mitigate impacts.

These strategies take into consideration a variety of viewpoints and landscape typologies and how people are likely to visually experience the proposal.

Phase A: Establish existing landscape and visual character baseline

The purpose of this phase is to understand the key parameters against which the project will need to be assessed in relation to landscape and visual amenity issues.

Identify the study area

The extent of the study area is determined by the distance at which it is considered that the PV cells will become either indiscernible to the human eye, or will occupy such a small proportion of the visual field of view that impacts could be considered negligible. This distance is directly related to the size of the PV cells and the viewing properties of the typical human eye.

Figure 63 illustrates the typical vertical field of view properties of the human eye. When standing, the human eye can discern detail within a typical 10° vertical field of view.

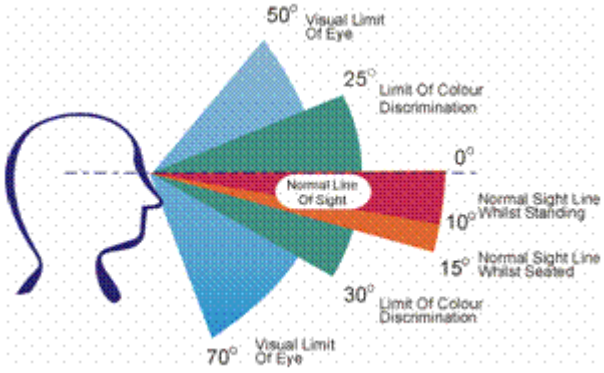


Figure 63 Typical vertical field of view of the human eye (Image source: Panero & Zelnik)

For the purposes of this study, the study area has been defined as the point at which PV cell occupies <5% of the vertical field of view of the human eye (at a typical 10° detailed vertical field of view when standing, this equates to a viewing angle of 0.5°). Beyond this distance, whilst the PV cells may be visible to the naked eye, it is considered that the magnitude of change within the broader landscape would be imperceptible to the typical viewer (particularly so given the highly modified character of the existing landscape setting).

The study area has therefore been defined as the land within a radius of 10 kilometres from the location of each of the proposed PV cell area location. This area captures the majority of the ZTVI mapping.

Review of legislation and planning policy

A review was undertaken of the key planning designations, policies and guidance relating to landscape and visual amenity within the study area at the national, state and local level.

The emphasis of this assessment was to identify elements outlined within legislation, policy and planning documents relevant to landscape and visual character and identity of the study area. This identifies and describes key designations and issues noted in policy that are directly relevant to landscape and visual amenity values as well as those that are considered indirectly relevant to landscape and visual amenity to a significant degree. Although many of the designations and policies do not strictly relate to maintaining and enhancing landscape character and visual amenity, their intentions potentially influence and affect the landscape and visual resource within the study area. The discussion of relevance to the current assessment considers the following key issues:

- Whether the purpose of the designation is related to the protection/management of landscape and/or visual values
- If the project has potential to theoretically directly or indirectly affect those landscape/visual values for which it has been designated - depending on the nature of the specific values this may be affected by factors such as proximity, the presence of intervening landform that may restrict inter-visibility, probable levels of recreation use etc.

Desktop analysis of the landscape and visual resource

The first task of this phase involved gathering existing data and other information for the landscape located within and adjacent to the study area. Key information sources include:

- Legislation and planning schemes from relevant local councils (see above)
- Digital aerial photography
- Cadastral data (showing roads and all major features, built areas, etc.)
- GIS mapping, including hydrology/riparian corridors, land use, geology, vegetation and contour/topographical data
- The NSW Heritage Database
- Existing landscape character assessment studies
- Background studies, reports and data available from Pacific Hydro.

Using this data, a preliminary assessment of the landscape and visual resource was undertaken and used to inform the field survey. This included analysis of the underlying landscape (hydrology and landform), land cover (e.g. vegetation, land use, settlement pattern etc.), landscape value (e.g. reflected in scenic routes/trails and landscape designations including national parks and conservation reserves), and desk-based site analysis (e.g. identification of recognised panoramas and views, key landmarks, and local peaks).

Where appropriate, Geographic Information System (GIS) analysis was undertaken to assist the assessment e.g., preparation of Digital Elevation Models (DEM) and landform analysis. Following this, draft landscape character types were created which formed the basis of field verification.

Prepare Zone of Theoretical Visual Influence (ZTVI) Assessment

The desktop assessment process was also informed by production of a 'Zone of Theoretical Visual Influence' (ZTVI) map (also known as a 'Zone of Visual Influence', 'Visual Envelope Map' or 'Viewshed') to indicate what areas are likely to have views of the project.

The ZTVI studies are computer–generated analyses which identify land in the study area from which it is theoretically possible to view any part of the project. These have been used primarily to guide the area of field work and representative viewpoint selection and to run comparison studies.

ESRI ArcGIS software was used to model the ZTV of the project. A digital elevation model (essentially a 3D terrain model) was produced using a combination of 1m contour intervals within the immediate vicinity of the PV cells, and 10m contour intervals for the wider study area. An elevation model with a cell size of 5x5m was produced (derived from LiDAR point data), which translates to the model having a uniform elevation for every 5x5m unit on the ground within the study area. A viewing height of 1.8m is assumed.

- One ZTV was produced depicting the entire swept path of the PV cells (a height of four metre).

The GIS software used then digitally determines the likely extent over which the feature would be visible or not visible.

