

Marulan Solar Farm

Landscape and Visual Impact Assessment



Glossary

Term	Definition
Amenity	'The pleasantness of a place as conveyed by desirable attributes including visual, noise, odour etc.' (Australian Institute of Landscape Architects QLD 2018)
Glare	'Condition of vision in which there is discomfort or a reduction in ability to see, or both, caused by an unsuitable distribution or range of luminance, or to extreme contrasts in the field of vision.' (AS4282:2019)
Landscape	'All aspects of a tract of land, including landform, vegetation, buildings, villages, towns, cities and infrastructure.' (TfNSW 2020)
Landscape character	The ... 'combined quality of built, natural and cultural aspects which make up an area and provide its unique sense of place'. (TfNSW 2020)
Landscape character zone (or area)	'An area of landscape with similar properties or strongly defined spatial qualities, distinct from areas immediately nearby.' (TfNSW 2020)
Magnitude	Magnitude is the ... 'measurement of the scale, form and character of a development proposal when compared to the existing condition. In the case of visual assessment this also relates to how far the proposal is from the viewer.' (TfNSW 2020)
Sense of place	The intangible qualities and character of a place, interpreted and valued by people.
Sensitivity	'Susceptibility of a landscape or receptor to accommodate change without losing valued attributes.' (Australian Institute of Landscape Architects QLD 2018) The sensitivity of a landscape character zone or view is ' <i>its capacity to absorb change</i> '. (TfNSW 2020)
Sky glow	'The brightening of the night sky that results from radiation (visible and non-visible), scattered from the constituents of the atmosphere (gaseous, molecules, aerosols and particulate matter), in the direction of observation.' It comprises Natural sky glow and artificial sky glow. (AS4282:2019)
Spill light	'Light emitted by a lighting installation that falls outside of the design area. Spill light may or may not be obtrusive depending on what it affects' (AS4282:2019)
View	'Any sight, prospect or field of vision as seen from a place, and may be wide or narrow, partial or full, pleasant or unattractive, distinctive or nondescript, and may include background, mid ground and/or foreground elements or features.' (Australian Institute of Landscape Architects QLD 2018)
Viewpoint	'The specific location of a view, typically used for assessment purposes.' (Australian Institute of Landscape Architects QLD 2018)
Visual absorption capacity	'The potential for a landscape or scene to absorb a particular change without a noticeable loss of valued attributes.' (Australian Institute of Landscape Architects QLD 2018)

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1. Introduction

1.1. Planning context

This technical paper assesses the impacts to visual amenity associated with the Marulan Solar Farm Project (the project). This technical paper addresses Secretary's Environmental Assessment Requirements (SEARS) issued by the NSW Department of Planning, Industry and Environment (DPIE) (provided in Section 1.2).

1.2. Project description

Terrain Solar are proposing an approximately 150MW solar farm and associated works at Lot 55 DP1141136, 740 Carrick Road, Carrick NSW 2580, **'the site'**. The site is an area of approximately 1,400 hectares and is located in the Goulburn Mulwaree Council (GMC) Local Government Area (LGA) (refer to **Figure 1-1**).

The solar farm is to occupy approximately 375.5 hectares of the site, hereafter referred to as **'the project area'**. The project area is located on the southern side of an existing gas pipeline running east-west through the site.

1.2.1. Key project components

The following project components have been considered in this visual impact assessment. Where there are alternatives being considered, the potential worst-case scenario for visibility has been assumed.

The key visible components of the project include:

- Solar panel arrays (single axis-tracker units or fixed mounting frames)
- Solar inverter stations (approximately 24 to 55) of a shipping container size
- Internal access roads for maintenance access (typically gravel)
- Site access track (gravel) via Munro Road (approximately 4 metres wide)
- Battery Energy Storage System (BESS), assumed to be grouped into an area proximate to the substation (if AC coupled) or distributed amongst the of the solar array development area (if DC coupled)
- 132 kV substation, including switchgear, a large transformer and small building
- Switching station area (about two hectares) (two locations are identified in this EIS, only one is to be selected at detailed design stage)
- 132 kV overhead power lines connecting the solar farm to the substation and grid, including towers up to 35 metres tall
- Office and maintenance compound including office and shed, car parking, shipping containers (height about seven metres)
- Security fencing around the solar panel array area, chain link with barbed wire (up to 3 metres tall)
- Specific native vegetation screening from identified visual impact locations.

Further information is provided in Chapter 3 (Project description) of the EIS.

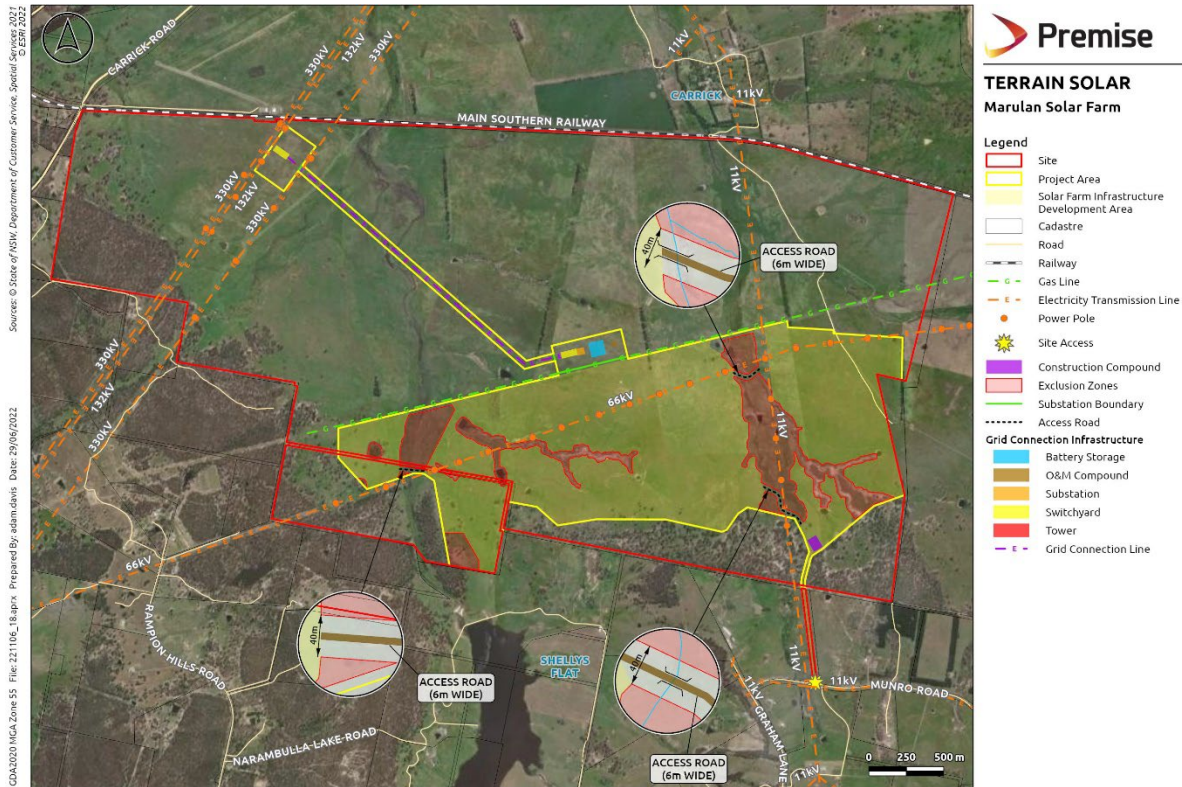


FIGURE 1-1 SITE AND LOCAL CONTEXT PLAN

1.2.2. Project construction

Construction activities would include:

- enabling works which involve:
 - establishment of a temporary construction compound to the south of the solar farm including material laydown areas, site offices, vehicle parking and amenities
 - establishment of transmission line easements
 - vegetation clearance.
- civil works:
 - minor earthworks
 - internal tracks and roads
 - installation of trackers and panel arrays
- pre-commissioning and commissioning
- testing and operational checks of equipment
- testing of control and metering systems.

The construction program is anticipated to occur over an approximately 18-month period, with approximately three (3) month shoulder mobilisation and demobilisation periods, and a peak 12-month construction period.

Further information is provided in Chapter 3.23.1 of the EIS.

1.2.3. Secretary’s Environmental Assessment Requirements

DPE has provided the Secretary’s Environmental Assessment Requirements (SEARs) for the EIS which specifically outlines the specialist study requirements for this visual assessment.

For Visual, the SEAR is:

‘Visual– including a detailed assessment of the likely visual impacts (including any glare, reflectivity and night lighting) of all components of the project (including arrays, transmission lines, substations and any other ancillary infrastructure) on surrounding residences and key locations, scenic or significant vistas, air traffic and road corridors in the public domain and provide details of measures to mitigate and/or manage potential impacts (including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners);’

Where these requirements have been addressed, is contained in the following

TABLE 1-1: SECRETARY’S ENVIRONMENTAL ASSESSMENT REQUIREMENTS – VISUAL IMPACT

SEARs requirements	Where addressed in this report
Detailed assessment of the likely visual impacts including:	
• Glare and reflectivity	Refer to section 6
• Night lighting	Refer to section 4.3.6
Impacts on:	
• surrounding residences	Refer to section 5
• key locations, scenic or significant vistas	Refer to section 4.3.3
• air traffic	Refer to section 4.3.7
• road corridors in the public domain	Refer to section 4.3
• details of measures to mitigate and/or manage potential impacts	Refer to section 8
Draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners.	Refer to Appendix B

1.2.4. Required assessment types

There are two types of assessment required for SSD projects:

- Incremental assessment, and
- Cumulative impact assessment.

The Incremental Assessment considers the adding of this project to the existing condition of the site and study area. The Cumulative Impact Assessment incorporates the additional impacts that may occur over time as a result of changes to existing projects (such as expansions or closures for example) and the construction and operation of other new energy and related infrastructure.

The following section outlines the methodology undertaken for the Incremental assessment. The cumulative impact assessment, and methodology, is contained in Section 6 of this technical paper.

This incremental assessment includes an assessment of:

- Visual impact on public domain views
- Night-time visual impact (night-lighting)
- Impacts on views from surrounding residences, and
- Glare and reflectivity risk.

The method for each of these assessments is described in the following sections.

1.2.5. Community engagement

A range of community consultation activities were undertaken as a part of the Community and Stakeholder Engagement Plan (Refer to the EIS Chapter 5). This included community engagement sessions as well as direct discussions with adjoining landholders.

When community representatives were asked what values are most important to them in terms of local values, respondents answers included ... '*Local environment and landscape*'. Some local residents noted concerns and questions regarding the impact of the solar infrastructure on visual amenity, glare and reflectivity.

There were specific questions raised during community consultation sessions about how visible the solar farm and infrastructure would be from residences to the north and south of the site. The extent of views to the access road, in particular, also raised by residences to the south of the site, in the vicinity of Munro Road. Further information about the potential for glare was also requested.

During direct engagement with neighbouring landholders, concerns about site lines and visual impacts from the solar panels, were discussed. Ways to mitigate the visual impact for the nearest landowners to the south and adjacent to of the proposed access handle was identified and ongoing consultation will occur.

2. Planning context

The following review identifies key documents which provide relevant planning context to this assessment.

2.1. Regional planning

2.1.1. South East and Tablelands Regional Plan 2036

The project is located in the north eastern part of the region, within the Goulburn Mulwaree local government area (LGA). This regional strategy document, prepared by the NSW State Government, identifies regional priorities. There are several planning priorities that are relevant to this landscape character and visual impact assessment, these are:

- Position the region as a hub of renewable energy excellence (Goal 1, Direction 6).
- Protect the region's heritage (Goal 3, Direction 23).

This plan provides a strategic context to the landscape and visual values of the region.

2.2. Local planning

While State Significant Development Projects are not subject to local planning requirements, the following local planning policies provide relevant information to inform the landscape and visual sensitivity levels and provide insight into community expectations relating to land use and future intended character.

2.2.1. Goulburn Mulwaree Local Strategic Planning Statement

Planning Priority 5 of the Goulburn Mulwaree Local Strategic Planning Statement (LSPS) (Goulburn Mulwaree Council, 2020) aims to maintain and promote the Goulburn Mulwaree's rural areas. It recognises potential rural land use conflicts, stating:

'Council's planning provisions need to ensure that there are adequate protections in place for agricultural land such as from encroachment by more sensitive uses such as ... renewable energy and extractive industries' (Planning Priority 5).

It further states that ... *'The co-location of renewable energy projects should occur where possible, in order to maximise infrastructure, including corridors with access to the electricity network'* (Planning Priority 5).

2.2.2. Goulburn Mulwaree Local Environmental Plan 2009

A key objective of the Goulburn Mulwaree Local Environmental Plan (LEP) is to provide direction and guidance for 'growth and change' in Goulburn Mulwaree (cl.1.2(2)(j)). The project site is located on land zoned RU1 – Primary Production under the LEP. Key objectives of this zone are to:

- 'Minimise the visual impact of development on the rural landscape
- Allow the development of non-agricultural land uses which are compatible with the character of the zone' (Part 2, Land Use Tables, Zone RU1).

There are several hilly and vegetated areas surrounding the site, including to the northwest, northeast, south and southwest of the project site which are zoned R2 – Rural Landscape and C3 – Environmental Management. The R2 zone objectives aim to *'maintain the rural landscape*

character of the land' and protect, manage and restore areas with high *'aesthetic values'* (Part 2, Land Use Tables, Zone RU2). The C3 zone objectives aim to protect, manage and restore areas with special *'aesthetic values'* and provide for a limited range of development that does not have an adverse effect on those values.

The 'Lockyersleigh' homestead and gardens is a local heritage item (I035). This rural property is located on the to the south of Carrick Road (about one kilometre north of the project site), on the eastern banks of Lockyersleigh Creek. It includes the main homestead and several other dwellings.

2.2.3. Goulburn Mulwaree Development Control Plan 2009

The Goulburn Mulwaree Development Control Plan (DCP) 2009 aims to provide clear and concise development guidelines for various forms of development. Part 2.4 of the DCP aims to protect the *'scenic values of the rural landscape'* and encourages development to be *'unobtrusive and sympathetic to the surrounding rural setting'*. Where practicable, existing vegetation is to be maintained and enhanced, so as to provide *'buffers and landscaped visual relief'* within rural areas (Part 2.4.2).

Appendix B, Preferred Planting Species and Appendix D, Landscape Policy; Site Analysis; Preparing a Landscape Plan are relevant to the preparation of a landscape plan for this proposal.

3. Existing landscape conditions and character

The project is located in a rural valley south of Carrick Road, between the rural townships of Marulan (about 5 kilometres east of the site) and Towrang (about 5 kilometres west of the site) (refer to **Figure 3-1 Location plan**).

The landscape setting of the project site is defined by a series of forested ridgelines to the east, south and west of the site, forming a U-shape around the site. This includes the Cookbundoon Range, located about 6 kilometres north west of the site and rising to about 900 metres AHD. There are a series of smaller hills and ridges located to the east and south of the project site, rising to about 700 – 750 metres AHD, providing visual enclosure to the site, including Nattery Hill (about 2 kilometres south west of the site), the foothills of Mount Marulan (about 2 kilometres south of the site) and the Stony Range Hills (about 2 kilometres north east of the site) (refer to **Figure 3-2 Topography**).

