

AGL

Broken Hill Solar Plant

ENVIRONMENTAL ASSESSMENT

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Appendix C Visual Impact Assessment

Broken Hill Solar Plant

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

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Executive Summary

Project Background

AGL Energy Limited (the proponent) is proposing to construct and operate a nominal 50 megawatt (MW) capacity solar photovoltaic power plant ('solar project') and associated infrastructure including a 2.7 kilometre double-circuit 22 kilovolt transmission line connecting the plant to the TransGrid substation at Broken Hill. The site of the proposed solar project is located approximately 5 kilometres southwest of the Broken Hill Township and is wholly within the unincorporated area administered by the Department Primary Industries, Catchments and Lands Division (formerly Land and Property Management Authority (LPMA)).

Assessment Objectives

This document assesses the Landscape and Visual Impacts associated with the solar project and transmission line components of the project, including:

- Statutory regulations pertaining to the preservation of landscape and visual resources.
- Landscape characteristics within the visual catchment of the project as well as any features or views which require special consideration.
- An analysis of a representative sample of viewpoints from public and residential areas. The degree of visual impact from each viewpoint has been assessed with photos and photomontages prepared from key areas.
- An investigation of local and regional landscape values which may have a bearing on the compatibility of the proposed development with its landscape context.
- An inquiry into the potential for the solar project to cause annoyance for motorists, trains or aircraft due to sun glare.
- Recommend and devise landscape mitigation strategies to reduce any predicted visual or glare impact.

Key Findings and Recommendations

Generally, the solar project would have a low or negligible visual impact. The only area where it would have a high impact is along the Barrier Highway close to the northeast corner of the site, viewing southwest toward The Pinnacles, an important local visual resource. This could be mitigated through the planting of low shrubby vegetation. The presence of the solar project may offer a positive contribution to the viewing experience and act as a gateway element when approaching Broken Hill from Adelaide.

The transmission line would have a very low visual impact especially for locations beyond 1km away.

1. Introduction

This chapter provides an overview of the proposed development as well as describing the purpose of this Landscape and Visual Impact Assessment and the methodology by which it has been carried out.

1.1 Project Overview

AGL Energy Limited (the proponent) seeks to construct and operate a nominal 50 megawatt (MW) capacity solar photovoltaic power plant ('solar project') and associated infrastructure including a 2.7 kilometre double-circuit 22 kilovolt transmission line connecting the plant to the TransGrid substation at Broken Hill. The solar project is located approximately 5 kilometres southwest of the Broken Hill Township and is wholly within the unincorporated area administered by the Department of Primary Industries, Catchments and Lands Division.

An updated layout was supplied to SKM after this assessment was carried out. The area occupied by the new layout is of a lesser extent and therefore of a less visually intrusive nature than the one that this assessment is based on. This assessment is therefore more conservative in nature.

A copy of the Director General's requirements (DGRs) was issued on 8 December 2010 to the proponent. The DGRs state that an Environmental Assessment (EA) is required for the project under Section 75F of *The Environmental Planning and Assessment Act 1979*.

1.2 Purpose of this Assessment

Sinclair Knight Merz (SKM) was engaged to undertake the EA. This document will form part of that submission as an appendix to the EA, and will assess the landscape and visual impacts associated with the solar project and transmission line components (the project). The following section reiterates the DGRs relating to the visual impact.

1.2.1 Director General's requirements

Visual Impacts - the EA must:

- Include a full assessment of the visual impacts associated with the solar project, including identification and documentation of all key viewing points and corridors particularly from any identified sensitive lands. This should also include the associated transmission line and a comprehensive assessment of the landscape character and values and any scenic or significant vistas of the area potentially affected by the project;

(Addressed in *Landscape Baseline Conditions* in Section 4and *Assessment of Impacts* in Section 5)

- Include photomontages of the project taken from potentially affected residences, settlements and significant public view points, and provide a clear description of proposed visual amenity mitigation and management measures for the solar project;

(Addressed in *Mitigation Measures* in Section 8 and *Appendix A: Photomontages*)