In interpreting the ZTVI, the following issues must be considered:

- It only takes account of the topographic constraints on the view and does not include land cover factors such as the presence of buildings and vegetation. As it only uses the landform it is considered a worst-case scenario of potential extents of visibility
- It does not consider the effect of distance. Generally, the greater the distance from the project, the lower the impact, as the development will take up a smaller portion of the view and atmospheric conditions reduce the prominence of the project within the view
- The ZTVI is only accurate to the resolution of the elevation model; in this case this resolution is 5x5m. This translated to every 5x5m cell on the ground giving a binary value of seeing the object or not seeing the object
- It should be noted that the ZTVI assessment does not provide any qualitative assessment of anticipated visual impacts.

Field survey to verify and refine understanding of the landscape and visual resource

A one-day site visit was undertaken on the 23rd of July 2020 and attended by one Landscape Architect experienced in landscape and visual impact assessment. The purpose of the field visits was to:

- Take photographs and ground truth the findings of the desktop assessment
- Assess and portray landscape character
- Refine the viewpoint assessment and selection of viewpoints
- Obtain data for the production of photographic simulations and visualisations.

The field visits focused on those aspects of the landscape with potential to be of the greatest sensitivity to the proposals, and on gaining an appreciation of those aspects of the proposals most likely to affect landscape and/or visual values. Records were made in the form of Global Positioning System (GPS) point data, field notes and photographs.

Viewpoints were selected in a variety of landscape types to represent a range of views and types of viewers likely to be affected by the project. The location of each viewpoint was recorded on site using a hand-held GPS. Photographs were taken with a digital single lens reflex (SLR) camera and 30 mm digital lens set to the equivalent of a 50 mm focal length lens on a 35 mm film camera and were used to feed into the visualisation process. Adobe Photoshop was used to piece together the adjoining images.

Definition, description and illustration of the landscape baseline

A landscape assessment, based on the findings of the desk and field investigation, was undertaken to describe the existing landscape and visual values within the study area. Key aspects considered include:

- Landform and topography
- Geological features
- Land use patterns
- Vegetative cover
- Hydrology.

Definition, description and illustration of the visual baseline

A visual assessment, based on the findings of the desktop and field investigation, was undertaken to determine the important views and view sheds within the study area. Key aspects considered (with reference to specialist technical studies where available at the time of assessment include:

- Views and view sheds for the study area
- The relative importance or significance of the views and view sheds
- The location of the project in relation to these views.

The visual baseline has been assessed and described in terms of views from selected representative viewpoints within the study area.

Landscape character assessment

Based on the outputs of the visual and landscape baseline, a landscape character assessment was undertaken. In brief, this assessment considers the way different components of the environment – both natural (the influences of geology, soils, climate, flora and fauna) and cultural (the historical and current impact of land use, settlement, enclosure and other human interventions) – interact together and are perceived to form a distinct pattern.

This approach has been used to establish a baseline audit of the current character of the landscape within the study area and to provide a framework for measuring the impact of the proposals. Using this approach, broad 'Landscape Character Types' (LCTs) have been defined and provide a framework for describing the area systematically, ensuring judgements can be made based on knowledge of what is distinctive so that changes can respect local character, where possible. An understanding of landscape character can be particularly helpful in informing the siting of new elements in the landscape and assist with identifying which types of mitigation may assist in integrating the project in the landscape.

Each character type identified represents a relatively homogenous character based on the consideration of the following attributes:

- Landscape value (e.g., landscapes designated for their scenic or landscape importance or valued recreational function)
- Landscape elements that contribute to defining character e.g., pasture, crops, drainage channels, river/creek corridors, bushland, mature bushland corridors alongside roads, cultural plantings (e.g., planting along property entrance drives) etc.
- Landscape character attributes (including scale, grain and perceptual characteristics such as the sense of remoteness, tranquillity and/or its perceived rural character).

The baseline assessment also considers factors which have influenced landscape change in the past and those that are likely to do so in the future e.g. recreational demands, changing agricultural practices, development pressures.

Phase B: Evaluation of the Impacts on the Landscape and Visual Resource

The purpose of this phase was to comparatively evaluate how the landscape and visual baseline (identified in Phase A) is likely to be affected by the project.

Identification of landscape sensitivity

The sensitivity of a landscape is judged based on the extent to which it can accept change of a particular type and scale without adverse effects on its character. Sensitivity varies according to the type of development and the nature of the landscape, including:

- Its inherent landscape value (its condition, perceptual qualities, cultural importance, and any specific values that may apply e.g. landscape planning designations)
- The likely congruency of the proposed change (i.e., the extent to which the proposal may fit or be 'visually absorbed' into the scale, landform, land use, pattern, texture of the existing landscape).

Identification of visual sensitivity

For the purposes of this assessment, the sensitivity of the viewers at the viewpoints is considered to be dependent upon factors including:

- The importance of the view i.e. the scenic qualities of the view, including the presence of other existing manmade elements in the view. Views can be assessed as being of national, state, regional, local or less than local importance as described in Table 25 below
- Viewer exposure, typically assessed by measuring the number of viewers exposed to the resource change, type of viewer activity, the duration of their view, the speed at which the viewer moves, and the position of the viewer
- The nature of the visual receptor (type and volume of sensitive receptors or viewers) experiencing the view. Viewer sensitivity is defined both as the viewer's concern for scenic quality and their response to change in the visual resources that make up the view. Local values may infer visual significance on landscape components and areas that would otherwise appear unexceptional in a visual resource analysis. Residents and visitors to important/valued landscapes are considered to have a higher sensitivity to their visual environment than, say, visitors to non-designated areas or motorists passing through the landscape.