The landform at the project site is undulating, including a series of small hills along the southern boundary, with a small ridge traversing through the centre of the site, in a northerly direction. From these high points, the site landform gently descends to shallow gullies, creeks and dams. Two creeks meander in a northerly direction through the site, including Narambulla Creek and Lockyersleigh Creek, both tributaries of the Wollondilly River. Osborns Creek also passes to the north of the site through the grid connection and proposed substation site.

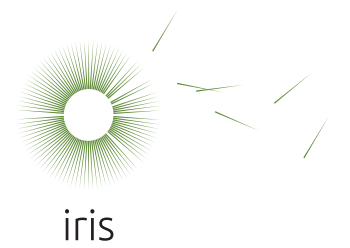
The project site and surrounding land has been largely cleared and predominantly used for livestock grazing. Several rows of trees have been planted as wind breaks along the field boundaries and fence lines, forming a landscape feature in this area. The site is currently accessed from the north via Carrick Road, a local road extending between Brayton Road and the Hume Highway, providing access to local properties for residents.

There are existing large-scale power infrastructure within this rural valley, including the steel lattice 330 kV transmission lines located to the west of the project site and smaller 132 kV transmission lines running parallel to the east of this corridor, near the proposed substation. An additional local transmission line (66 kV) traverses diagonally through the northern part of the project site, generally parallel to the northern site boundary.

The Southern Highlands rail line is located about one kilometre to the north of the project site, aligned generally east to west. Several passenger trains would pass the project site each day along this rail line, travelling between Bundanoon and Goulburn.

There are a number of quarries near the site, the closest being Holcim Lynwood Quarry, located about one kilometre east of the project site, extending to either side of the Southern Highlands rail line, which has been active since about 2005. Other quarries include Gunlake Quarry, located about 3 kilometres northeast of the site, and Marulan Quarry, located about 5 kilometres southwest of the site.

Other infrastructure within the landscape and visual study area is limited to local roads, rural homesteads and agricultural development, including sheds, fences and yards.

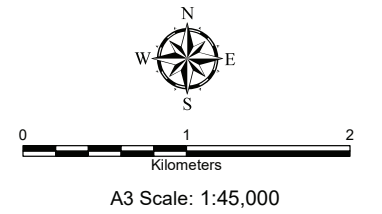


Marulan Solar Farm
Terrain Solar

Figure 3-1: Location plan

- Proposal site
- Exclusion zone
- Existing 66kV Line easement
- Grid connection infrastructure

SOURCE:
Cadastral Boundary: NSW Department of Finance,
Services and Innovation 2021
Surface analysis: Derived from LIDAR - GOULBURN
2013 (5m) & MOSSVALE 2018 (2m) Digital Elevation
Model © Department Finance, Services and Innovation



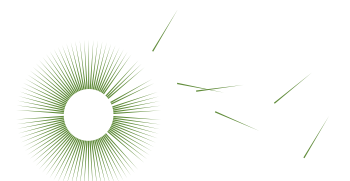
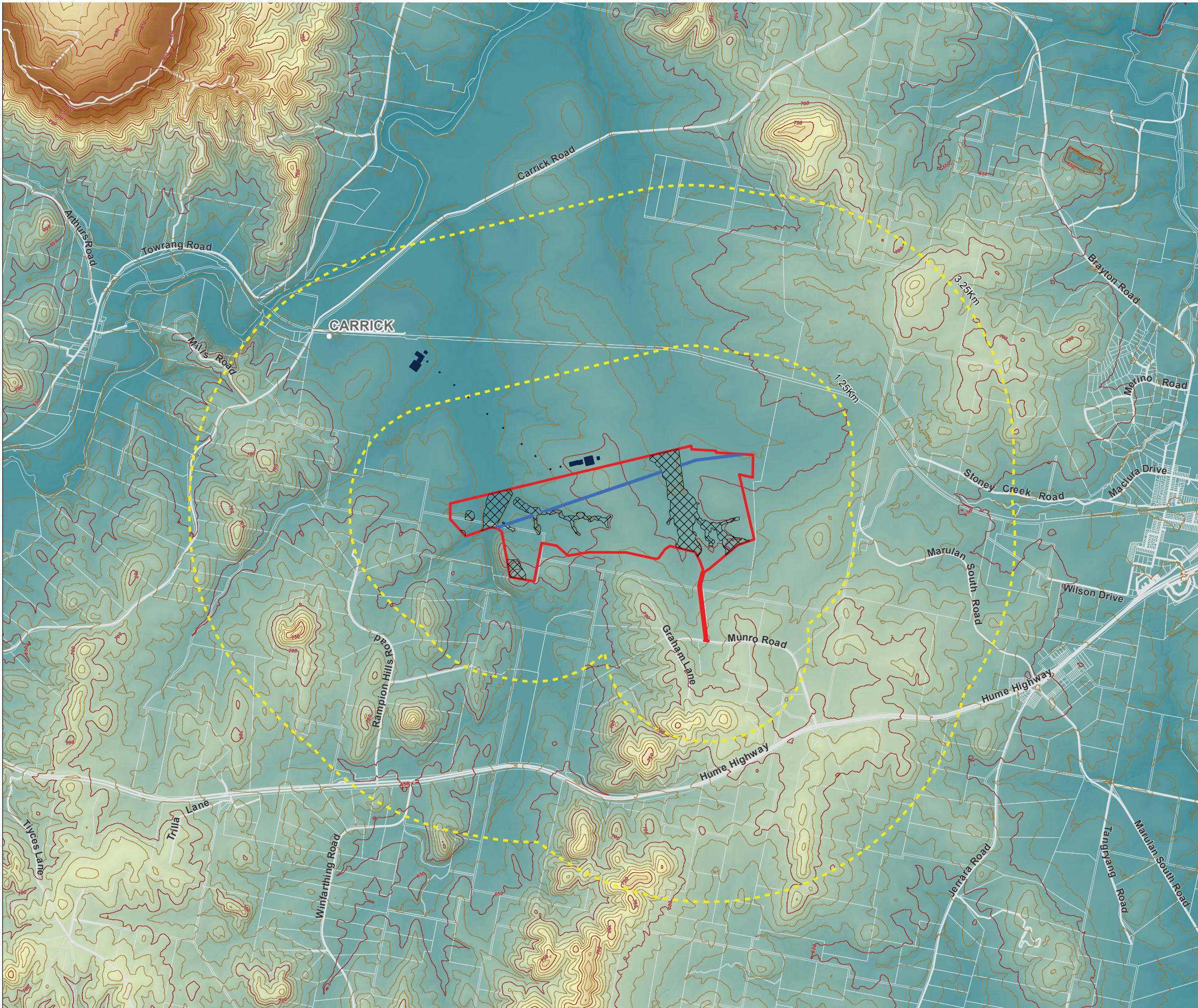
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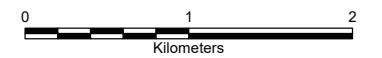
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Marulan Solar Farm
Terrain Solar

Figure 3-2: Topography

-  Proposal site
-  Exclusion zone
-  Existing 66kV Line easement
-  Grid connection infrastructure
-  Contour (50m)
-  Contour (10m)
- Elevation AHD**
-  High (913m)
Low (595m)

SOURCE:
Cadastral Boundary: NSW Department of Finance,
Services and Innovation 2021
Surface analysis: Derived from LIDAR - GOULBURN
2013 (5m) & MOSSVALE 2018 (2m) Digital Elevation
Model © Department Finance, Services and Innovation



A3 Scale: 1:45,000

File:MarulanSolar-Fig2-Topography-220708 Date: 8/07/2022

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4. Assessment of visual impact on public domain views

4.1. Approach

This assessment has been undertaken generally in accordance with the *Guideline for Landscape Character and Visual Impact Assessment EIA-N04*, Transport for NSW, 2020 and the *Guidance Note for Landscape and Visual Assessment (GNLVA)*, Australian Institute of Landscape Architects Queensland, 2018. There are also useful concepts in the AS4282 Control of the obtrusive effects of outdoor lighting (2019) that will be used in the assessment of night time visual impact.

While there is guidance for the consideration of cumulative impacts in relation to landscape character and visual impact, this assessment will also follow the guidance provided in the *Cumulative Impact Assessment Guidelines for State Significant Projects*.

4.2. Assessment steps

The following section describes the assessment steps undertaken to determine the public domain views.

4.2.1. Potential visibility of the project

The potential visibility of the project (zone of visual influence) has been identified based on GIS modelling that combines a digital terrain model (landform) and points modelled across the proposed solar farm. This analysis identifies areas from which views to the project may be seen.

The analysis used a Digital Surface Model derived from two metre LiDAR data flown in 2013 and 2018. This analysis does not take into the filtering effect of vegetation or views through infrastructure such as the existing transmission towers. This analysis is, therefore, indicative and a first step in the analysis process.

Site photographs were taken during January of 2022. These photographs were used to verify the results of a preliminary visibility analysis. From these photographs, viewpoints have been selected to represent the range of views to the project. These representative viewpoints are from key locations, road corridors and the public domain. They include views from a range of distances and orientations and focus on locations where there may be a potential visual impact. There were no scenic routes or significant vistas in the vicinity of the project.

4.2.2. Representative viewpoint assessment

The potential impact on each view has been assessed by identifying the **sensitivity** of the view and the **magnitude of change** that would be caused by the project. Combined, these characteristics are used to assign a level of visual impact. This methodology is explained more fully in the following paragraphs.

4.2.2.1. Visual sensitivity

Visual sensitivity combines the viewer sensitivity with the scenic quality of the view. The following tables describe the visual sensitivity levels which have been used in this assessment (refer Table 4-1).

Viewer sensitivity takes into account the number of viewers and duration of a view, as well as the activity taking place at the viewing location. Locations from which a view would potentially

be seen for a longer duration, where there are higher numbers of potential viewers and where visual amenity is important to viewers, would be regarded as having a higher visual sensitivity.

TABLE 4-1 VISUAL SENSITIVITY LEVELS

Visual sensitivity	Description
High	<p>Heavily experienced view to a feature or landscape that is iconic to a major portion of a city or a non-metropolitan region, or a designated view in a natural area to a landscape of high visual amenity. It may be a view from a regional open space or designated viewpoint for example.</p> <p>These views are generally unique or uncommon within the regional landscape.</p>
Medium	<p>Views experienced by a concentration of residents and/or local recreational users, views identified in the planning provisions as having value to the wider community, and / or views with moderate level of visual amenity and visual coherence.</p> <p>These may be a gateway view, view from an identified scenic route and/or large numbers of road or rail users, and or/ views to important visual features.</p> <p>These views are less common within the landscape.</p>
Low – medium	<p>Views from a moderate number of receptors, and / or views including local features which are identified in the planning provisions as having value to the local community, and / or views with a minor to moderate level of visual amenity and visual coherence.</p> <p>These may be views seen from the entry to a place, a local collector road, a view with some landscape features, and views from larger groups of residences.</p>
Low	<p>Views from a small number of receptors, and / or views not including features identified in the planning provisions as having value to the wider community, and / or views which have a lower or fragmented quality and lack coherence.</p> <p>These may be views seen from local roads, briefly glimpsed views to landscape features, and views from small groups of residences.</p> <p>These views are likely to be common within the landscape.</p>

4.2.2.2. Magnitude of change

Magnitude is the ... *'measurement of the scale, form and character of a development proposal when compared to the existing condition. In the case of visual assessment this also relates to how far the proposal is from the viewer.'* (TfNSW 2020)

The magnitude of change considers the extent of change resulting from the proposal and the compatibility of these new elements with the surrounding landscape.

Magnitude of change will be determined by characteristics of the view, such as distance, landform, backdrop, intervening vegetation etc. There are also characteristics of the proposal which are: scale, form and line/alignment. Changes to a view can result in an improvement or reduction in visual amenity.

A high magnitude of change would result if the development contrasts strongly with the existing characteristics of the view. A low magnitude of change occurs if there is a high level of integration of form, line, shape, pattern, colour or texture values between the proposal and its visual setting.

In some circumstances, there may be a visible change to a view which does not alter the amenity of the view, this would be due to the compatibility of the proposal and capacity of the view to accommodate the change without losing valued elements.

Table 4-2 lists the terminology used to describe the magnitude of change.

TABLE 4-2 MAGNITUDE LEVELS

Magnitude	Description
High	The proposal is visually dominant and / or contrasts substantially with the character of the view. It would result in a substantial change in the amenity of the view.
Medium	The proposal is somewhat prominent and / or is not compatible with the character of the view. It would result in a noticeable change in the amenity of the view.
Low	The proposal is not visually prominent and / or is visually compatible with the character of the view. It would result in a slight change in the amenity of the view.
Negligible	The proposal is not visible, is not visually prominent in the view and / or is compatible with the character of the view. It would result in no perceived change in the amenity of the view.

4.2.3. Assessment of night-time visual impact

The assessment of night-time impact has been carried out with a similar methodology to the daytime assessment. However, the assessment also draws upon the guidance contained within AS4282 *Control of the obtrusive effects of outdoor lighting* (2019).

AS4282 identifies environmental zones which are useful for categorising night-time landscape settings. This methodology uses these environmental zones to describe the existing night-time visual condition and assign a sensitivity to these settings.

4.2.3.1. Night-time visual sensitivity

The environmental zone (defined in AS4282) which best describes the existing night-time visual condition of the site has been selected. These zones are typical night-time settings and reflect the predominant light level of each landscape character area. Each environmental zone is assigned a level of sensitivity as described in Table 4-3.

TABLE 4-3: ENVIRONMENTAL ZONE SENSITIVITY – NIGHT-TIME

Environmental Zones (AS4282:2019)		
Sensitivity level	Description	Examples
High	A0: Intrinsically dark	UNESCO Starlight Reserve IDA Dark Sky Parks Major optical observatories No road lighting – unless specifically required by the road controlling authority
High	A1: Dark	Relatively uninhabited rural areas No road lighting – unless specifically required by the road controlling authority
Medium	A2: Low district brightness	Sparsely inhabited rural and semi-rural areas
Low	A3: Medium district brightness	Suburban areas in towns and cities
Very low	A4: High district brightness areas	Town and city centres and other commercial areas Residential areas abutting commercial areas

4.2.3.2. Night-time magnitude of change

The magnitude of change that would be expected within each landscape character area at night is then identified.

Table 4-4 lists the categories used to describe the visual magnitude of change at night.