- Provide an assessment of the feasibility, effectiveness and reliability of proposed mitigation measures and any residual impacts after these measures have been implemented; and

(Addressed in *Mitigation Measures* in Section 8)

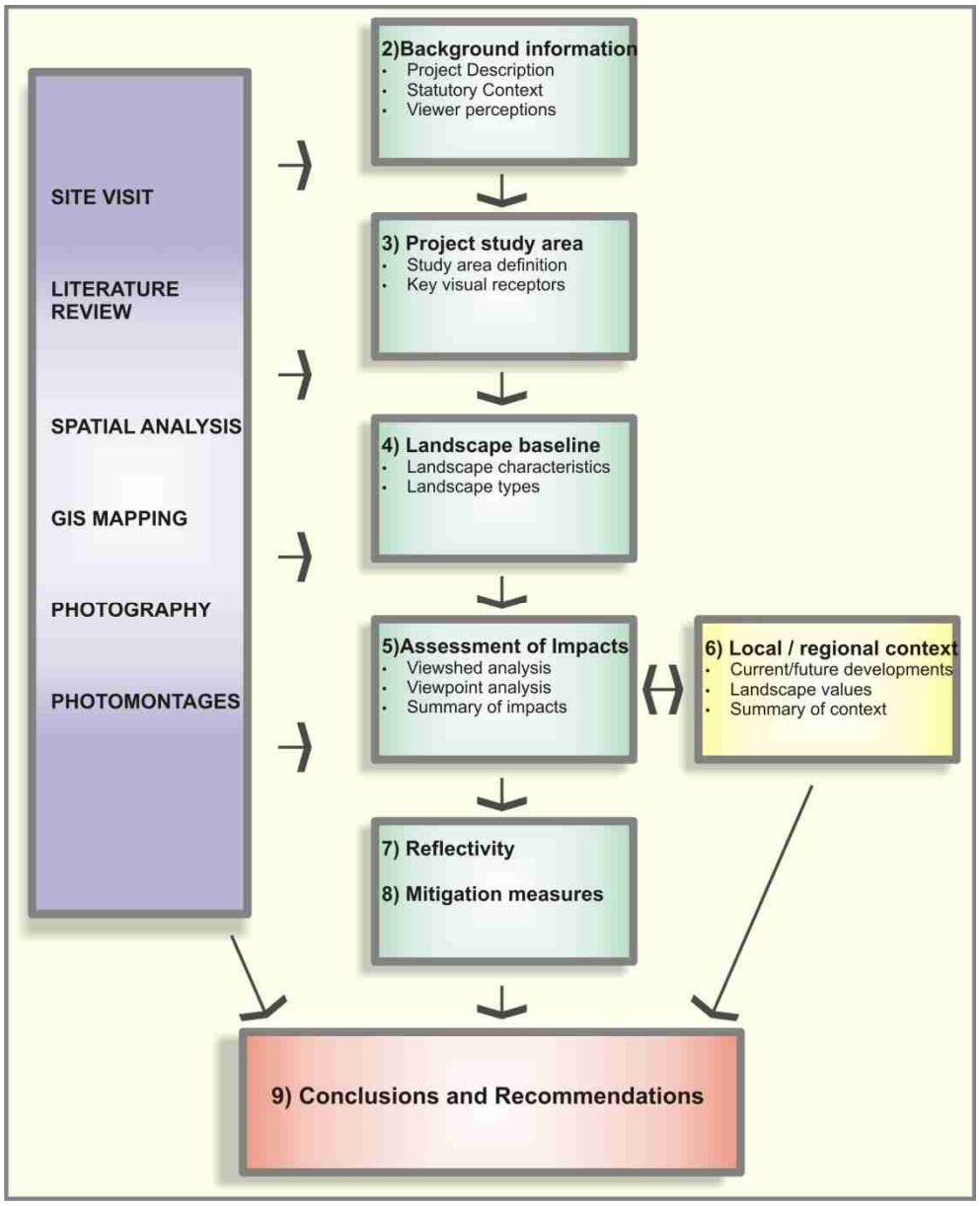
- Provide an assessment of the potential for reflectivity from the panels and associated infrastructure, and any safety impacts for motorists, trains or aircraft.