Table 25 Levels of Visual Importance

Importance	Indicator
National visual importance	A heavily experienced view to a national icon, for example, views of the Twelve Apostles; the view to Parliament House, Canberra, down Anzac Parade, or views to Uluru.
State visual importance	A heavily experienced view to a feature or landscape that is iconic to the state, for example, views along the Yarra River in Melbourne.
Regional visual importance	A heavily experienced view to a feature or landscape that is iconic to a major portion of a city or non–metropolitan region, an important view from an area of regional open space, or a heavily used viewpoint from which a wide region can be viewed. For example, a view to Wollongong from Mount Keira, a view of the Bulahdelah Mountain from Pacific Highway.
Local visual importance	A view experienced by concentrations of residents and/or local recreational users, and/or road and rail users, for example, views from residential areas to a local golf course.

Importance	Indicator
Less than local visual importance	Views experienced by residents, workers, road/rail users, or from recreational areas where visual amenity is not a primary value.

Both landscape and visual sensitivity is described as being negligible, low, medium, or high, as defined and illustrated in Table 26 (landscape impacts) and Table 27 (visual impacts). It is noted that these tables are intended as a guide to the process only. The classifications are illustrative, as there is no defined boundary between levels of sensitivity.

Identification of magnitude of change

This step involved prediction of the magnitude of change in the landscape or the view that may result from the project.

The magnitude of change affecting a landscape or visual receptor depends on the nature, scale and duration of the particular change that is expected to occur. It describes the extent of change and identifies elements which are removed or added, changed in colour or texture, and compatibility of new elements with the existing landscape. Visual modification can result in an improvement or reduction in visual amenity.

With regard to impact on landscape character types, the magnitude assessment assumes a worst-case scenario and the assessment is based upon the area of LCT which would be impacted to the greatest extent by the project. The effect on a view will depend on the extent of visibility, degree of obstruction of existing features, degree of contrast with the existing view, angle of view, duration of view and distance from the development.

Magnitude of change is described as being barely perceptible (negligible), noticeable (low), considerable (medium) or dominant (high), as defined and illustrated in Table 26 (landscape impacts) and Table 27 (visual impacts). It is noted that these tables are intended as a guide to the process only. The classifications are illustrative, as there is no defined boundary between levels of magnitude.

Given that the purpose of the current assessment is to assess the potential impacts associated with the varied project relative to the current approved permit, all discussions and judgements made on the magnitude of change and associated impact ratings are made *relative to the current approved permit.*

Evaluation of significance of change

This step involved evaluation of the significance of landscape and visual impacts based on the sensitivity of the landscape or viewer to change and the magnitude of change. No established, measurable technical thresholds of significance exist for landscape and visual (The Landscape Institute and Institute of Environmental Management and Assessment, 2002). Significance is therefore determined by considering the sensitivity of the landscape or visual receptor and the magnitude of change expected as a result of the development.

Professional judgement and experience are applied on a case by case basis in order to identify broad levels of significance for each receptor. Each case is assessed on its own merits as factors unique to each circumstance need to be considered. However, there are general principles which can be used as a guide to this process, which provide transparency about how judgements have been made. These are set out in the following diagram (Figure 64) and Table 26 (landscape impacts) and Table 27 (visual impacts).

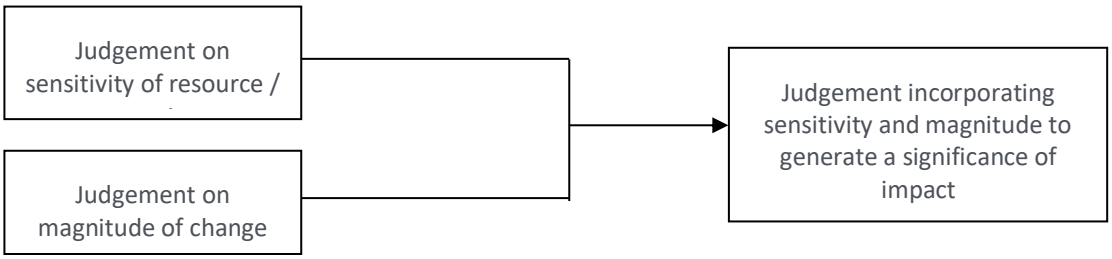


Figure 64 Approach to evaluating the significance of change

The impacts identified can be adverse, beneficial, neutral or, under some circumstances, subjective. The following provides a summary of each scenario:

- **Adverse** – a visual change that is likely to be perceived as unfavourable by most affected viewers e.g., the loss of vegetation and replacement by an industrial plant

- **Beneficial** – a visual change that is likely to be perceived as favourable or advantageous by most affected viewers e.g., installation of screening which improves an existing unfavourable view
- **Neutral** – a visual change that is likely to be perceived as neither favourable nor unfavourable by most affected viewers
- **Subjective** - This applies to situations where there are likely to be mixed opinions, making consultation the only suitable way to define effects e.g., replacement of farmland with forest.