TABLE 4-4: VISUAL MAGNITUDE OF CHANGE LEVELS – NIGHT-TIME

Magnitude of change	Description
High	Substantial change to the level of skyglow, glare or light spill expected, and / or The lighting of the project would transform the character of the surrounding setting at night, and / or The effect of lighting would be experienced over an extensive area and / or
Medium	Considerable change to the level of skyglow, glare or light spill and / or The lighting of the project would noticeably contrast with the surrounding landscape at night and / or The effect of lighting would be experienced across a large portion of the landscape.
Low	Alteration to the level of skyglow, glare or light spill would be expected, and / or The lighting of the project would not contrast substantially with the surrounding landscape at night, and or The effect of lighting would be experienced across a small portion of the landscape.
Very Low	Either the level of skyglow, glare and light spill is unchanged or if it is altered, the change is generally unlikely to be perceived by viewers or compatible with the existing or intended future use of the area.

4.2.4. Assigning impact levels

An assessment of visual impact has been made by combining the visual sensitivity and magnitude of change levels for each representative viewpoint and assigning an impact level (refer to Table 4-5).

TABLE 4-5: VISUAL IMPACT LEVELS

	High sensitivity	Medium sensitivity	Low sensitivity	Very low sensitivity
High visual magnitude	High	High	Moderate	Low
Medium visual magnitude	High	Moderate	Low	Low
Low visual magnitude	Moderate	Low	Low	Very low
Very low visual magnitude	Low	Low	Very Low	Very low
Negligible magnitude	Negligible	Negligible	Negligible	Negligible

4.3. Visual impact assessment - Public domain views

4.3.1. Zone of visual influence

A zone of visual influence (ZVI) for the project has been prepared to identify the theoretical area from which the solar farm may be visible (refer to **Figure 4-1**). This analysis uses a digital surface model (landform data derived from LiDAR) combined with points on the site at the maximum height of the proposed solar farm (assumed solar panel height of 5.2 metres) and identifies areas that would have a direct line of sight to these points. As this analysis does not take into account vegetation and buildings, that may offer visual screening, the area shown on this plan is a worst-case scenario for locations where there may be a view to the site. The visibility of the site has been further analysed, by ranking the zone of visual influence, with the darker colours highlighting those locations that view a larger portion of the solar farm (refer to **Figure 4-2**).

This analysis (refer to **Figure 4-1** and **4-2**) shows that the visual influence of the project would be limited. This is due to the undulating terrain and hills surrounding the site.

The visibility analysis shows the visual influence (ZVI) of the proposal potentially extending to the north, east and south across the valley. Views to the site are contained to the west by a series of small hills which extend generally northwest to southeast between the Cookbundoon Range in the north and Mount Marulan in the south. The visual catchment to the west and southwest would be further reduced by the vegetation in this area, in the vicinity of Rampion Hills Road.

To the north, the ZVI extends across the Southern Highlands rail line and Carrick Road, to the Towrang valley alongside the Wollondilly River. The visual catchment in this area is contained by Stony Range Hill and the Cookbundoon Range, which rise to the east and west of the Wollondilly River. In views from these areas, only a small area of the project would potentially be seen, due to intervening vegetation and local variation in landform, not reflected in the ZVI. The Southern Highlands rail line and Carrick Road provide the main opportunity for viewing the site from the public domain, located between one and three kilometres from the project area.

From Stony Range Hill, there are a series of small hills extending to the southeast, towards Marulan. These hills as well as the raised terraces along the western side of Lynwood Quarry contain the visual catchment northeast and east of the project site. There are no residences in this location, and views to the project would be experienced from private rural fields and southerly views from the Southern Highlands rail line.

The ZVI includes areas further to the southeast and south of the site, across Munro Road and Grahams Lane, ending at a local ridgeline to the north of the Hume Highway. From these areas there may be glimpses of the project. The proposed access road off Munro Road would also be visible from parts of this area.

There are several locations in the region which have higher scenic values, including the Cookbundoon Nature Reserve, Tarlo River National Park, Marulan Township Conservation Area, Bungonia State Conservation Area, including walking trails and scenic lookouts. These areas are beyond the ZVI of the site. As such, no scenic or significant views or vistas have been identified within the landscape and visual study area. There are also no tourist routes near the project site.

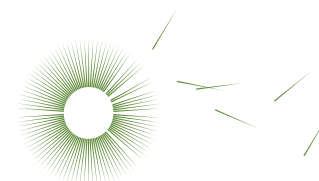
4.3.2. Potential visibility of the project

A reverse viewshed diagram has also been prepared (refer to **Figure 4-3**). This diagram identifies the areas of the project site that have the most visibility from surrounding dwellings. This diagram is based on a digital surface model (landform data derived from LiDAR) and points at each dwelling within the visual catchment (in this case 34 dwellings).

This diagram shows no colour on the areas that are not visible from surrounding dwellings, and the darkest colour (red) on areas of the site where there the greatest number of dwellings have a theoretical direct line of sight to the proposal.

- This diagram shows: limited visibility of the proposal in areas to the west of the site, in the centre of the site, and areas to the east of the site
- greater visibility in areas near the northern boundary of the site, to the centre west
- greater visibility in areas to the south of the creekline and rising up the hill to the south west of the site
- an area of greater visibility within the centre of the north eastern field.

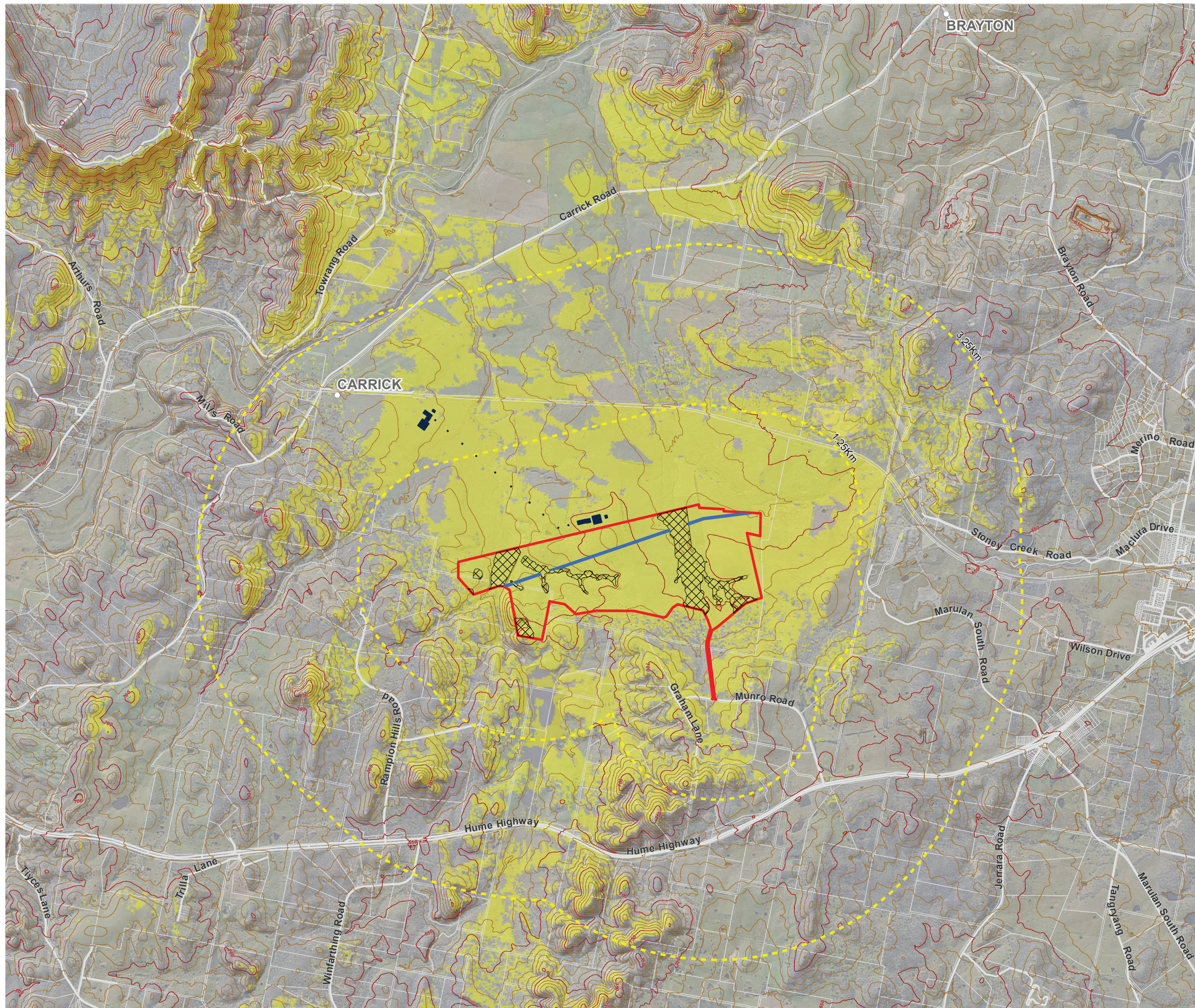
The areas of greater potential visibility have been used to locate the areas of vegetation upon the site. Refer Appendix B, Landscape Plan, and section 8.0 Ability to avoid, mitigate or offset the impacts of the project.







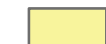


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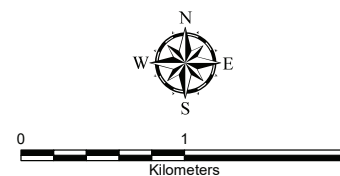
Marulan Solar Farm Terrain Solar

Figure 4-1: Zone of Visual Influence



-  Proposal site
-  Exclusion zone
-  Existing 66kV Line easement
-  Grid connection infrastructure
-  Contour (50m)
-  Contour (10m)
- Visibility**
-  Visual catchment

SOURCE:
Cadastral Boundary: NSW Department of Finance,
Services and Innovation 2021
Surface analysis: Derived from LiDAR - GOULBURN
2013 (5m) & MOSSVALE 2018 (2m) Digital Elevation
Model © Department Finance, Services and Innovation



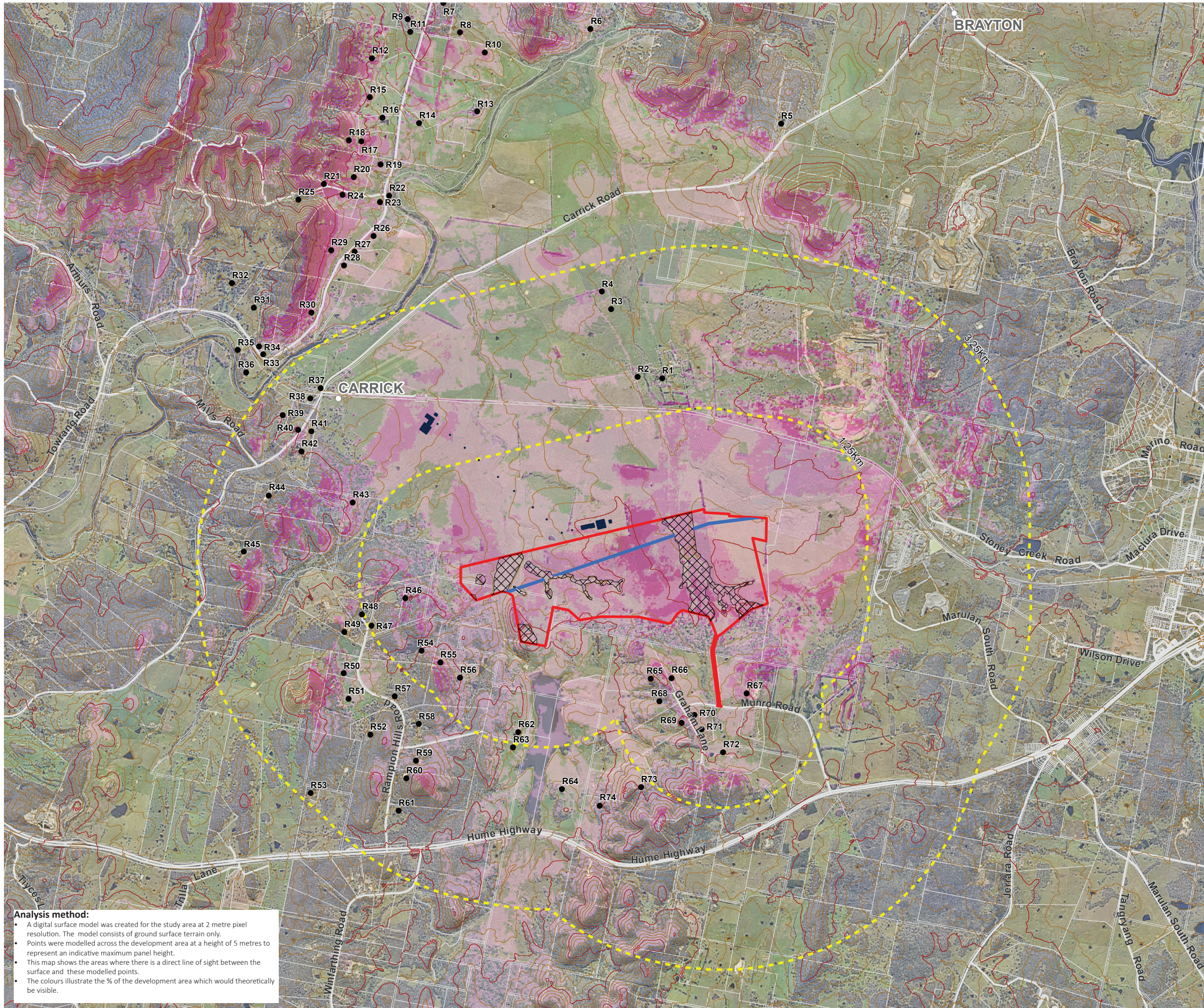
A3 Scale: 1:45,000

File: MarulanSolar-Fig3-VisualCatchment-220708 Date: 8/07/2022

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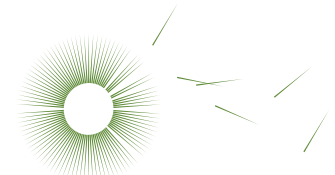
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Analysis method:

- A digital surface model was created for the study area at 2 metre pixel resolution. The model consists of ground surface terrain only.
- Points were modelled across the development area at a height of 5 metres to represent an indicative maximum panel height.
- This map shows the areas where there is a direct line of sight between the surface and these modelled points.
- The colours illustrate the % of the development area which would theoretically be visible.