(Addressed in *Reflectivity* in Section 7)

1.3 Methodology

SKM's approach to this assessment has been synthesised from a number of guidelines as listed in the References. This approach is summarised in Table 1.

Table 1 Methodology for Landscape and Visual Impact Assessment.



Specific details of each step can be found under the relevant heading chapter. The site visit was carried out between the 15th and 17th of March, 2010 to photograph and document the site and surrounding area from key locations identified in the desktop analysis. The site photography was undertaken with a Nikon D70s digital SLR camera with a lens size ranging from 60mm to 90mm focal length. Photomontages were undertaken using industry standard practices with photos taken with the 90mm lens. The proposed infrastructure was modeled using 3D Studio Max with the photo editing being undertaken within Photoshop and Corel Draw.

The solar project will have different degrees of visual impact depending on, among other factors, how far it is away from the viewer. Various 'zones of visual influence' may be determined which relate distance and level of impact. Consideration is also given to the degree of visual exposure of that viewpoint (high, medium, low). This relates to the relative number of people that are likely to experience that view. Consideration is also given to the sensitivity of the landscape type to manmade visual modifications. This sensitivity is dependent on the type of development and its visual compatibility with the existing landscape. It is also influenced by community attitudes and perceptions, which may either support or oppose the development. A synthesis of the 3 main factors (i.e. distance, degree of visual exposure, landscape sensitivity) are analysed to give the overall level of visual impact. The scale of impacts in each category as well as its interpretation is described as follows:

1.3.1 Exposure

- High – A high rating would be given those public areas which experience a high degree of visitation as well as residential dwellings and populated areas. Public locations include areas such as major roads, parks and recreation reserves and scenic lookouts. Special priority is given to locations with the express purpose of appreciating the landscape as well as views from residential locations.
- Medium - A medium rating would be given to secondary roads and less frequented areas.
- Low – A low rating would be given to infrequently visited locations which are far away from populated areas and residences.

1.3.2 Landscape sensitivity

- High – Includes *Parks & Recreation Reserves* and *The Pinnacles* landscape types.
- Medium – Includes *Pastoral*, Commercial, *Residential*, *Conservation Area* and *Creeks and Drainage Systems* landscape types.
- Low – Includes *Mining* and *Industrial* landscape types.

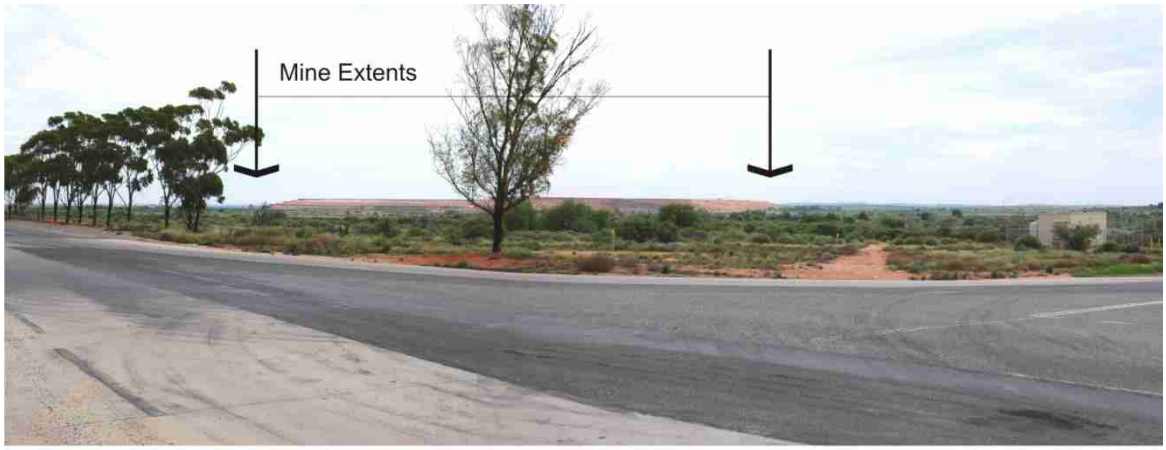
Detailed information is provided in *Landscape sensitivities*. Sensitivities are generally based on the degree of manmade modifications already present. Consideration is also given to general community perceptions of its value for landscape and visual amenity as well as the preservation of that amenity through statutory planning provisions.