Table 26 Evaluating the significance of Landscape Impacts

LANDSCAPE IMPACT ASSESSMENT			Magnitude of change in landscape caused by development			
			Dominant change	**Considerable change**	**Noticeable change**	**Barely perceptible change #**
			A clearly evident and frequent/continuous change in landscape characteristics affecting an extensive area, which is likely to fundamentally change the character of the landscape.	A considerable change in landscape characteristics, frequent or continuous and over a wide area or a clearly evident change, but over a restricted area.	A noticeable change in landscape characteristics over a wide area or a considerable change over a restricted area, but will not fundamentally change the character of the landscape.	An imperceptible, barely or rarely perceptible change in landscape characteristics.
Sensitivity of landscape to proposal		**Indicator**				
	High	A landscape protected by national designation and/ or widely acknowledged for its quality and value; a landscape with distinctive character and low capacity to accommodate the type of change envisaged.	**Major***	**Moderate to major***	**Moderate**	**Negligible to Minor**
	Medium	A moderately valued landscape, perhaps a regionally important landscape and / or protected by regional/state designation, or where its character, land use, pattern and scale may have some capacity to accommodate a degree of the type of change envisaged.	**Moderate to major***	**Moderate**	**Minor to moderate**	**Negligible to Minor**
	Low	A landscape valued to a limited extent, perhaps a locally important landscape or where its character, land use, pattern and scale is likely to have the capacity to accommodate the type of change envisaged.	**Moderate**	**Minor to moderate**	**Minor**	**Negligible to Minor**
	Negligible	A landscape which is not valued for its scenic quality or where its character, existing land use, pattern and scale are tolerant of the type of change envisaged, and the landscape has capacity to accommodate change.	**Minor to moderate**	**Minor**	**Negligible to Minor**	**Negligible**

* Denotes the most significant impacts for consideration by decision makers

Note: If *no* changes would be perceptible a significance of **No Impact** is recorded.

Table 27 Evaluating the significance of Visual Impacts

VISUAL IMPACT ASSESSMENT			Magnitude of change in views caused by development			
			Dominant change	**Considerable change**	**Noticeable change**	**Barely perceptible change #**
			Major changes in view, typically at close distances and/or affecting a substantial part of the view, continuously visible for a long duration, or obstructing a substantial part or important elements of view.	Clearly perceptible changes in views, typically at intermediate distances and/or resulting in either a distinct new element in a significant part of the view, or a wider ranging, less concentrated change across a wider area.	Minor changes in views typically at longer distances or visible for a short duration, and/or are expected to blend in with the existing view to a moderate extent.	Change which is barely visible, typically at a very long distance and/or visible for a very short duration, and/or are expected to blend with the existing view.
Sensitivity of viewpoints to proposal	High	**Indicator** Large numbers of viewers or those with proprietary interest and prolonged viewing opportunities such as residents and users of attractive and/ or well-used recreational facilities. Views from a regionally important location such as a scenic lookout whose interest is specifically focussed on the landscape	**Major***	**Moderate to major***	**Moderate**	**Negligible to Minor**
	Medium	Medium numbers of residents and moderate numbers of visitors with an interest in their environment e.g. visitors to State Forests, including bush walkers, horse riders, trail bikers. Larger numbers of travellers with an interest in their surroundings.	**Moderate to major***	**Moderate**	**Minor to moderate**	**Negligible to Minor**
	Low	Small numbers of visitors with a passing interest in their surroundings e.g., those travelling along principal roads. Viewers whose interest is not specifically focussed on the landscape e.g., workers, commuters.	**Moderate**	**Minor to moderate**	**Minor**	**Negligible to Minor**
	Negligible	Very occasional numbers of viewers with a passing interest in their surroundings e.g., those travelling along minor roads e.g., those travelling along minor routes.	**Minor to moderate**	**Minor**	**Negligible to Minor**	**Negligible**

* Denotes most significant impacts for consideration by decision maker's

#: If ***no* changes** would be perceptible a significance of **No Impact** is recorded.

Note: Distances identified in the magnitude of change are project specific

Prepare Photo Montages

The use of photo montages play an important part in visual impact assessments to convey the proposals to the assessors, decision makers and the local community.

A photo montage is a technique whereby an image of the project is produced using an existing photograph, overlayed with the project, to provide an indicative representation of the scheme. The process entails inserting a computer–generated model of the proposal into a photograph taken from a geographically referenced viewpoint, using existing elements of a known size, location and scale to suitably locate the digital representation within the photograph.

Visualisations have been compiled from locations agreed with Pacific Hydro to appreciate the potential visual impact of the presence of the project from a number of representative viewpoints. These have been created from the baseline viewpoints, using 2D and 3D AutoCAD drawings issued by Pacific Hydro in combination with 3D modelling software and Photoshop for rendering.

The process and parameters adopted in the development of the photo montages are as follows:

1. Georeferenced photographs were obtained from each of the Representative Public Viewpoints. Photographs were captured on a Canon EOS 50D at a focal length of 35mm. Based upon the 1.5 crop sensor of this camera, this equates to a 50mm focal length on a 35 mm equivalent camera, which is broadly considered to replicate the viewing conditions of the human eye. Several overlapping photographs were taken covering a horizontal field of view of 124 degrees (equivalent width of 3.45 photographs) to replicate the field of view of the human eye
2. The photographs are then stitched together in Photoshop. It is acknowledged that some distortion can occur at the edges of individual images with this process. We therefore overlap, rather than automatically stitch the photographs. The photos are inserted into a template sized to meet the 124° field of view at 420.62 centimeter (cm) wide x 67.2cm high, based on the size of the photograph
3. A 3D base model is prepared in Rhino and 3ds max software by loading an online digital map of the project location, using a local Ordnance Survey. Terrain data together with elevation and roughness is included in this survey
4. The PV cells are positioned in the model, as proposed project layout, using the georeferenced locations provided by Pacific Hydro proposed layout plan. The proposed PV cells for the Daroobalgie solar farm site are approximately four metres in height and we have allowed a 0.5 m ground clearance. The elevation at which these are placed is set by the TIN data calculated by the elevation survey data in the base model
5. The substation and associated infrastructure such as transmission towers are based on indicative 3d that have been scaled to be consistent with constructed projects. Exact models will be determined during detailed design phase once a construction partner has been appointed by Pacific Hydro
6. GPS photographs taken from representative viewpoints provide the geocoordinates, based on camera information matching view aspect and focal length. The GPS photographs are also used as control, to check the placement and scale of the rendered proposal, to panoramic renders
7. The render settings are inputted to match the date and time that the photograph was taken. The PV cells are rendered at their maximum height, thus presenting a ‘worst case’ visual scenario
8. The PV cells are then rendered and imported into Adobe Photoshop. The PV cells are then masked where they fall behind objects in the image, to give a realistic impression of the PV cells sitting in the landscape.