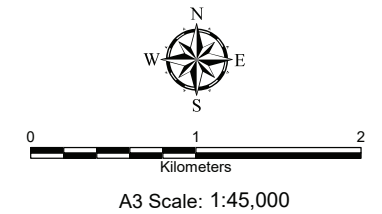
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Marulan Solar Farm
Terrain Solar

Figure 4-2: Visibility of the site

- Exclusion zone
- Existing 66kV line easement
- Grid connection infrastructure
- Contour (50m)
- Contour (10m)
- Receiver location
- Visibility:**
- Low
- Low-moderate
- Moderate
- High

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2021
Surface analysis: Derived from LIDAR - GOULBURN 2013 (5m) & MOSSVALE 2018 (2m) Digital Elevation Model © Department Finance, Services and Innovation



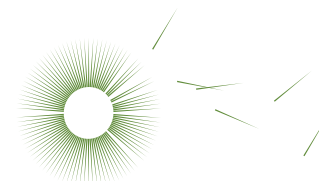
File:MarulanSolar-Fig25-RankedVisibility-220303 Date: 3/03/2022

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Marulan Solar Farm Terrain Solar

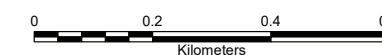
Figure 4-3: Reverse viewshed diagram

-  Exclusion zone
-  Existing 66kV line easement
-  Grid connection infrastructure
-  Receiver (private dwelling)

Number of receiver points that see the site
(based on topography only)

-  1-7
-  8-13
-  14-34

SOURCE:
 Cadastral Boundary: NSW Department of Finance,
 Services and Innovation 2021
 Surface analysis: Derived from LiDAR - GOULBURN
 2013 (5m) & MOSSVALE 2018 (2m) Digital Elevation
 Model © Department Finance, Services and Innovation



A3 Scale: 1:12,000

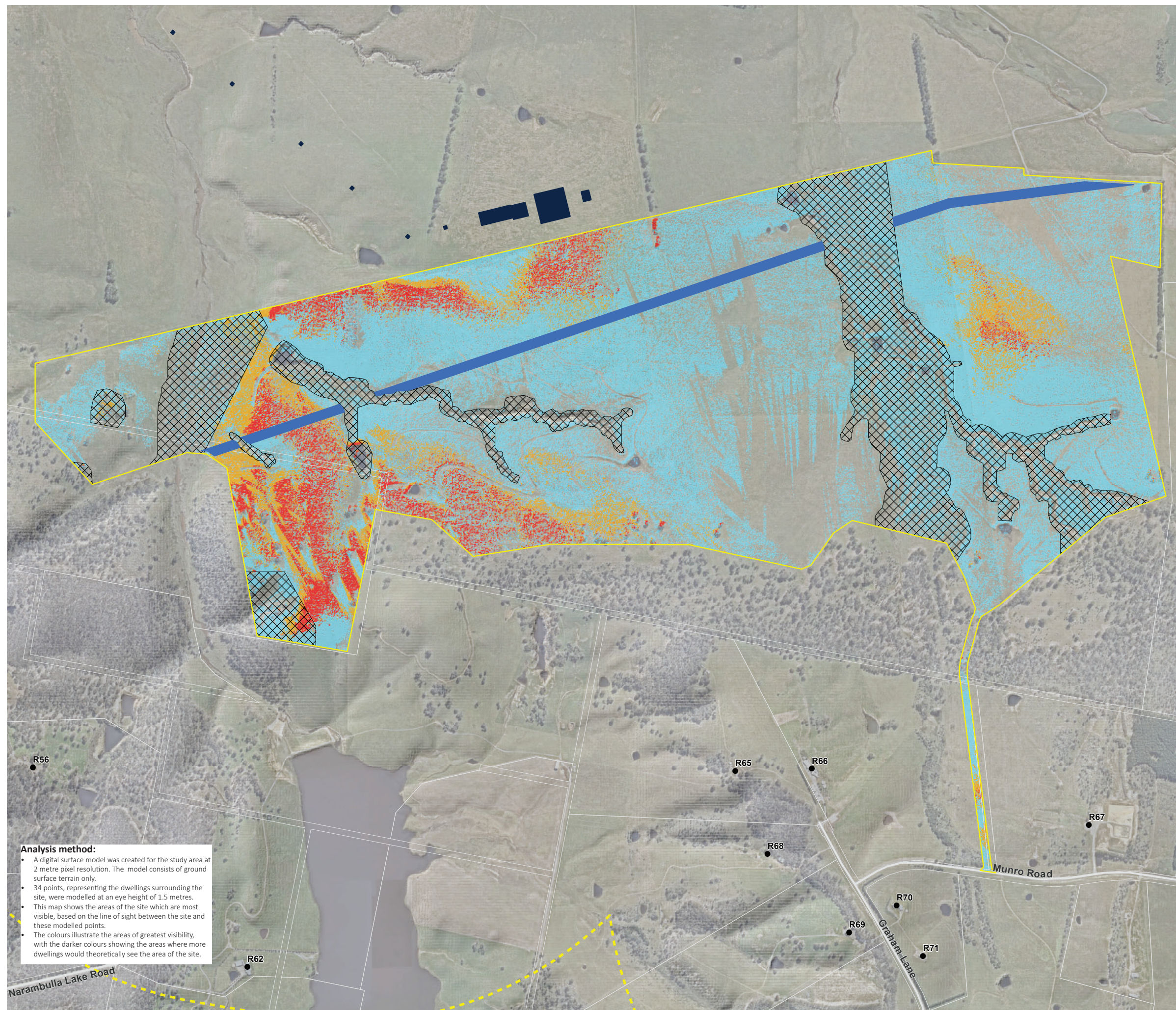
File: MarulanSolar-Fig21-ReceptorsHeatSite-220708 Date: 8/07/2022

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Analysis method:

- A digital surface model was created for the study area at 2 metre pixel resolution. The model consists of ground surface terrain only.
- 34 points, representing the dwellings surrounding the site, were modelled at an eye height of 1.5 metres.
- This map shows the areas of the site which are most visible, based on the line of sight between the site and these modelled points.
- The colours illustrate the areas of greatest visibility, with the darker colours showing the areas where more dwellings would theoretically see the area of the site.

4.3.3. Representative viewpoint assessment - Public domain views

Six viewpoints were selected as representative of the range of views to the project from the public domain. These representative viewpoints are:

1. View north from the Hume Highway
2. View north east from Rampion Hills Road
3. View north west from Munro Road
4. View north west from Munro Road
5. View south from Carrick Road
6. View south east from Towrang Road.

The location of these viewpoints is shown in **Figure 4-4**.

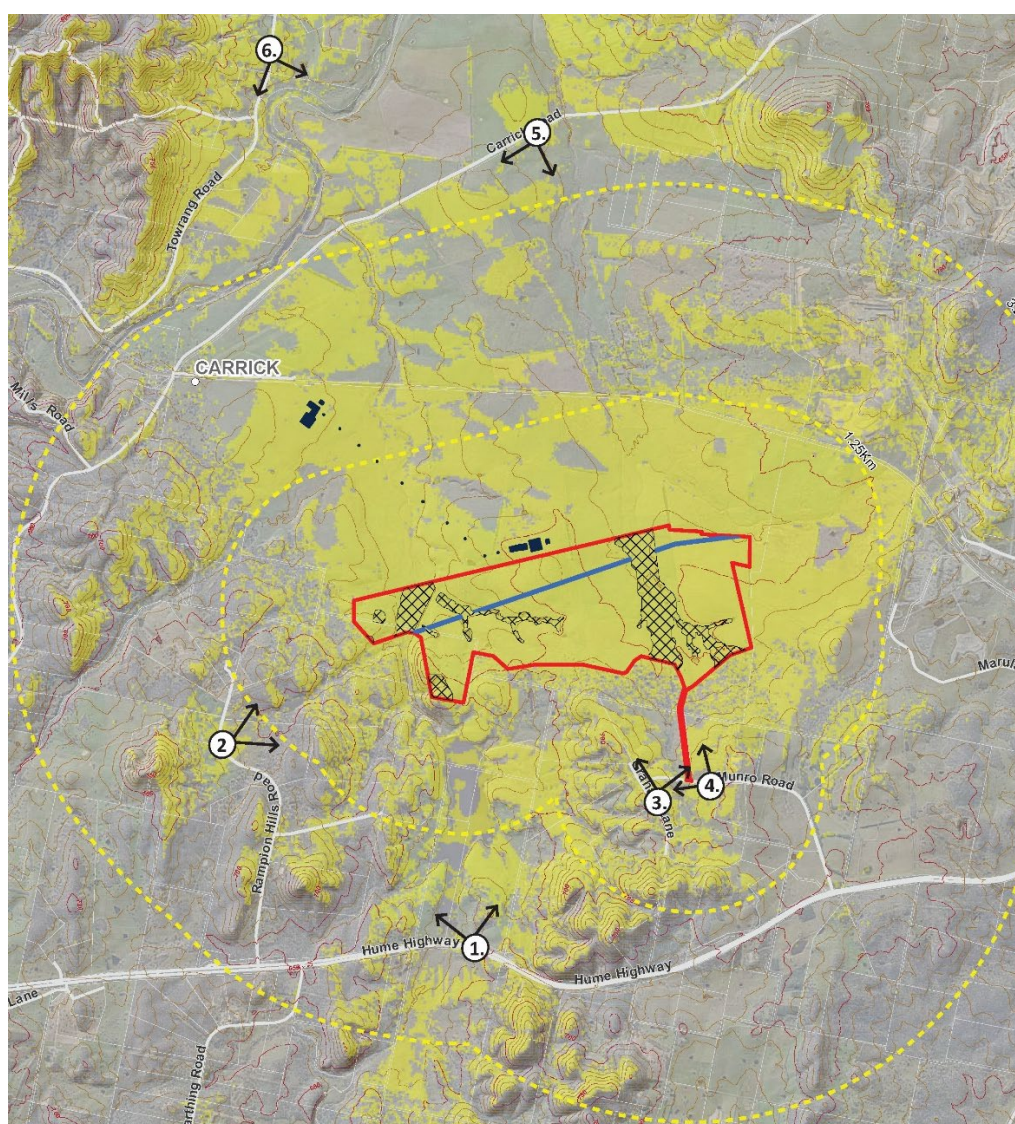


FIGURE 4-4 VIEWPOINT LOCATION PLAN

The following section includes an assessment of each representative view and identifies the daytime visual impacts.

4.3.3.1. Viewpoint 1: View north from the Hume Highway



FIGURE 4-5 VIEW NORTH FROM THE HUME HIGHWAY



FIGURE 4-6 VIEW NORTH FROM THE HUME HIGHWAY, APPROXIMATE LOCATION OF THE SITE HIGHLIGHTED IN TURQUOISE (CENTRE OF VIEW)

Existing view: This view is directed along a small rural valley, with Lake Narambulla, in the centre of the view. This valley is framed by vegetation on the local ridgelines and hills, and there are trees along the field boundaries and roads. The rural landscape around the lake is undulating and used for grazing pastures. There are dwellings visible from this location, set amongst trees. There is a glimpse to the site in the background of this view and otherwise, most of the site would be screened by intervening landform and vegetation and out of view.

Sensitivity: The Hume Highway is a heavily trafficked route connecting Goulbourn with Sydney and used by a wide range of vehicles, including recreational travellers. The varied landform, vegetation cover and waterbody improve the amenity of this view. Overall, this view is of **medium** visual sensitivity.

Magnitude of change: A very small part of the project would be seen in the centre, background of this view. As the site is over two kilometres away, this would form a small portion of the overall view. The proposed panel arrays would sit below the height of the adjacent trees on the ridgeline, and merge visually due to the distance so that they would appear as a block of colour. Overall, the magnitude of change would be **negligible**.

Visual impact level: **Negligible**

4.3.3.2. Viewpoint 2: View north east from Rampion Hills Road



FIGURE 4-7 VIEW NORTH EAST FROM RAMPION HILLS ROAD

Existing conditions: This view includes a rural landscape in the foreground, with a cleared area currently used for grazing. The landform slopes away from Rampion Hills Road to the northeast towards Narambulla Creek, which includes an area of dense native vegetation which forms the middle ground of this view, and limits views to the distant fields. There is a glimpse over this vegetation towards the rural fields of Carrick and the Lynwood Quarry. The

escarpment of Cookbundoon Ridge is a landscape feature, visible in the distant background of this view.

Sensitivity: Rampion Hills Road is a local road, extending north from the Hume Highway, used mainly by local residents and their visitors, with occasional recreation traffic. Views such as this are common within this area, north of the highway, around Nattery Hill. This viewpoint is therefore of very low visual sensitivity. The scenic quality of this view would be moderate, due to the presence of a varied landform, vegetation cover and creek line. This view would therefore be of **low visual sensitivity**.

Magnitude of change: There may be a glimpse to a small part of the eastern area of the proposal site, in the middle ground of this view, glimpsed between the vegetation. The project would be located well below the Cookbundoon Ridge escarpment and would be over two kilometres away so that the panel arrays would merge visually and be seen as a block of colour, if at all. Overall, there would be a **negligible magnitude of change**.

Visual impact level: **negligible**

4.3.3.3. Viewpoint 3: View north east from Munro Road

Existing conditions: This view is from a slightly elevated area to the south of the project site, along Munro Road. The view shows an undulating landscape, mostly cleared for rural purposes and used for livestock grazing. The landform gently descends to the creeks that meander through this area, including Lockyersleigh Creek (middle ground of view), a tributary of the Wollondilly River. The upper terraces at Lynwood Quarry are visible in the background of view (right), which sits below the vegetated skyline of the tablelands beyond. Further to the west (left of view), the escarpment and dense vegetation in Cookbundoon Nature Reserve is a landscape feature, seen in the distant background of this view.

Sensitivity: Munro Road is a local road, extending north from the Hume Highway, used mainly by local residents and their visitors. Views such as this are common within this area, west of Marulan. This viewpoint is therefore of very low visual sensitivity. The scenic quality of this view would be moderate, due to the presence of a varied landform, vegetation cover and watercourses. This view would therefore be of **low visual sensitivity**.

Magnitude of change: A small part of the project site would be seen in the centre background of this view, glimpsed on the rural fields beyond the creek line vegetation. The project would remain below the vegetated skyline of the tablelands which forms a backdrop to this view. Within this area there would be panel arrays, inverters and potentially batteries. Due to the distance, the panel arrays would not be clearly differentiated, and would be seen as a block of colour and the batteries would not be prominent amongst the panels as they would be similar or lower in height depending upon the tracking angle of the arrays. A small section of the access road would be seen in the middle ground of view, extending along the fence line and would be of similar character to nearby rural tracks and small roads. Overall, due to the small area of the project that would be visible and the effect of distance on the prominence of the visible area, there would be a **low magnitude of change**.