1.3.3 Distance

- High – A high impact rating is given where the proposed development would be a dominant element in the view (within 2 km for the solar project and within 500m for the transmission line).
- Medium – A medium impact rating is given where the proposed development will be a moderately dominant element in the view (between 2 to 5km for the solar project and 500m to 1km for the transmission line).
- Low – A low impact rating is given to those locations where the proposed development would appear to recede into the distance (between 5 to 10km for the solar project and 1 to 10km for the transmission line).

These distance thresholds are meant to serve as a guideline only and are based on observations of objects during the site visit which have a similar visual footprint. Figure 1 provides an indication of the effect of distance on visual impact of an existing transmission line near the site. Figure 2 shows Perilya Mine (which has a similar visual footprint to the solar project) across the 3 distance ranges described above. The distances quoted have been measured using aerial imagery and GIS data.

Figure 1 Effect of distance on existing transmission line.



Approximately 1.7km away

Approximately 4.1km away

Approximately 11.5km away

Figure 2 Effect of distance on existing mine to the southeast of site.

1.3.4 Overall impacts

The overall visual impact for the solar project and transmission line components for each viewpoint will be derived from the ratings for exposure, landscape sensitivity and distance. Values for these will be synthesized and adjusted in accordance with site specific conditions to best represent the overall rating. A rationale will also be given. Overall visual impact values will range from *high, medium, low, negligible, nil* and *positive*. These are described as follows:

High impact – A large and detrimental change to the landscape characteristics and visual amenity.

Medium impact – The level of change would be moderately substantial.

Low impact – The level of change may be noticeable, however it would not result in a substantial change to the visual characteristics of the landscape.

Negligible impact – The level of change would be virtually un-noticeable.

Nil – The project would not visible, therefore would not have a visual impact.

Positive impact – A change which results in a positive contribution to the visual amenity of the landscape.

2. Background Information

This chapter provides a description of the project and its main visually prominent components, the statutory context of the project site as well as providing some details on viewer perceptions of solar technology.

2.1 Project Description

The project site is located in far western New South Wales (NSW), approximately 5 km south-west of the City of Broken Hill. The main components of the project are a photovoltaic plant and a transmission line which connects to an existing substation. Other components associated with the project include fencing, a site office and maintenance building and access roads. Construction and decommissioning activities are also discussed as they would also have a visual impact. The location of the project site is shown in Figure 3. The individual components of the project are discussed in the following sections.