Note that the images produced are indicative only to illustrate the development from a handful of representative public viewpoints. The views selected within this analysis were chosen based upon the ZTVI analysis, identification of sensitive receptors and on-site observations and are likely to represent locations from which the project will be most highly visible.

Prepare Glare Analysis

A software program specialising in glare analysis (ForgeSolar) has been used to calculate glare results, based on input of the following parameters:

- Photovoltaic cells located at a height of 1.5 m above ground level, consisting of solar glass with anti-reflection surface treatment
- Single-axis tracking rotation aligned on a north-south axis with a range of +/- 60° from vertical.

An assumption has been made that once the panels reach their maximum tracking angle (+/- 60° from vertical), they remain in this position until the sun has set.

Impacts were assessed against visual receptors located at approximate 500m intervals along the adjacent roads. A viewing height of 1.5 m was assigned to each visual receptor.

The analysis software calculates the potential minutes of glare on observation receptors at different times of the day, with results indicating the type of glare, if any, and the amount of potential to cause flash blindness. The software classifies glare into two types, either Green Glare (low potential for temporary after-image), or Yellow Glare (potential for temporary after-image).

The glare analysis does not account for physical obstructions between the receptor and the PV cells, including buildings, tree cover and geographical obstructions. Therefore, the worst-case scenario is calculated. Refer to Appendix C for ForgeSolar Glare Analysis results.

Prepare Landscape and Visual Impact Assessment report

This stage entailed compilation of the landscape and visual impact assessment report, based on the assessment methodology described above. Using text, figures, tables and illustrations as required, this report sets out the findings and outcomes of the study and presents conclusions regarding the landscape and visual impacts associated with the project.

Appendix B Representative Public Viewpoint Photo Montages

Appendix B Representative Public Viewpoint Photo Montages



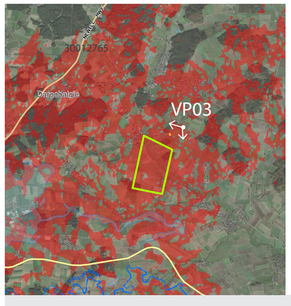
VIEWPOINT 3 - Existing conditions



VIEWPOINT 3 - PHOTO MONTAGE: Solar Array



VIEWPOINT 3 - PHOTO MONTAGE (proposed view with vegetation screening)



LOCATION DATA REFERENCE

VIEWPOINT: 03

LOCATION: Kooringle Road

RATIONALE: Local Road

COORDINATES: 33°19'35.24"S 148° 8'16.46"E

ELEVATION: 255m

DISTANCE TO SOLAR FARM: 1.5 km

NOTE:
The depiction of the electrical elements contained in the substations; BESS storage and O&M facility, are indicative only demonstrating likely 'worst-case' scenario and subject to detailed design.

Daroobalgie Solar Farm

Proposed viewpoints

Date: 22/4/2021 | Revision: B
SMEC Project Reference: 30012765 | Drawing: LP001
Drawn by: D.Ong| Checked by: S.OCallaghan

SMEC
Member of the Surbana Jurong Group

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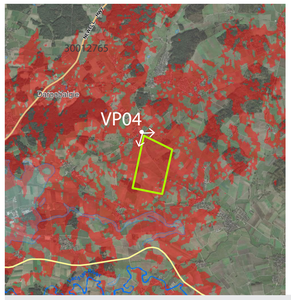
VIEWPOINT4 - Existing conditions



VIEWPOINT4 - PHOTO MONTAGE: Solar Array



VIEWPOINT 4 - PHOTO MONTAGE: (proposed view with vegetation screening)



LOCATION DATA REFERENCE

VIEWPOINT: 04

LOCATION: Toubalgie Road

RATIONALE: Local Road abutting north boundary of solar farm

COORDINATES: 33°19’54.69”S 148° 6’45.01”E

ELEVATION: 249m

DISTANCE TO SOLAR FARM: 0.03 km

NOTE:
The depiction of the electrical elements contained in the substations; BESS storage and O&M facility, are indicative only demonstrating likely ‘worst-case’ scenario and subject to detailed design.