Visual impact level: **Low**



FIGURE 4-8 VIEW NORTH EAST FROM MUNRO ROAD

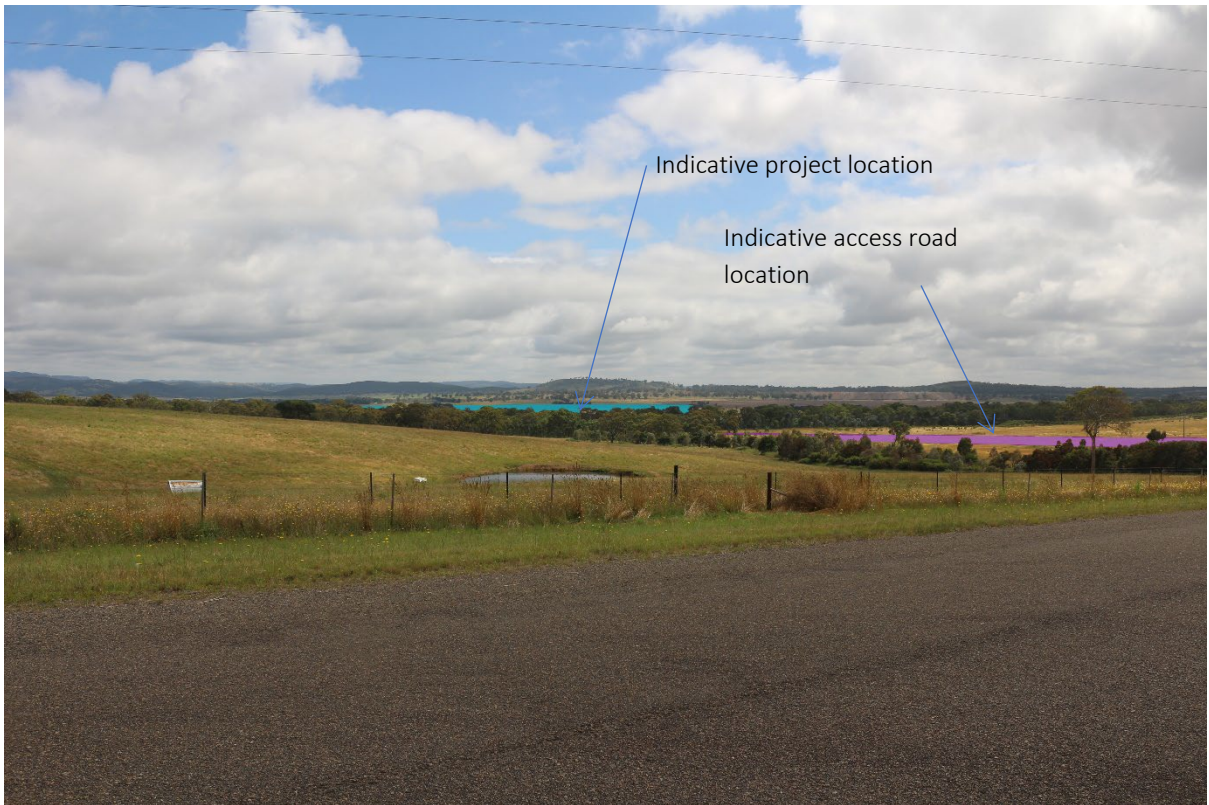


FIGURE 4-9 VIEW NORTHEAST FROM MUNRO ROAD, APPROXIMATE LOCATION OF THE PANEL ARRAYS HIGHLIGHTED IN TURQUOISE (CENTRE OF VIEW) AND THE ACCESS ROAD LOCATION IN PINK (RIGHT OF VIEW)

4.3.3.4. Viewpoint 4: View north west from Munro Road



FIGURE 4-10 VIEW NORTHWEST FROM MUNRO ROAD

Existing conditions: This view includes an undulating landform with fields in the fore and middle ground. There are corridors of vegetation along the field boundaries and following the creek valleys (left and centre of view). The vegetation along the ridgeline in the middle ground of this view screens the view to the fields to the north. There are a few local transmission poles and overhead wires glimpsed in this view but not rising above the backdrop of vegetation. The hills of the Cookbundoon Nature Reserve can be seen in the distant background, enclosing the view. This vegetated escarpment is a local landscape feature and an attractive feature of views from this area.

Sensitivity: This view includes an attractive rural landscape, framed by vegetation, and distant hills, which are a local visual feature. Munro Road is a local road, connecting a small group of rural properties with the Hume Highway, and would be mainly seen by local residents and their visitors. Overall, this view is of **low visual sensitivity**.

Magnitude of change: The main areas of the site, containing the solar panel arrays, inverters and the grid connection infrastructure, would not be seen from this location due to the intervening landform and vegetation, visible across the middle ground of this view. A section of the site access track would, however, be visible in the middle ground of view, extending from Munro Road, parallel to the vegetation along the field boundary, towards the site. This access track would typically be gravel and would have a similar character to nearby rural tracks and small roads. There would be some vegetation removed in the middle ground of this view, opening up a small gap and potentially a glimpse to the site over the intervening hill. Overall, there would be a **low magnitude of change**.

Visual impact level: **Low**

4.3.3.5. Viewpoint 5: View south from Carrick Road



FIGURE 4-11 VIEW SOUTH FROM CARRICK ROAD



FIGURE 4-12 VIEW SOUTH FROM CARRICK ROAD, APPROXIMATE LOCATION OF THE PANEL ARRAYS HIGHLIGHTED IN TURQUOISE (CENTRE OF VIEW)

Existing conditions: This view shows an undulating rural landscape formed by several creeks, including the Narambulla, Lockyersleigh and Osborns Creek, all tributaries of the Wollondilly River. The land has been mostly cleared and used for livestock grazing. The trees surrounding Lockyersleigh homestead (local heritage item, Goulburn Mulwaree LEP) are visible in the middle ground of view. Beyond this, the Southern Highlands rail line can be seen, crossing the view, with several passenger trains passing through this landscape each day, travelling between Bundanoon and Goulburn. The 330kV transmission line towers are visible in the foreground of view, crossing overhead and extending away from Carrick Road to the southwest (right of view). A series of hills and ridges, including Nattery Hill (right of view) and the foothills of Mount Marulan (centre of view, form the background and enclose this view.

Sensitivity: Carrick Road is a local road, extending between Brayton and the Hume Highway, used mainly by local residents and their visitors. This view includes an attractive rural landscape, framed by vegetation, and distant hills, which are a local visual feature. Overall, this view is of **low visual sensitivity**.

Magnitude of change: Parts of the northern edge of the solar panel arrays would be visible in the background of this view where the site is not screened by intervening landform and trees. The proposal area would be located below the vegetated backdrop and view of the tablelands beyond, at a distance of over four kilometres. At this distance, the panel array areas would merge visually and there would appear as several blocks of colour, broken up horizontally by fields following the local drainage lines. Within this north western area of the site (left of view) there would potentially be batteries scattered amongst the panel arrays. These batteries would not be perceptible at this distance, and mostly screened by the adjacent panel arrays as they would be similar or lower in height depending upon the tracking position of the panel arrays. The grid connection infrastructure, potentially including a battery storage area, would be visible on the northern side of the proposal site and with the transmission towers extending west towards the existing 330kV line. The towers would not rise above the vegetation in the background and the grid connection infrastructure would be viewed together with the panel arrays and / or existing transmission line infrastructure.

Overall, due to the distance, intervening landform, scale and layout of the infrastructure the magnitude of change would be **negligible**.

Visual impact level: **Negligible**

4.3.3.6. Viewpoint 6: View south east from Towrang Road

Existing conditions: This view across the Towrang valley includes an undulating rural landscape. The landform gently slopes towards the Wollondilly River (middle ground of this view) and associated creeks and drainage lines which meander through this landscape. The foothills of Mount Marulan are visible in the distant background, including a forested hill and ridges, with a single telecommunications mast (about ten kilometres away). The 330kV transmission lines are visible in the background of this view, in the vicinity of Carrick Road. The Southern Highlands rail line is also visible, raised slightly on an embankment, with trains intermittently crossing the view in the background.

Sensitivity: Towrang Road is a local road, used by local residents and visitors travelling through this part of the Towrang Valley. This view includes an attractive rural landscape, framed by vegetation, and distant hills, which are a local visual feature. Overall, this view is of **low visual sensitivity**.



FIGURE 4-13 VIEW SOUTHEAST FROM TOWRANG ROAD



FIGURE 4-14 VIEW SOUTHEAST FROM TOWRANG ROAD, APPROXIMATE LOCATION OF THE PANEL ARRAYS HIGHLIGHTED IN TURQUOISE (CENTRE OF VIEW)

Magnitude of change: The proposal would be seen in the background of this view at a distance of about six kilometres. The panel array infrastructure, the inverters and any batteries, would have a low profile and would be viewed against the existing vegetation on the elevated land to the south of the proposal site and remain well below the vegetated ridgelines of the Mount Marulan foothills.

At this distance, the panel array areas would merge visually and there would appear as several blocks of colour, broken up horizontally by fields following the local drainage lines. The grid connection infrastructure, including battery storage area, would be visible in front of the proposal site, with the transmission towers extending west (right of view) towards the existing 330kV line. The towers would not rise above the vegetation in the background and the grid connection infrastructure and at this distance, would not be prominent in the view.

Due to the elevation of this viewing location, a slightly greater depth of the solar arrays would be seen, as there would be less screening by intervening landform and trees.

Overall, due to the distance, scale and layout of the infrastructure, and the location of the proposal site below and seen against the backdrop of vegetation, the proposal would not be prominent in this view and the magnitude of change would be **negligible**.

Visual impact level: Negligible

4.3.4. Summary of visual impacts from the public domain

The following table (refer to **Table 4-6**) summarises the visual impacts on views from the public domain.

TABLE 4-6: SUMMARY OF VISUAL IMPACTS FROM THE PUBLIC DOMAIN

	Viewpoint number and location	Sensitivity	Without mitigation	
			Magnitude	Visual impact
1	View north from the Hume Highway	Low	Negligible	Negligible
2	View northeast from Rampion Hills Road	Low	Negligible	Negligible
3	View northwest from Munro Road	Low	Low	Low
4	View north from Munro Road	Low	Negligible	Negligible
5	View south from Carrick Road	Low	Negligible	Negligible
6	View southeast from Towrang Road	Low	Negligible	Negligible

4.3.5. Visual impacts during construction

During construction there would be views to the construction of the access track from Munro Road, where there would be some vegetation removal and minor roadworks. In this location there would also be construction vehicles seen accessing the site to install the solar farm infrastructure.

In views from the north, at Carrick Road and Towrang Road, work to construct the solar farm and grid connection infrastructure would be seen in the background of most views. This work would include a range of activities to construct internal access tracks, piling of tracker arrays, installation of panels, grid connection infrastructures, batteries, and the installation of transmission line structures. This work would be seen in the background of most views and would be temporary in nature. Overall, there would be a **minor adverse to negligible visual impact** on views to the site during construction.

4.3.6. Visual impact of lighting

The site and surrounding area has a **moderate visual sensitivity** at night as it is an area of A2: Low district brightness (refer Table 3-5) with sparsely inhabited rural and semi-rural areas.

There is no night works proposed to construct the project and therefore there would be **no visual impact** at night during construction.

During operation, there is limited permanent lighting proposed as a part of this proposal. Any security lighting associated with the grid connection infrastructure, for example, would be consistent with the lighting associated with homesteads and dwellings scattered across this rural landscape. Due to the rural landscape and distance between the proposal site and neighbouring dwellings, there would also not be any light spill onto neighbouring residences. Overall, there would be **no visual impact** at night during operation.

4.3.7. Views from air traffic

Views from commercial planes and helicopters do not have a high sensitivity as their primary function is for travel, and not to appreciate views. If there were a view to the proposal from a commercial flight, there would not be a visual impact to pilots or passengers.

There are scenic flights operating out of the Goulburn Airport, which is about 30 kilometres from the proposal site, as well as helicopter charters and hot air balloon tours based in Goulburn. The proposal site is not located in an area of particularly high scenic value and is unlikely to attract these scenic flights. However, any views from air traffic would offer a unique, aerial view of the landscape. The study area for this proposal includes a complex landscape with natural features, rural landscapes as well as existing high voltage transmission lines and quarries in close proximity to the site. There are also other renewable energy developments including solar farms and wind farms in the broader visual catchment. These are interesting visual features and do not necessarily detract from the amenity of views from the air.

If viewed from the air, the proposal would not be of a scale that would alter the overall character of this landscape. Overall, if seen, there would be a negligible visual impact during construction and operation.

5. Visual impact assessment - Views from surrounding residences

5.1. Approach

The assessment of visual impact on views from private residences is guided by the planning principles for 'view sharing' provided in the judgement of the NSW Planning Environment court in the *Tenacity Consulting V Warringah Council* [2004], NSWLEC 140. View sharing is when a property ... 'enjoys existing views and a proposed development would share that view by taking some of it away.' (NSWLEC 140, 2004)

5.2. Assessment steps

To determine whether or not view sharing is reasonable the judgement suggests the following four-step assessment be undertaken.

Step 1: Assess views to be affected, noting:

- water views are valued more highly than land views
- iconic views are valued more highly than views without icons
- whole views are valued more highly than partial views.

Step 2: Consider from what part of the property the views are obtained, noting:

- this should be undertaken from the whole of the property (residence), not just for the view that is affected
- the impact on views from living areas is more significant than from bedrooms or services areas
- views from kitchens are highly valued because people spend so much time in them.

Step 3: Assess the extent of the impact, noting:

- this should be undertaken from the whole of the property (residence), not just for the view that is affected
- the impact on views from living areas is more significant than from bedrooms or services areas
- views from kitchens are highly valued because people spend so much time in them.

To identify the extent of impact (step 3) viewshed analysis has been used as well as observations on site.

It is important to note that a view of the project does not necessarily constitute a visual impact.

5.3. Visual impact assessment – Views from surrounding residences

Figure 4-2 shows the location of residences located within the study area. The study area includes dwellings located within the valleys surrounding the catchment of the site and extends about six to seven kilometres to the north, and south to the Hume Highway. This includes the Lockyersleigh homestead, located about 1.6 kilometres to the north of the site. This property includes three additional residences including two further to the north. To the south, there is a group of eight residences located along Munro Road and Graham Lane, which are in close proximity to the proposed site access road. There are also dwellings around Carrick Road and Towrang Road to the north.

Table 5-1 includes an assessment of the potential visual impact from each private receptor where there may be a view to the site. Where there are groups of dwellings and the visual analysis would be similar, these are assessed together.

In summary:

- **Dwellings on the fields to the north** - There would be **no visual impact** in views from the rural dwellings located to the north of the site, between 1.7 and 6 km of the site including (R1, R2, R3, R4, R5 and R6), due to intervening landform, including the embankments of the Main Southern railway and vegetation.
- **Dwellings to the northwest along Towrang Road** - In views from dwellings to the northwest of the site, on the lower slopes of the Cookbundoon Range, east and west of Towrang Road, there would be a **negligible visual impact**. While the proposal may be seen, it would be in the background of the view, viewed against a backdrop of existing vegetation and would remain below the height of the Marulan hills beyond. The whole of the site would not be visible from any location, as the panel array areas would be visually broken up into smaller areas separated by fields maintained along the lower lying areas of the site.
- **Dwellings in Carrick, to the west** - Existing vegetation encloses views from dwellings on Carrick Road and Towrang Road in the vicinity of the township of Carrick (R37, R38, R39, R40, R41 and R42), to the west of the site and there would be a **low visual impact**. Over time, the proposed landscape screening would reduce this impact to **negligible**.
- **Dwellings to the west and southwest** - Views from most of the dwellings in this location are screened by dense vegetation. However, R43 may have views northward towards the grid connection infrastructure, including the proposed transmission line and towers, viewed together with the existing transmission line corridor, and glimpses to the solar farm array over the intervening trees. There would be a **low visual impact** from this location, that would be reduced to **negligible** with the establishment of screening vegetation.
- **Dwellings to the south near Narambulla Lake** - There would be **low visual impact** from dwellings that have a view to the short section of the southwestern edge of the solar panel array area located on the highpoint (R62, 63, 64, 74, 73). Over time, the proposed screening vegetation would reduce this impact to **negligible**.
- **Dwellings to the south near Graham Lane and Munro Road** - Existing vegetation to the south of the site encloses view to the site, however, there would be **low visual impact** experienced from several properties (R66, R67, R70, R71 and R72) and where the access road and north eastern portion of the panel array area would be seen above and through the existing vegetation. Over time, this would be reduced to **low** and **negligible visual impacts** where additional vegetation would provide further screening of these views.