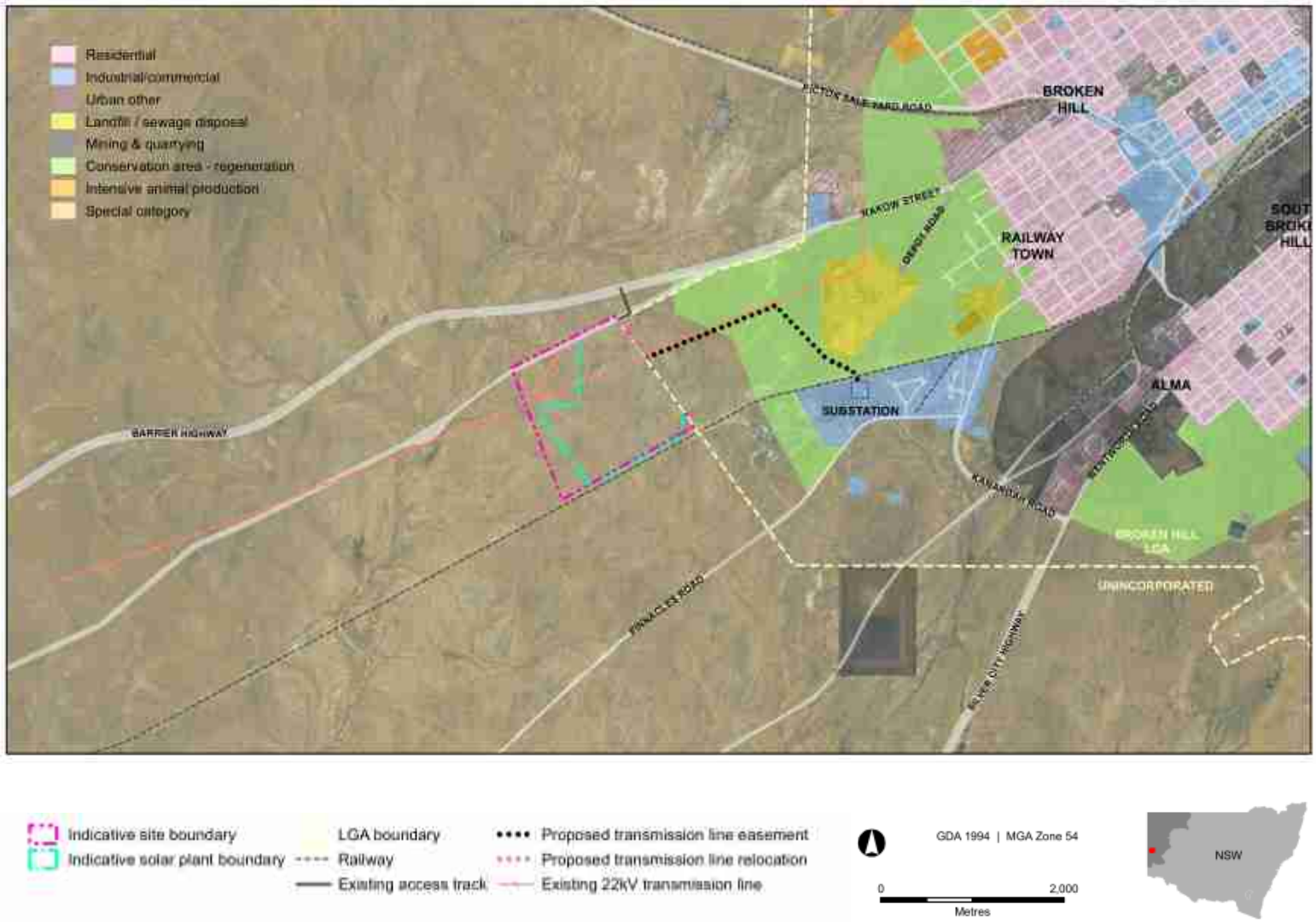


Figure 3 Indicative Site Layout and Zoning.

2.1.1 Photovoltaic plant

The photovoltaic plant (solar project) will be situated on approximately 200 hectares of land which is a predominantly cleared, relatively flat area encompassing numerous unsealed access tracks. It is located between the Barrier Highway to the north and the Peterborough Broken Hill railway line to the south. There is currently one residence and several utility sheds located in the northern part of the property. The photovoltaic infrastructure will occupy most of the area within the allocated parcel of land.

A photovoltaic cell is a semiconductor device that converts sunlight into electricity. Multiple cells are combined to form a solar module. The plant will have a nominal capacity of 50 MW and will comprise over 650,000 photovoltaic modules arranged in regular arrays. Each module will be mounted onto steel tilt brackets which are angled at 25 degrees from horizontal and face directly north. These brackets are supported by posts driven approximately 1.5 metres below ground with electrical cabling beneath the modules. The total height of the structure is not expected to exceed 1.5 – 2m. A similar photovoltaic plant under construction showing the posts, brackets and modules is shown in Figure 4. Figure 5 shows the proposed layout of the plant and Figure 6 shows an example of a 40MW plant built in Germany using similar photovoltaic modules.