Daroobalgie Solar Farm

Proposed viewpoints

Date: 22/4/2021 | Revision: B
SMEC Project Reference: 30012765 | Drawing: LP001
Drawn by: D.Ong| Checked by: S.OCallaghan

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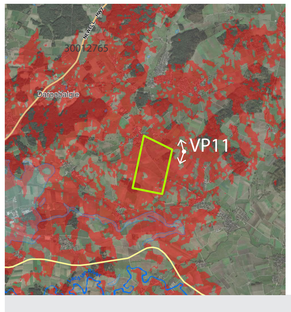
VIEWPOINT 11 - Existing conditions



VIEWPOINT 11- PHOTO MONTAGE Solar Array



VIEWPOINT 11 - PHOTO MONTAGE (proposed view with vegetation screening)



LOCATION DATA REFERENCE

VIEWPOINT: 11

LOCATION: Troubalgie Road

RATIONALE: : Local Road abutting north boundary of solar farm

COORDINATES: 33°20’17.20”S 148° 7’51.66”E

ELEVATION: 250m

DISTANCE TO SOLAR FARM: 0.12 km

NOTE:
The depiction of the electrical elements contained in the substations; BESS storage and O&M facility, are indicative only demonstrating likely ‘worst-case’ scenario and subject to detailed design.

Daroobalgie Solar Farm

Proposed viewpoints

Date: 22/4/2021 | Revision: B
SMEC Project Reference: 30012765 | Drawing: LP001
Drawn by: D.Ong| Checked by: S.OCallaghan

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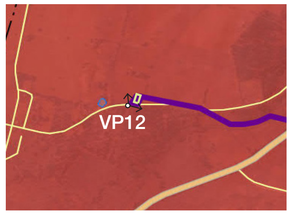
Existing conditions



PHOTO MONTAGE (proposed view)



PHOTO MONTAGE (proposed view with vegetation screening)



LOCATION DATA REFERENCE

VIEWPOINT: 12
LOCATION: Daroobalgie Road
RATIONALE: Local Road
COORDINATES: 33°20’7.61”S 148° 1’51.31”E

ELEVATION: 251m
DISTANCE TO SWITCHYARD: 60m

NOTE:
The depiction of the electrical elements contained in the switchyard is indicative only and subject to detailed design.

Daroobalgie Solar Farm Switchyard

Proposed viewpoints

Date: 26/5/2021 | Revision: A
SMEC Project Reference: 30012765 | Drawing: LP002
Drawn by: D.Ong| Checked by: G.Tallentire

SMEC
Member of the Surbana Jurong Group

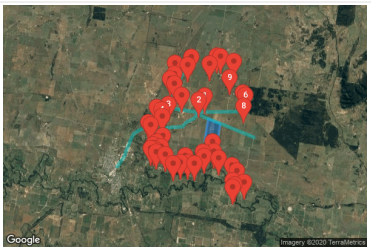
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Appendix C Glare Analysis Results

ForgeSolar

Site Configuration: Daroobalgie Solar Farm

Project site configuration details and results.



Created **Aug. 24, 2020 7:03 a.m.**
Updated **Aug. 24, 2020 9:04 a.m.**
DNI **varies** and peaks at **1,000.0 W/m^2**
Analyze every **1** minute(s)
0.5 ocular transmission coefficient
0.002 m pupil diameter
0.017 m eye focal length
9.3 mrad sun subtended angle
Timezone **UTC10**
Site Configuration ID: 42453.7675

Summary of Results No glare predicted!

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
PV array 1	SA tracking	SA tracking	0	0	-

Component Data

PV Array(s)

Note: PV array encompasses a large surface area (greater than 25 acres). Accuracy of path receptor glare analysis may be affected by footprint size. Additional analyses of array sub-sections may provide more information on expected glare.

Name: PV array 1
Axis tracking: Single-axis rotation
Tracking axis orientation: 0.0 deg
Tracking axis tilt: 0.0 deg
Tracking axis panel offset: 0.0 deg
Maximum tracking angle: 60.0 deg
Resting angle: 60.0 deg
Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad
Approx. area: 2,967,018 sq-m

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-33.333072	148.116091	250.49	1.50	251.99
2	-33.354332	148.111971	243.69	1.50	245.19
3	-33.355837	148.126305	244.54	1.50	246.04
4	-33.337769	148.129781	250.00	1.50	251.50



Route Receptor(s)

Name: Route 1
Route type Two-way
View angle: 50.0 deg



Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-33.378486	148.013237	240.00	1.50	241.50
2	-33.368738	148.021391	250.31	1.50	251.81
3	-33.365011	148.022593	253.44	1.50	254.94
4	-33.352680	148.028601	240.45	1.50	241.95
5	-33.347303	148.032034	243.74	1.50	245.24
6	-33.344435	148.037270	245.46	1.50	246.96
7	-33.341782	148.044051	244.91	1.50	246.41
8	-33.339201	148.048600	244.70	1.50	246.20
9	-33.336978	148.050574	250.14	1.50	251.64
10	-33.326648	148.058440	255.95	1.50	257.45
11	-33.319906	148.064363	258.29	1.50	259.79
12	-33.316571	148.067689	255.84	1.50	257.34
13	-33.313612	148.072731	259.54	1.50	261.04
14	-33.310761	148.076315	261.86	1.50	263.36
15	-33.307051	148.079929	269.86	1.50	271.36
16	-33.303895	148.082140	272.65	1.50	274.15
17	-33.302316	148.082676	277.00	1.50	278.50
18	-33.300541	148.083084	284.64	1.50	286.14
19	-33.298353	148.083341	288.98	1.50	290.48
20	-33.295770	148.084146	290.84	1.50	292.34
21	-33.289098	148.087590	290.29	1.50	291.79

Name: Route 2
Route type Two-way
View angle: 50.0 deg



Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-33.321742	148.063602	255.68	1.50	257.18
2	-33.327193	148.104801	244.32	1.50	245.82