TABLE 5-1 REVIEW OF POTENTIAL VISUAL IMPACT ON PRIVATE RESIDENTIAL DWELLINGS

Ref. No.	Property address	Distance to the panel arrays	Step 1: Assess views to be affected.	Step 2: From what part of the property are the views obtained.	Step 3: Assess the extent of the impact			
					Visible area of the proposal	Potential impact	Effect of vegetation screening	Potential mitigated impact
<i>Dwellings to the north</i>								
1	1114 Carrick Road	1.7 km (Local Heritage listed Associated dwelling)	Southerly towards the site mostly enclosed by trees around the house, the raised railway line and intervening landform on intervening fields. Views would have a backdrop of hills to the south and west.	N/A	No view to the panel array area	-	-	Nil
2	1114 Carrick Road	1.76 km (Associated dwelling)				-	-	Nil
3	1114 Carrick Road	2.66 km (Associated dwelling)	South westerly views towards adjacent rural areas, with a backdrop of hills to the south and west.	N/A	No view to the panel array area Grid connection infrastructure, southwest of the site, may be visible	-	-	Nil
4	1114 Carrick Road	2.90 km (Associated dwelling)				-	-	Nil
5 and 6	Carrick Road	6 km+	Southerly views enclosed by vegetation.	N/A	No view to the proposal	-	-	Nil
<i>Dwellings to the northwest, along Towrang Road</i>								
R7, R8, R10, R13, R14, R22, R23, R26, R27, R28	Dwellings east of Towrang Road	4.0+ km	Southerly views from dwellings on the slopes generally below Towrang Road. Views likely to be to rural fields with vegetation along field boundaries and creeks, including existing transmission lines, rail line and rural roads.	N/A	Any views to the proposal would be seen in the background, partly obstructed by intervening landform and vegetation, and viewed against existing vegetation so that it would not be prominent.	Negligible	Vegetation proposed along the northern boundary of the site, and within fields within the site, would break up the solar array area and provide localised screening.	Negligible

Ref. No.	Property address	Distance to the panel arrays	Step 1: Assess views to be affected.	Step 2: From what part of the property are the views obtained.	Step 3: Assess the extent of the impact			
					Visible area of the proposal	Potential impact	Effect of vegetation screening	Potential mitigated impact
R12, R15, R16, R18, R17, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30	Dwellings west of Towrang Road	3.75-7 km	Southerly views from dwellings on the lower slopes of the Cookbundoon Range, generally located above Towrang Road. Views to rural fields with vegetation along field boundaries and creeks, may include transmission lines, rail line and rural roads.	N/A	Any views to the proposal would be seen in the far background, partly obstructed by intervening landform and vegetation, and viewed against existing vegetation so that it would not be prominent.	Low and Negligible	Screening vegetation proposed along the northern boundary of the site, and within fields within the site, would break up the solar array area and provide localised screening.	Negligible

Dwellings in Carrick, to the west

37, 38, 39, 40, 41, 42	Carrick Road	2.42 – 2.87 km	Easterly views filtered through trees in gardens, on Carrick Road and on intervening fields.	Unknown	Unlikely to be a view to the panel array area of the solar farm due to vegetation in this area. There may be views to the grid connection infrastructure, if located adjacent to the existing transmission line corridor, filtered through trees on Carrick Road and surrounding these dwellings	Low	Screening vegetation in the vicinity of the grid connection infrastructure and battery storage facilities would reduce its visibility over time. The transmission line towers would not be screened.	Negligible
32, 33, 34, 35, 36	Towrang Road, western areas of Carrick	3.25 km+	N/A	N/A	The proposal would not be visible from this location	-	-	Nil

Dwellings to the west and southwest

43	658 Carrick Road Carrick	1.54 km	Potential for a view to the panel array area of the solar farm identified in viewshed, however, much of the area containing the solar farm	Unknown	Potential for a view to the grid connection infrastructure	Low	Proposed screening vegetation at the buildings proposed for the grid connection and within the solar farm array areas	Negligible
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Ref. No.	Property address	Distance to the panel arrays	Step 1: Assess views to be affected.	Step 2: From what part of the property are the views obtained.	Step 3: Assess the extent of the impact			
					Visible area of the proposal	Potential impact	Effect of vegetation screening	Potential mitigated impact
			array would be screened by intervening vegetation. May be view north to the transmission line and grid connection infrastructure.				would reduce the visibility of the proposal over time. The transmission towers would not be screened due to clearance zones and their height.	
44	596 Carrick Road Carrick	2.52 km	Eastward views limited by densely vegetated location.	N/A	No view from this dwelling	-	-	Nil
45	494 Carrick Road Carrick	2.66 km		N/A	No view from this dwelling	-	-	Nil
46, 47, 48, 49, 50, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61	292 Rampion Hills Road Carrick	700 metres - 3.1 km	Unlikely to be a view to the solar farm due to surrounding vegetation.	N/A	-	-	-	Nil
50	269 Rampion Hills Road	1.8 km	Appears to be a shed.	N/A	-	-	-	Nil
51	282 Carrick Road Carrick	1.97 km	Appears to be a shed.	N/A	-	-	-	Nil

Dwellings to the south near Narambulla Lake

62, 63	Narambulla Lake Road Carrick	1 – 2.1 km	Northerly views along the valley. Panoramic views east across the lake and to the hills near Munro Road. The proposal site would be on the ridgeline, in the background and on the periphery of the main view line.	N/A	Potential for a glimpse to a short section of the southwestern edge of the solar panel array area, located on the highpoint.	Low	Proposed vegetation along the southern and southwestern edge of this area would screen this infrastructure.	Negligible
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Ref. No.	Property address	Distance to the panel arrays	Step 1: Assess views to be affected.	Step 2: From what part of the property are the views obtained.	Step 3: Assess the extent of the impact			
					Visible area of the proposal	Potential impact	Effect of vegetation screening	Potential mitigated impact
64, 74	Hume Highway and Graham Lane	1 – 2.1 km	Buildings enclosed by vegetation, unlikely to have a view towards the site.	N/A	No view from this dwelling	-	-	-
69	Graham Lane Carrick	700 metres to panel array	Westerly, panoramic views across the lake towards the hills near Rampion Hills Road. The proposal site would be on the ridgeline, in the background and on the periphery of the main view line.	Likely to be north facing living areas.	Potential for a glimpse to a short section of the southwestern edge of the solar panel array area, located on the highpoint. This would be on the periphery of the panoramic views west. Would not be prominent in the view.	Negligible	Proposed vegetation along the southern and southwestern edge of this area would screen this infrastructure.	Negligible
65, 68	Graham Lane Carrick	700 metres to panel array	Unlikely to be a view due to intervening vegetation	N/A	N/A	-	-	Nil
73	100 Graham Lane Carrick	2 kilometres	Unlikely to be a view due to intervening vegetation	N/A	N/A	-	-	Nil

Dwellings to the south, near Graham Lane and Munro Road

66	3 Graham Lane Carrick	675 metres to panel arrays 525 metres from access road	Elevated, northerly panoramic view across the Carrick valley towards the Cookbundoon Range. There is dense vegetation in the middle ground of this view. The Lynwood Quarry and several transmission line towers can be seen in this view.	North east facing verandah and living rooms oriented towards the site. (Identified with a visit to dwelling)	The panel array area of the proposal would be mostly screened by intervening landform and vegetation. There would be a small area of panel arrays, within the north eastern portion of the site, seen in the middle ground of the view. The grid connection infrastructure would not be visible from this dwelling. The site access track via Munro Road would be visible during construction, through a gap in the trees along the	Low	Vegetation proposed within the site would provide further screening of the view to the panel array area.	Low
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Ref. No.	Property address	Distance to the panel arrays	Step 1: Assess views to be affected.	Step 2: From what part of the property are the views obtained.	Step 3: Assess the extent of the impact			
					Visible area of the proposal	Potential impact	Effect of vegetation screening	Potential mitigated impact
					western boundary of this property. The existing vegetation would otherwise screen this area of the proposals site. During operation this access road would be consistent with the character of local rural roads in the area and used intermittently by light vehicles.			
67	Munro Road Carrick	810 metres from the panel array area 345 metres from access road	There is no dwelling on this site. However, it is anticipated that any dwelling constructed on this site would have a northerly aspect, with views towards the Cookbundoon Range The vegetation to the north of this property would limit views to the proposal site.	N/A	There may be a view to the central northern area of the site. There would also be an unobstructed view to the site access route during construction and operation. During operation this access road would be consistent with the character of local rural roads in the area and used intermittently by light vehicles.	Low	Vegetation proposed within the site would provide some further screening of the view to the panel array area.	Low
70	41 Graham Lane Carrick	1.03 kilometres 300 metres from access road	Northerly views along the valley towards the site.	Likely to be north oriented living areas.	There may be a view to the central north eastern area of the panel arrays. There would also be a view to the site access route during construction and operation. The grid connection infrastructure would not be visible due to intervening vegetation.	Low	Vegetation proposed within the site would provide some further screening of the view to the panel array area.	Negligible
71	41 Munro Road Carrick	1.17 kilometres 350 metres from access road						
72	97 Graham Lane Carrick	1.43 kilometres 575 metres from access road						

Views from the north facing verandah and garden of 3 Graham Lane, Carrick (R66)



Northwesterly view from the verandah



Northwesterly view from the verandah, approximate location of the site boundary highlighted in turquoise

6. Glare and reflectivity assessment

6.1. Approach

There is no specific guidance for the assessment of the impact of glare specific to solar energy projects of this scale in NSW. However, the NSW Department of Planning has recently released on exhibition a *Draft Large-Scale Solar Energy Guidelines (2020)* which offers some guidance for the assessment of amenity glare impacts on residential dwellings. The industry also typically refers to the guidance provided in the *Solar Energy Facilities Design and Development Guideline (August 2019)* prepared by the Victorian State Government.

A glare assessment was undertaken using the 'GlareGauge' Solar Glare Hazard Analysis Tool. The assessment is based on the following parameters, which were entered into the model. (Refer Table 6-1). Some of the concepts presented in these guidelines have been used for this methodology, taking into account the scale of this proposal and our field observations verifying glare analysis.

6.1.1. Identifying receptors

The visual catchment prepared for the visual impact assessment (refer section 4.2 of this report) was used to identify areas from which the project may be visible from private residential properties. All residences located within four kilometres of the site have been assessed for a glare impact. Those without a view to the site have then been identified as such and removed from the assessment. For the purposes of this assessment, an observer point has been selected for each dwelling and assigned a unique number.

Roads within four kilometres of the site and the Southern Tablelands Gliding Club runway have also been analysed. This analysis considers the amenity impacts but does not determine any impact on road or air safety.

6.1.2. Key concepts and terms

The following section describes some of the key concepts and terms used in this assessment. This is based upon information provided in the technical manual provided by ForgeSolar.

6.1.2.1. Solar glare

Solar glare is a visual sensation caused by reflected light which causes annoyance, discomfort, or loss in visual performance.

Reflected light can be divided into two subtypes, specular reflection and diffuse reflection. Specular reflection is the mirror-like reflection of light from a smooth surface and diffuse reflection is the dispersed reflection from a rough surface.

The law of reflection is that an angle of incidence (entrance angle of the sun's ray) is equal to the angle of reflection (exit angle of the potential glare). Assuming specular reflection (excluding all other factors), the geometric possibility of glare can be accurately predicted.

6.1.2.2. Ocular impacts

An ocular impact is an impact on the eye or on vision. Ocular impact from solar glare is a function of retinal irradiance (power of electromagnetic radiation produced by the sun) and the subtended source angle (size and distance) of the glare source. (Ho, 2011)

The ocular impact of solar glare can be quantified into three categories (Ho, 2011):

- a) Green - low potential to cause after-image
- b) Yellow - potential to cause temporary after-image
- c) Red - potential to cause retinal burn (permanent eye damage)

An afterimage is an image that continues to appear in a person's vision after the exposure to the original image has ceased. It is caused by a brief exposure to a bright stimulus when the surrounding conditions are darker. Glancing at the sun or bright headlights at night are commonly encountered situations when an after-image may be experienced. An afterimage may distract and cause annoyance but does not cause harm. This is a commonly experienced phenomenon, which is usually brief.

Retinal burn is permanent damage to the eye caused by prolonged exposure to solar radiation or other bright light. Lasers and welding torches can cause retinal burn, for example. Photovoltaic modules do not focus reflected sunlight, therefore, it is not possible for photovoltaic modules to produce retinal burn (red glare). (ForgeSolar, 2019).

It is important to note that the yellow and green glare categories are risk ratings, and identify a potential for glare, rather than an actual glare effect. There are a range of atmospheric conditions that influence the potential for glare, including clouds, dust, smoke, rain etc. The intensity of a reflection also generally decreases with distance.

6.1.2.3. Solar Glare Hazard Analysis

To identify the risk of glare effects from the project the Solar Glare Hazard Analysis Tool (SGHAT 3.0) 'GlareGauge' has been used. This is a glare impact assessment model specifically designed to identify the risk of glare caused by solar farms.

The proposed panel areas and the location of observer points are entered into a model, which applies vector calculations based on the geographic location of the site, sun position, the photovoltaic module orientation, reflectance environment and ocular factors.

If potential glare is identified by the model, the tool calculates the retinal irradiance and subtended angle (size/distance) of the glare source to predict potential ocular hazards according to the glare intensity categories red, yellow and green.

The GlareGauge analysis tool, however, has several limitations, which include:

- The model does not rigorously represent the detailed geometry of the solar farm; features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results.
- The model assumes specular reflection i.e. assumes there are no factors that may diffuse the light reflecting from the panel surface, such as dust.
- The model does not account for atmospheric conditions such as cloud cover, dust in the air and haze which will impact light reflection. For example, GlareGauge assumes sun with no cloud cover every day of the year.
- Intervening landform, buildings and vegetation between the sun and the site and also between the site and the receptor are not accounted for by the software.

This model shows a scenario which exaggerates the potential for glare. This software is therefore likely to predict solar reflections over a larger area and for a greater length of time than would be experienced in reality.

6.2. Assessment steps

A glare assessment was undertaken using the Solar Glare Hazard Analysis Tool 'GlareGauge'. The assessment is based on the specific project parameters shown in **Table 6-1**. The results of this analysis have then been analysed and the following steps undertaken.

Step 1: Identify the glare risk

- The glare results were summarised, showing the number of glare minutes in total for each panel array area (east and west) and the type of glare identified i.e. yellow or green.

Step 2: Confirming a receiver for the glare

- For dwellings where there was a risk of glare identified, those that have been confirmed as not having a view to the site were eliminated. This is because if there is not a view from this property, or there is not a habitable room oriented towards the proposal site, there would be no glare impact.
- This judgement was based on the level of visibility of the site identified in the Visual Catchment analysis and from field investigations.