Figure 4 Photovoltaic modules and brackets under construction

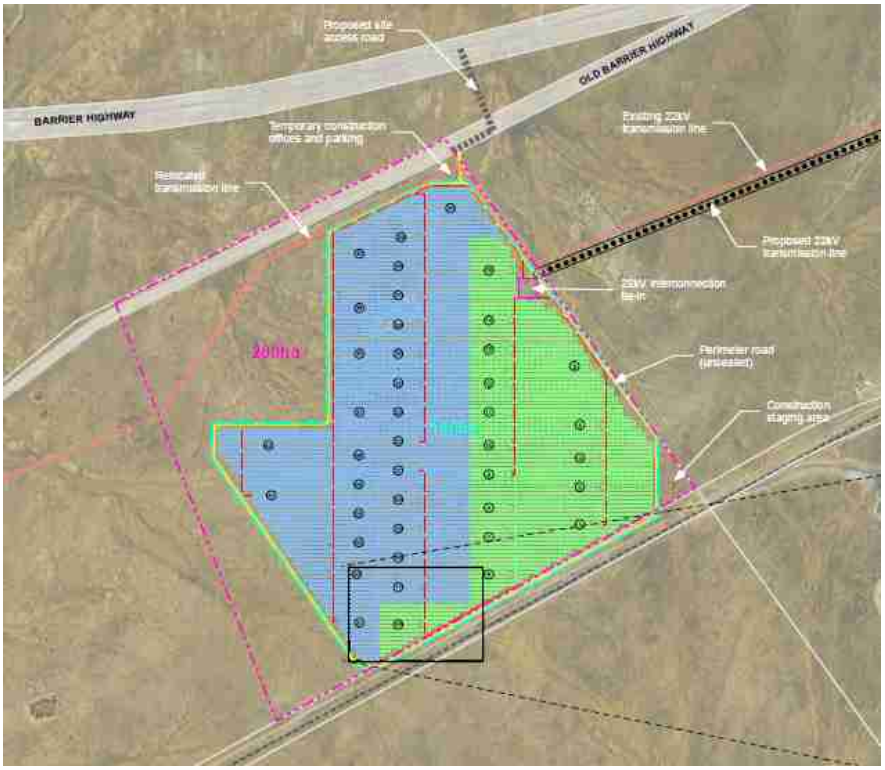


Figure 5 Proposed photovoltaic plant layout.

Figure 6 Existing 40MW plant in Brandis, Germany.

2.1.2 Transmission line

This component of the project consists of a double circuit 22kV overhead transmission line, approximately 2.7 km long, to connect the solar project to the TransGrid Broken Hill substation which is located approximately 1.8 km to the east of the plant site. The transmission line runs through predominantly cleared grazing land for approximately 1.4km in a north easterly direction from the plant site before turning south east and running approximately 1.3km to the substation. The proposed easement for the transmission line would be approximately 20 metres wide. The transmission line is located within the Broken Hill Local Government Authority and would traverse three land holdings and also the Peterborough Broken Hill railway line. Figure 7 shows the route that the transmission line will take.