Name: Route 3
Route type Two-way
View angle: 50.0 deg



Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-33.327224	148.104727	244.47	1.50	245.97
2	-33.327260	148.107688	246.12	1.50	247.62
3	-33.325646	148.111336	248.23	1.50	249.73
4	-33.326399	148.114126	248.84	1.50	250.34
5	-33.326794	148.116314	250.00	1.50	251.50
6	-33.326399	148.142450	258.83	1.50	260.33
7	-33.326184	148.159380	265.06	1.50	266.56

Name: Route 4
Route type Two-way
View angle: 50.0 deg



Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-33.341738	148.044811	243.38	1.50	244.88
2	-33.343674	148.047300	238.24	1.50	239.74
3	-33.345251	148.061119	239.63	1.50	241.13
4	-33.341595	148.070303	239.79	1.50	241.29
5	-33.340663	148.087040	243.57	1.50	245.07
6	-33.337023	148.090624	243.08	1.50	244.58
7	-33.335015	148.094829	243.17	1.50	244.67
8	-33.332936	148.099893	244.43	1.50	245.93
9	-33.330211	148.102726	244.02	1.50	245.52
10	-33.328705	148.105129	243.61	1.50	245.11

Name: Route 5
Route type Two-way
View angle: 50.0 deg



Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	-33.327482	148.104637	244.32	1.50	245.82
2	-33.328343	148.104980	243.51	1.50	245.01
3	-33.329956	148.107898	246.00	1.50	247.50
4	-33.331247	148.110473	246.15	1.50	247.65
5	-33.339386	148.134806	250.91	1.50	252.41
6	-33.350700	148.167711	258.52	1.50	260.02

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	m	m	m
OP 1	-33.328203	148.112415	247.71	1.76	249.47
OP 2	-33.332447	148.105891	245.00	1.76	246.76
OP 3	-33.336382	148.071548	242.81	1.76	244.57
OP 4	-33.341320	148.063772	241.86	1.76	243.62
OP 5	-33.339259	148.058064	242.18	1.76	243.94
OP 6	-33.327562	148.158537	261.29	1.76	263.05
OP 7	-33.325563	148.155930	259.86	1.76	261.62
OP 8	-33.338121	148.156326	260.29	1.76	262.05
OP 9	-33.310937	148.140924	266.00	1.76	267.76
OP 10	-33.295319	148.145258	275.00	1.76	276.76
OP 11	-33.291032	148.130538	268.31	1.76	270.07
OP 12	-33.290243	148.126117	264.42	1.76	266.18
OP 13	-33.298081	148.118221	265.74	1.76	267.50
OP 14	-33.291637	148.097566	275.07	1.76	276.83
OP 15	-33.297102	148.078668	294.53	1.76	296.29
OP 16	-33.299075	148.093323	280.85	1.76	282.61
OP 17	-33.307312	148.077889	272.66	1.76	274.42
OP 18	-33.312012	148.073726	259.00	1.76	260.76
OP 19	-33.316548	148.078210	255.51	1.76	257.27
OP 20	-33.347599	148.064241	240.80	1.76	242.56
OP 21	-33.355665	148.051474	239.58	1.76	241.34
OP 22	-33.353658	148.048706	239.70	1.76	241.46
OP 23	-33.366160	148.064904	240.15	1.76	241.91
OP 24	-33.371985	148.058009	239.89	1.76	241.65
OP 25	-33.376482	148.062987	239.63	1.76	241.39
OP 26	-33.374708	148.054404	243.23	1.76	244.99
OP 27	-33.377952	148.051271	241.07	1.76	242.83
OP 28	-33.377880	148.054747	241.94	1.76	243.70
OP 29	-33.381824	148.057837	244.69	1.76	246.45
OP 30	-33.383616	148.068180	243.99	1.76	245.75
OP 31	-33.384798	148.090775	247.37	1.76	249.13
OP 32	-33.392752	148.076611	241.95	1.76	243.71
OP 33	-33.391462	148.084830	244.54	1.76	246.30
OP 34	-33.391211	148.093206	244.35	1.76	246.11
OP 35	-33.392572	148.100545	245.19	1.76	246.95
OP 36	-33.385496	148.111617	243.16	1.76	244.92
OP 37	-33.381446	148.110544	244.48	1.76	246.24
OP 38	-33.371882	148.121588	246.65	1.76	248.41
OP 39	-33.381199	148.122575	244.87	1.76	246.63
OP 40	-33.387399	148.128368	247.31	1.76	249.07
OP 41	-33.394244	148.143507	247.38	1.76	249.14
OP 42	-33.399583	148.148914	244.51	1.76	246.27
OP 43	-33.410223	148.157154	247.84	1.76	249.60
OP 44	-33.408683	148.144064	248.31	1.76	250.07
OP 45	-33.414952	148.144150	246.02	1.76	247.78
OP 46	-33.412516	148.146339	248.00	1.76	249.76
OP 47	-33.327766	148.086656	245.85	1.76	247.61

PV Array Results

Summary of PV Glare Analysis PV configuration and predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
PV array 1	SA tracking	SA tracking	0	0	-	-