Step 3: Assess the potential amenity effect of glare based on the identified risk

- This involved the consideration of the number of minutes of glare experienced per day and the time of day.
- An impact level was assigned according to the ranges in Table 7-1.

Step 4: Describe the context of this impact and mitigation measures

- This includes a more detailed consideration of the visibility of the proposal, and area of the solar array that would reflect glare, in the view. What time of day the effect would be experienced and the other potential sources of glare in the view that may mitigate this impact. The effect of the proposed screening vegetation or other mitigation measures would also be considered.
- Where there would be a moderate or high glare impact, mitigation measures would be proposed.

TABLE 6-1 CATEGORIES OF GLARE RISK

Effect level	Details
Low	Where 10 minutes or less of yellow glare is identified on any given day and / or Green glare is identified
Medium	Where 10 - 30 minutes of yellow glare is identified on any given day
High	Where greater than 30 minutes of yellow glare is identified on any given day

A general comment on the potential for a glare effect during construction has been made based upon observations from other solar farm projects during construction.

For the assessment of glare effects on roads and railways there is no guidance available. Therefore, where there is a risk of glare identified, the type of glare (i.e. green or yellow) is noted along with the time of day, orientation of the glare source from the main line of the view and potential visibility of the panel array area identified as potentially causing the glare effect.

6.3. Glare risk assessment

A glare risk assessment was undertaken using the inputs provided in **Table 6-2**.

TABLE 6-2 INPUT DATA FOR SGHAT ANALYSIS

Parameter	Value
Time zone	UTC +10
Axis tracking:	Single-axis rotation
Backtracking:	Shade / slope
Tracking axis orientation:	180.0 deg
Maximum tracking angle:	60.0 deg
Resting angle	0.0 deg
Ground coverage ratio	0.5
Panel material:	Smooth glass with coating

The results of this analysis are provided at **Appendix C** Glare Risk Data.

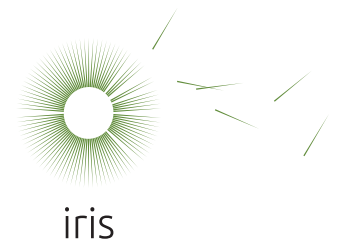
Table 6-3 summarises the results of the GlareGauge analysis. These represent the risk of glare from the project during operation. The following paragraphs summarise these findings.

6.3.1. Glare risk to private dwellings during operation

Of the 32 observer points (dwellings) considered, the Glaregauge analysis tool has identified a risk of glare for 18 dwellings. Of these, there would be eight with a potential view to the proposed solar array area.

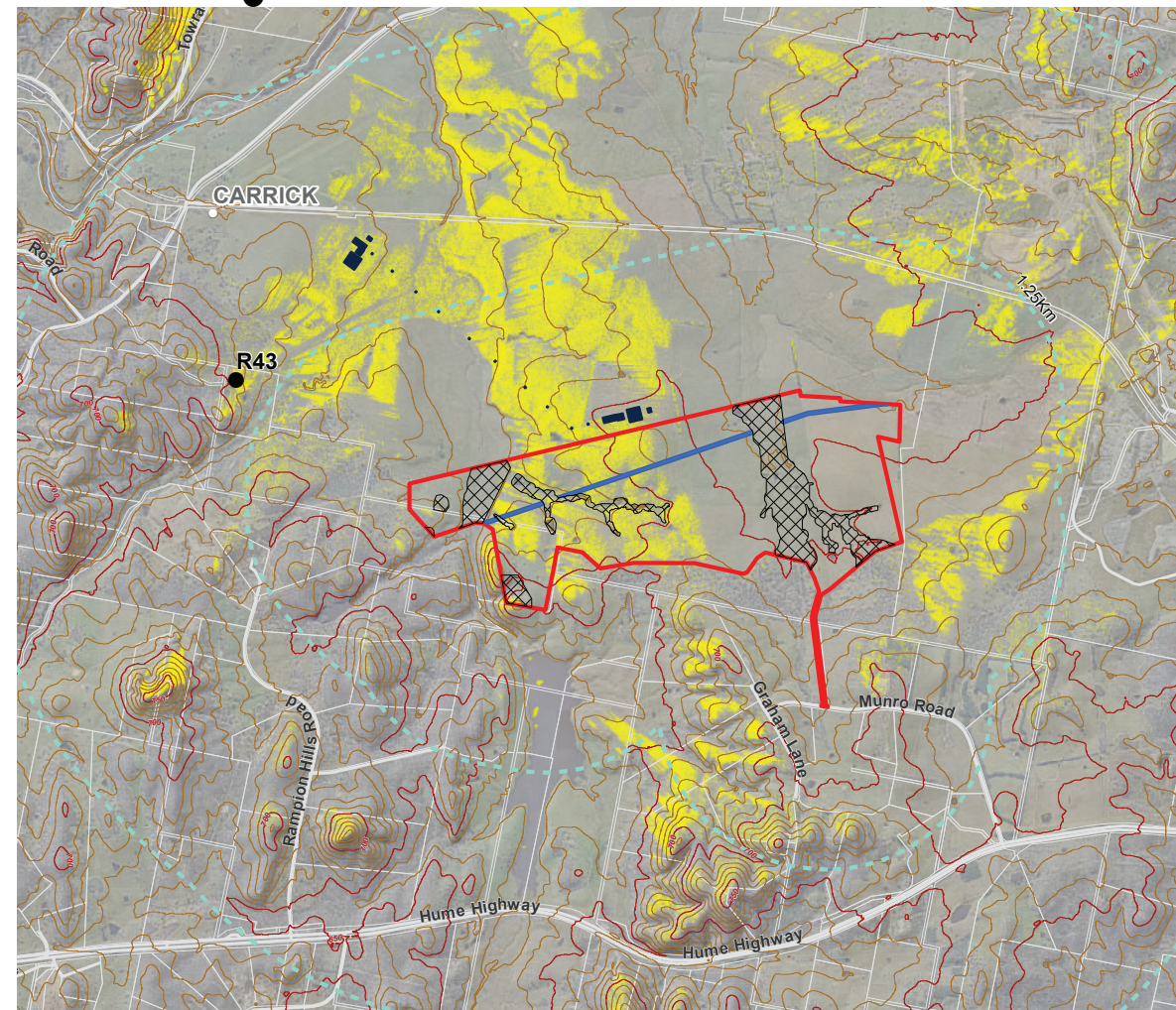
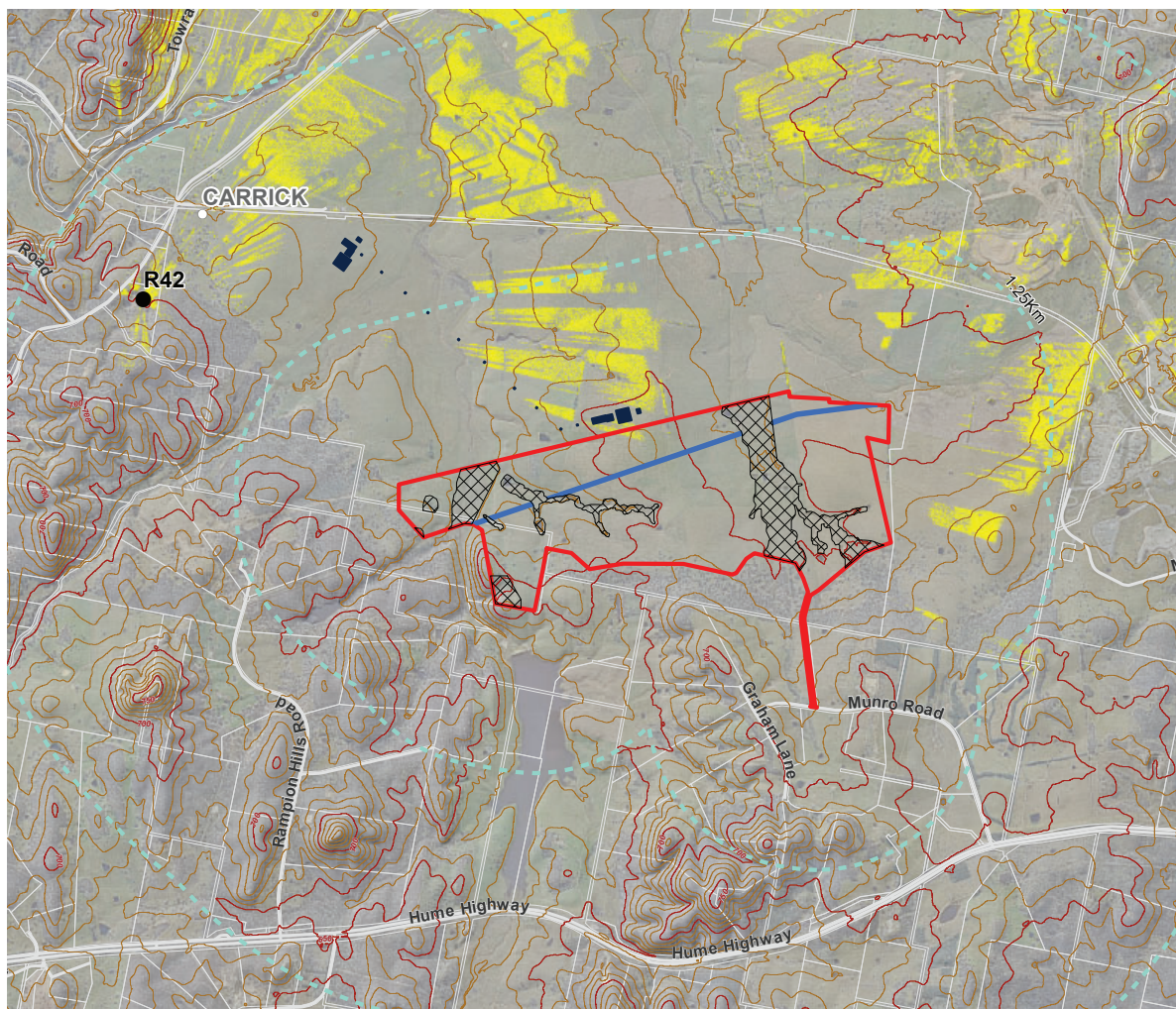
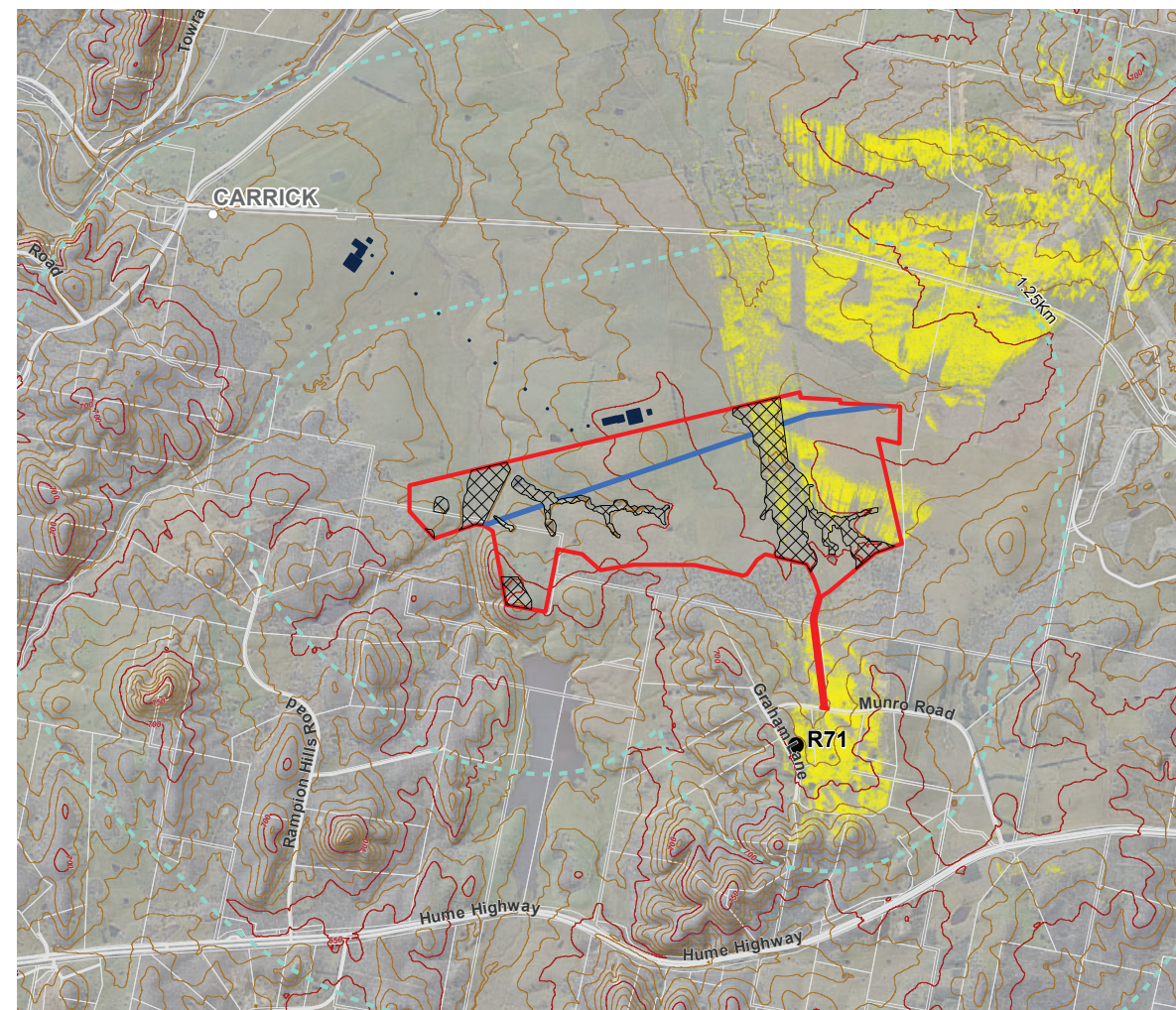
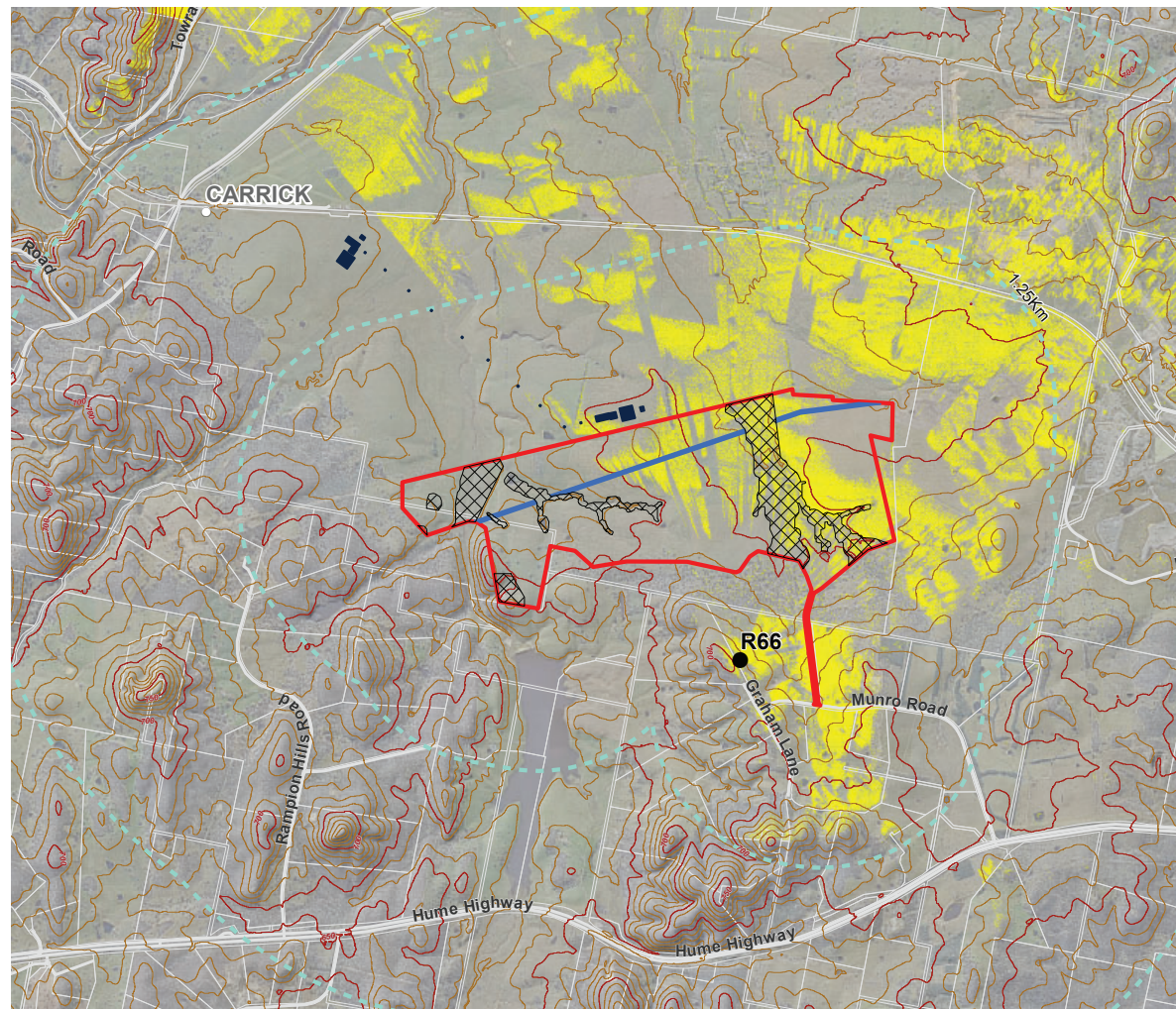
Further viewshed analysis was used to confirm which potentially reflecting panel array areas are out of view. A few examples of this analysis are provided in **Figure 7-1**. Where it is the case that potentially reflecting panel array areas are out of view, the predicted glare minutes have been adjusted to remove the glare minutes from non-visible areas of the proposed solar array area.