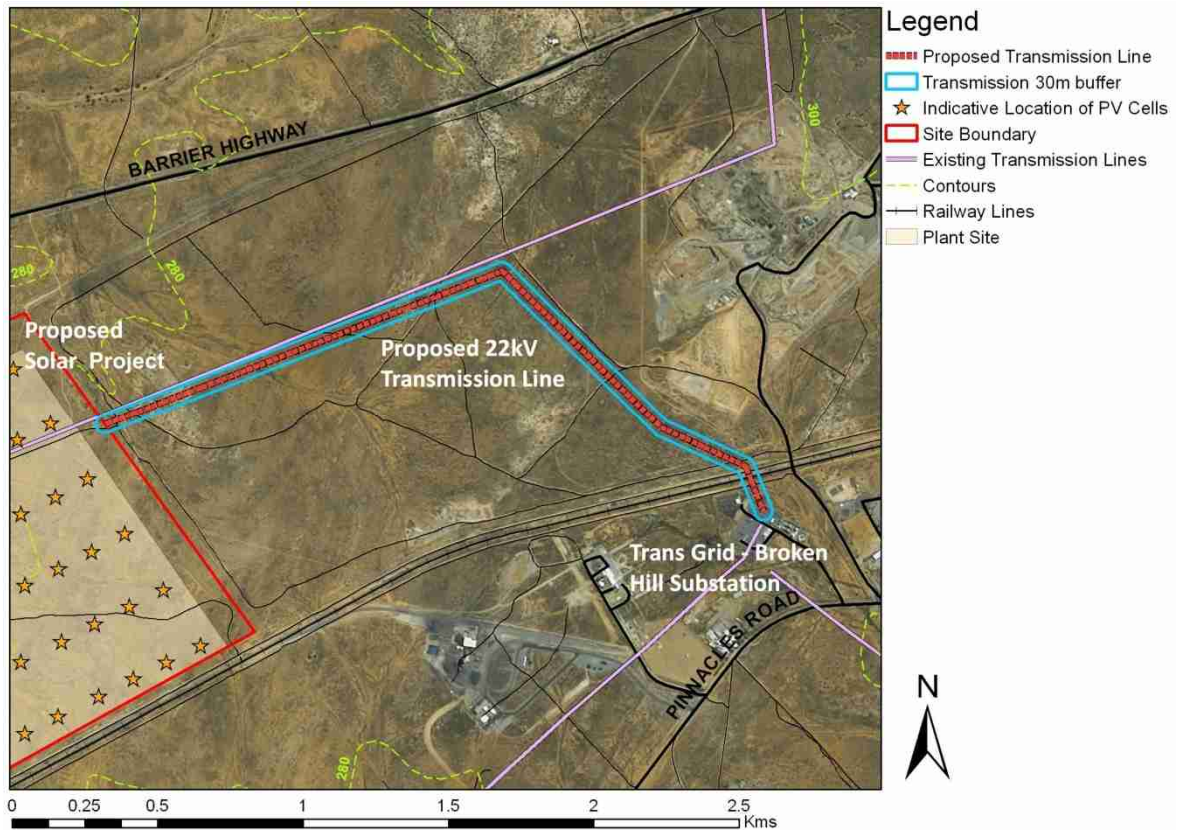


Figure 7 Route of proposed 22kV transmission line.

The transmission towers comprise a single monopole of galvanized steel construction with a number of cross beams to support the electrical cables. The height of the poles would be approximately 14 metres above ground and will be spaced at intervals of 100 metres apart. A diagram of a transmission tower similar to that being used for the Broken Hill Solar PV Project is shown in Figure 8. Figure 9 shows an existing transmission line running adjacent to the site of a roughly similar appearance to the one which is proposed.