Click the name of the PV array to scroll to its results

PV & Receptor Analysis Results detailed results for each PV array and receptor

PV array 1 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: OP 1	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: OP 6	0	0
OP: OP 7	0	0
OP: OP 8	0	0
OP: OP 9	0	0
OP: OP 10	0	0
OP: OP 11	0	0
OP: OP 12	0	0
OP: OP 13	0	0
OP: OP 14	0	0
OP: OP 15	0	0
OP: OP 16	0	0
OP: OP 17	0	0
OP: OP 18	0	0
OP: OP 19	0	0
OP: OP 20	0	0
OP: OP 21	0	0
OP: OP 22	0	0
OP: OP 23	0	0
OP: OP 24	0	0
OP: OP 25	0	0
OP: OP 26	0	0
OP: OP 27	0	0
OP: OP 28	0	0
OP: OP 29	0	0
OP: OP 30	0	0
OP: OP 31	0	0
OP: OP 32	0	0
OP: OP 33	0	0
OP: OP 34	0	0
OP: OP 35	0	0
OP: OP 36	0	0
OP: OP 37	0	0
OP: OP 38	0	0
OP: OP 39	0	0
OP: OP 40	0	0
OP: OP 41	0	0
OP: OP 42	0	0
OP: OP 43	0	0
OP: OP 44	0	0
OP: OP 45	0	0
OP: OP 46	0	0
OP: OP 47	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0

Route: Route 5	0	0

No glare found

Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
- Glare analysis methods used: OP V1, FP V1, Route V1
- Refer to the **Help page** for assumptions and limitations not listed here.

Appendix D Landscape Mitigation Plan

LANDSCAPE MITIGATION PLAN



- Property Boundary
- Proposed Solar Panel Arrays
- Proposed Track
- Proposed Screen Planting Type 1 - Shrubs and Native Grasses
- Proposed Screen Planting Type 2 - Small Trees with under storey Native Grasses
- Proposed Screen Planting Type 3 - Tree Planting Groups of 2-3 with under storey Shrubs and Native Grasses

N

0 50 100 150 200 500m

Scale 1:7,500 @A3

LANDSCAPE MITIGATION PLAN

Switchyard



Chain Wire Security Fence

Proposed Screen Planting
- Shrubs planting

NOTE:

The depiction of the electrical elements contained in the switchyard is indicative only and subject to detailed design.

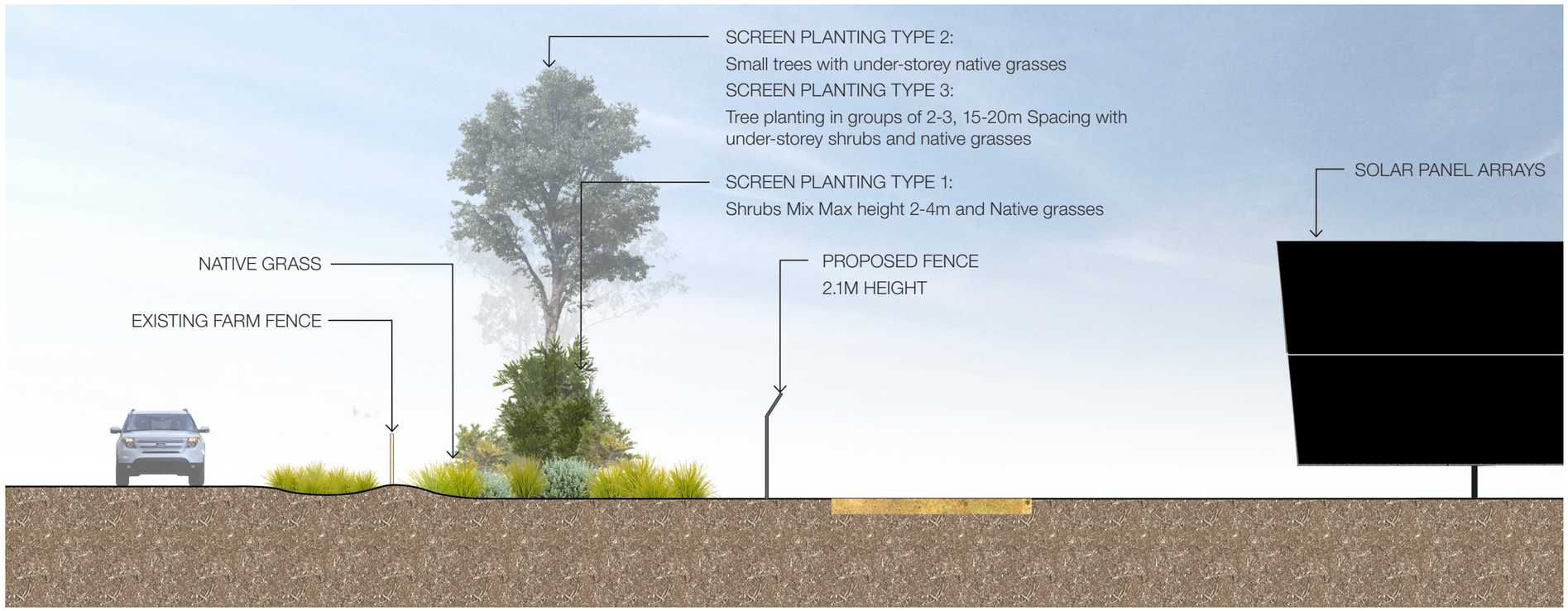
N

0 10 20 30 40 50 100m

Scale 1:1,000 @A3

TYPICAL SECTION

Typical Section of Proposed Screening on Site Perimeter



Tree Palette



Eucalyptus microcarpa
Grey Box
(25 x 10-15m)



Callitris glaucophylla
White cypress pine
(15 x 8-10m)



Allocasuarina luehmannii
Bull-oak
(5-15 x 5-10m)

Shrub Palette



Acacia brachybotrya
Grey mulga



Alectryon oleifolius
Boonaree



Myoporum montanum
Waterbush

local people
global experience

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