There is one dwelling that has the potential for a glare effect (R43) (refer **Figure 7-1**). However, due to vegetation between this building (R43) and the site, the actual visibility of the panel array areas that have the potential to produce a glare effect is likely to be limited. Regardless, at this location the predicted glare would occur for a duration of up to 20 minutes per day, which is the potential for a **moderate** glare impact. This effect would occur during sunrise, in a view towards the sun, in spring and summer. Screening vegetation proposed for the project may provide screening of the central areas of the site from this location, reducing the number of glare minutes and level of glare effect. It is expected that this would reduce the risk to a **low** glare impact.



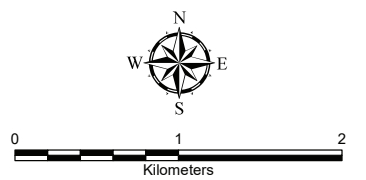
Marulan Solar Farm
Terrain Solar

Figure 7-1: Visual catchment plans - Private dwellings



-  Proposal site
-  Exclusion zone
-  Existing 66kV Line easement
-  Grid connection infrastructure
-  Contour (50m)
-  Contour (10m)
-  Receiver location (private dwelling)
-  Visual catchment

SOURCE:
Cadastral Boundary: NSW Department of Finance,
Services and Innovation 2021
Surface analysis: Derived from LiDAR - GOULBURN
2013 (5m) & MOSSVALE 2018 (2m) Digital Elevation
Model © Department Finance, Services and Innovation



A3 Scale: 1:45,000

File: MarulanSolar-Fig23-VisualCatchment-R43-220302 Date: 8/07/2022

The information shown on this plan may be insufficient for some types of design. GEOVIEW should be consulted as to the suitability of the information shown herein prior to the commencement of any works based on this plan.

This map is not guaranteed to be free from error or omission. GEOVIEW hereby disclaims liability for any act done or omission made on the basis of the information in this plan, and any consequences of such acts or omissions

TABLE 6-3 GLARE ANALYSIS

Receiver ID	OP ID	Address / location	Step 1: Identify Glare Risk:		Step 2: Confirm receiver for glare	Adjusted glare risk (minutes per year)		Step 3: Describe the context of this impact and mitigation measures	Step 4: Assess potential effect of glare	Revised glare effect due to contextual issues (Step 3)
			Glare risk (minutes per year)			Total	Yellow			
			Total	Yellow						
R33	OP 6	799 Towrang Road	455	0	Not in visual catchment	-	-	N/A	No impact	-
R34	OP 7	787 Towrang Road	368	0	Not in visual catchment	-	-	N/A	No impact	-
R39	OP 8	641 Carrick Road	1802	0	Not in visual catchment	-	-	N/A	No impact	-
R42	OP 9	684 Carrick Road	2952	207	Not in visual catchment	-	-	N/A	No impact	-
R43	OP 10	658 Carrick Road	4344	1884	Array 9 not visible based on landform	3498	1884	Intervening vegetation Up to 20 min per day Effect at sunrise between October and February	Moderate impact	Low impact
R46	OP 11	292 Rampion Hills Road	1271	545	Substantial intervening vegetation	0	0	N/A	No impact	-
R50	OP 12	269 Rampion Hills Road	165	0	Shed - Array 6 & 9 not visible	0	0	N/A	No impact	-
R51	OP 13	282 Carrick Road	75	0	Shed - Array 6 & 9 not visible	0	0	N/A	No impact	-
R54	OP 14	284 Rampion Hills Road	145	13	Substantial intervening vegetation	0	0	N/A	No impact	-
R55	OP 15	174 Rampion Hills Road	283	111	Substantial intervening vegetation	0	0	N/A	No impact	-
R65	OP 23	2 Graham Lane	3729	2053	Array 1 & 3 not visible	0	0	N/A	No impact	-
R66	OP 24	3 Graham Lane	3538	1780	Array 1 & 3 not visible	0	0	N/A	No impact	-
R67	OP 25	Munro Road Carrick	1945	0	Array 1 & 3 not visible	0	0	N/A	No impact	-
R68	OP 26	8 Graham Lane	1953	997	Array 1 & 3 not visible	0	0	N/A	No impact	-
R69	OP 27	44 Graham Lane	1651	582	Not in visual catchment	0	0	N/A	No impact	-
R70	OP 28	41 Graham Lane	2058	382	Array 1 & 3 not visible	0	0	N/A	No impact	-
R71	OP 29	41 Graham Lane	1522	128	Array 1 & 3 not visible	0	0	N/A	No impact	-
R72	OP 30	97 Graham Lane	1062	0	Array 1 & 3 not visible	0	0	N/A	No impact	-

6.3.2. Glare risk from the public domain

6.3.2.1. Local roads

There was a glare risk identified from Munro Road, however, the panel array areas identified as potentially causing a glare risk would not be visible due to the intervening vegetation and landform. As there was no glare risk identified from the panel array areas that would be seen, there would be a **negligible** glare impact on amenity from Munro Road.

There was also a glare risk identified from Carrick Road. The analysis identifies the areas where this glare effect would occur, to be in the vicinity of the rail crossing. In this location there is unlikely to be a view to the panel array area due to the screening effect of intervening landform and roadside trees. There would be a **negligible** glare impact on amenity expected from Carrick Road. Hume Highway

The Hume Highway is located about two to three kilometres to the south of the site. Due to intervening landform and vegetation there is very limited potential for a direct line of sight to the solar arrays and therefore a low risk of a direct reflection that may cause a glare effect. The SGHAT analysis for the section of the highway that may have a view to the site identified no glare risk. There would be a **negligible** glare impact on amenity expected from the Hume Highway.

6.3.2.2. Main Southern railway

The Main Southern railway is located at over one kilometre to the north of the site at its closest point. The SGHAT analysis for the railway line shows an area of potential glare risk to the northeast of the site, as the rail line passes to the south of the Lynwood Quarry. The glare analysis shows mostly green glare, and only a few minutes of yellow glare (which has the potential to cause an after image). The panel array area identified as having the potential to cause yellow glare is within the centre of the site, about two kilometres from this section of the railway.

There may be a direct line of sight from this section of the railway to the solar array panel area with some screening by intervening vegetation and undulating landform on the fields between the railway and this panel array area. Any view to this area would be possible during westbound travel, as the train passes this short section of the route. While the glare identified for this area is up to 15 minutes prior to sunset, the actual time that there is a risk of yellow glare is for the duration that it takes to pass this section of the rail line. The direction of travel, and therefore orientation of the view from the train, would be about 45 degrees from the main line of sight to the panel array area and any view to the reflecting surface of the solar farm would be viewed together with the setting sun.

As the train (and any viewer) would be moving the duration of the view to the glare effect would be less than the total timeframe during which the risk would exist. Therefore, this analysis shows a **low** amenity glare impact from the railway (assuming the residential thresholds).

The risk of there being a disability glare effect is reduced by the angle of the of view, distance and intervening elements between the train and the area of the solar farm from which the potential glare effect was identified.

6.3.2.3. Southern Tablelands Gliding Club runway

The Southern Tablelands Gliding Club uses a small turf runway about 2.5 kilometres to the northwest of the proposal site. There was no glare risk identified for the northern approach to the runway. However, there was a glare risk identified for the southern approach to the runway. This glare would occur soon after sunrise and occur for a period of up to 25 minutes per day. While there would be a potential glare impact expected at the Gliding Club from the southern approach to the runway at sunrise in summer, it is unlikely that gliding would occur at this time of the day, and therefore a **negligible** glare impact on amenity of users.

6.3.1. Glare risk during construction

There would be some potential for a temporary glare effect during construction. This would include a glare risk from the freshly galvanised posts as they are installed, an effect that would be temporary. The galvanised array support posts would become mostly shaded and screened by the Photovoltaic modules as they are installed. The impact from the galvanised posts would therefore only be experienced for the duration between installation of the array posts, and installation of the panels.

There is also the potential for a further glare risk when the panels are installed and stowed in a fixed position, particularly if they are oriented towards a receptor. The glare from these fixed panels (i.e. before they are operational and tracking the sun) would be a temporary effect.

Overall, due to the limited visibility of this site from private dwellings there would be a low risk of this glare impact during construction. Any glare experienced during construction would be temporary and be experienced for a short duration. This would result in a **negligible visual impact**.

7. Cumulative impact assessment

This section presents an issue-specific CIA, defined as the cumulative impacts of the project on [matter] with other relevant future projects within an identified area. The assessment has been conducted in accordance with the *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPIE, 2021).

7.1. Relevant future projects

While there are numerous solar farms proposed across the region, the closest is the Parkesbourne Solarfarm, 35 kilometres east of the site. There would not be a cumulative visual impact due to this proposal together with these proposed and approved solar farm developments as they would not be seen together in the same view, or within a sequence of views within the local area.

Other major projects within the locality include several quarry developments that have been approved or are proposed. Within three kilometres of the site there are:

- Lynwood Quarry (Mod 5 and Part 4) - approved, 300 metres northeast of the site
- Gunlake Quarry (Extension and Park 3A) - approved, 2.5km north-east of the site
- Marulan Quarry - EIS under preparation, 2.6 kilometres south of the site.

The Lynwood Quarry (Mod 5 and Part 4), located to the northeast of the site, may be seen together with this proposal and a simple assessment of the potential cumulative impact of this project on visual amenity has been undertaken.

7.1.1. Potential cumulative impacts on visual amenity

The existing Lynwood Quarry, located to the northeast of the site, can be seen in views together with this proposal, including in views from Munro Road and some private residences in this area. The Lynwood Quarry (Modification 5 and Part 4) would include an additional quarry pit, utilities and overburden to the north of the Main Southern railway, that may be visible in the background of these views, alongside the existing quarry.

The expanded quarry would be seen in the background of these views, and while having a different character to the proposed solar farm, together they would reduce the visible area of open rural character fields. Due to the relatively minor area of the solar farm that would be seen from this area, and predominantly **low** and **negligible** visual impacts identified, the cumulative effect of this proposal with the quarry would not increase due to this proposal.

Due to the limited visibility of both this proposal and the quarry more broadly, there would not be a cumulative visual impact anticipated from locations.

8. Ability to avoid, mitigate or offset the impacts of the project

8.1. How potential impacts have been avoided/minimised

The potential visibility of the project has informed the site selection for this project. The project has avoided visual impact by:

- Selecting a portion of the land holding to the south of the Main Southern railway line, with large areas of fields between the private dwellings to the north and the proposal site
- Locating the solar farm infrastructure on existing fields to avoid the removal of vegetation
- Locating the solar array areas outside the environmental exclusion zones so that the panel array areas are broken up into smaller parcels and there would not be a continuous expanse of panels across the full frontage of the site
- Locating the solar array area adjacent to a vegetated hill to the south, so that in views from the north it is viewed against this backdrop
- Locating the access route to the south of the main solar farm area, so that it can be screened by existing vegetation from most locations.

8.2. Other mitigation measures

A concept landscape plan has been prepared to respond to the findings of this visual and glare impact assessment (Refer to Figure 8-1, 8-2 and Appendix B). In particular it aims to screen areas of the site identified in the reverse viewshed analysis as having the greatest potential visibility (refer Figure 4-3 Reverse viewshed diagram)

Consultation with affected landholders is ongoing.

This landscape plan includes:

- Native screen planting along parts of the northern perimeter of the site
- Native screen planting in the vicinity of the grid connection infrastructure
- Riparian vegetation in accordance with the Strahler stream order requirements
- Some additional scattered trees on the upper slopes on the land to the south of the project area (within the same landholding)
- Trees along the access road from Munro Road.

The landscape plan includes specific plant lists selected for their suitability on the wet lower slopes of the site, and also the dryer upper slopes. There is no vegetation proposed for the River Tussock grassland areas where weed removal would occur and additional tree planting would not be appropriate. The panel array areas would have pasture grasses under them, so that sheep grazing could occur.

This plan includes plant species from the Goulburn Mulwaree Council DCP, Appendix B: Preferred Planting Species, as well as plant species identified by the project ecologist as present on or suitable for the site.