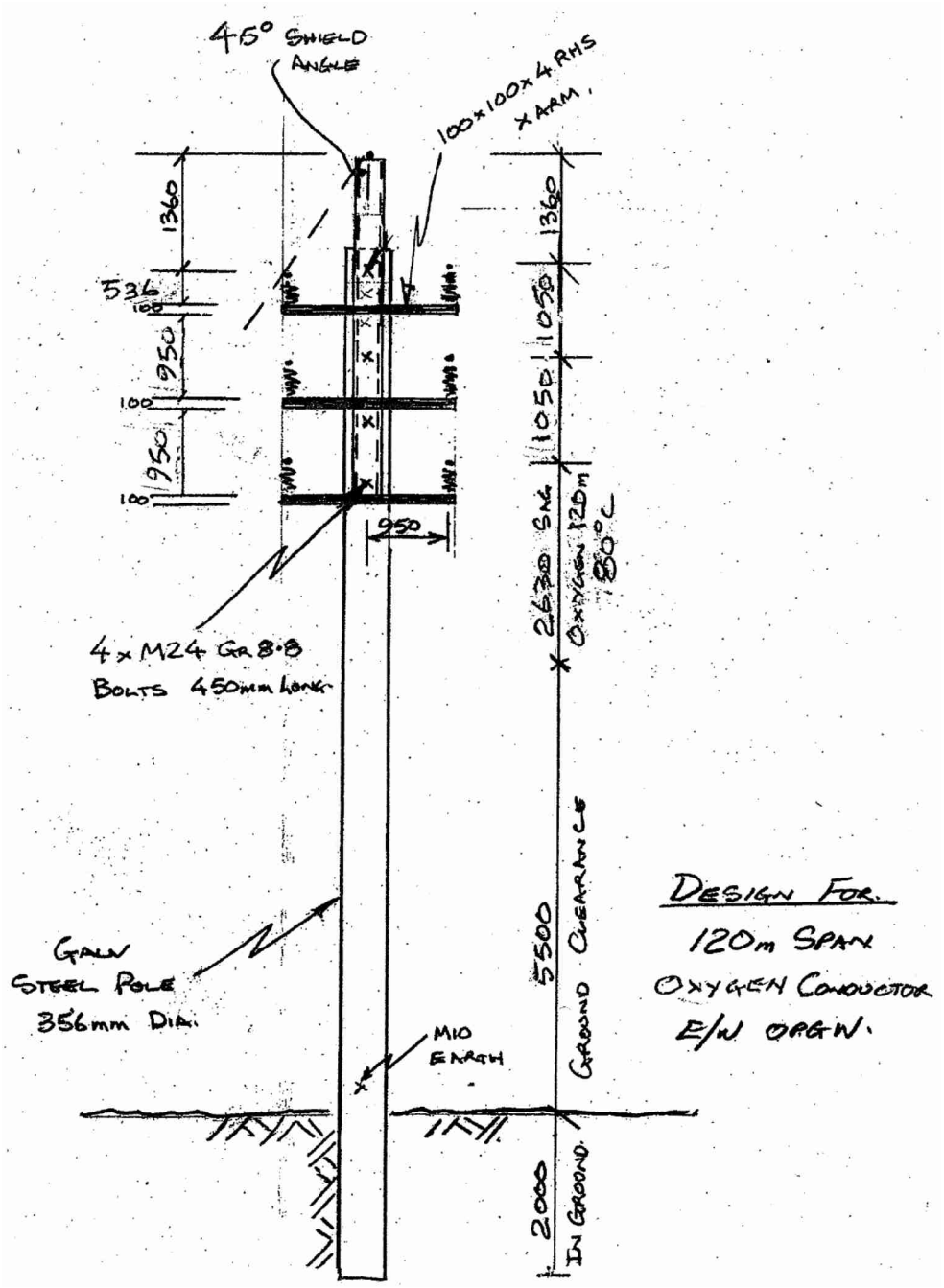


Figure 8 Proposed transmission tower.

Figure 9 Existing transmission line adjacent to the solar project site.

2.1.3 Other components

Other components of the project are listed below however these are not considered to have a major influence over visual impact as the solar project and transmission line.

- *Site office and maintenance building*. No details have been given on the dimensions and finish of these structures, however it is assumed that they would appear similar to the farm sheds which are common in the area.

- *Access tracks*. The existing access track from the Barrier Highway would be upgraded with compacted gravel to allow for vehicle traffic during construction. A perimeter track and internal access roads would be constructed as part of initial site works. These roads would be unsealed but compacted to an engineered standard to minimize dust and erosion. Signage and turn lanes from the highway would be installed as necessary. Parking areas would also be constructed.

- *Fencing and landscaping*. The solar project would be completely enclosed by fencing around the perimeter for security purposes with landscaping for visual amenity purposes.

- *Electrical infrastructure*. These include numerous other devices and equipment such as inverters, transformers, switchgear, aboveground and underground electrical conduits and cabling.

2.1.4 Construction and decommissioning

Construction of the project would take approximately 17 months from commencement and this would involve civil works, mechanical works, electrical works, and finally commissioning. The works would be divided into several sections, allowing many of the stages to occur simultaneously. The work would require temporary construction infrastructure, site offices and facilities, compounds, stockpiles and storage areas. Construction activities would be undertaken during the standard hours for construction works and staff are likely to be accommodated in the Broken Hill area.

The construction of the solar project may give rise to visual impacts associated with the presence of cranes, sheds, materials and movement associated with general construction activity. As this activity is temporary in nature, any impact will not endure beyond completion of the project. Figure 10 provides an overview of the construction process that would be followed for the Broken Hill solar project.

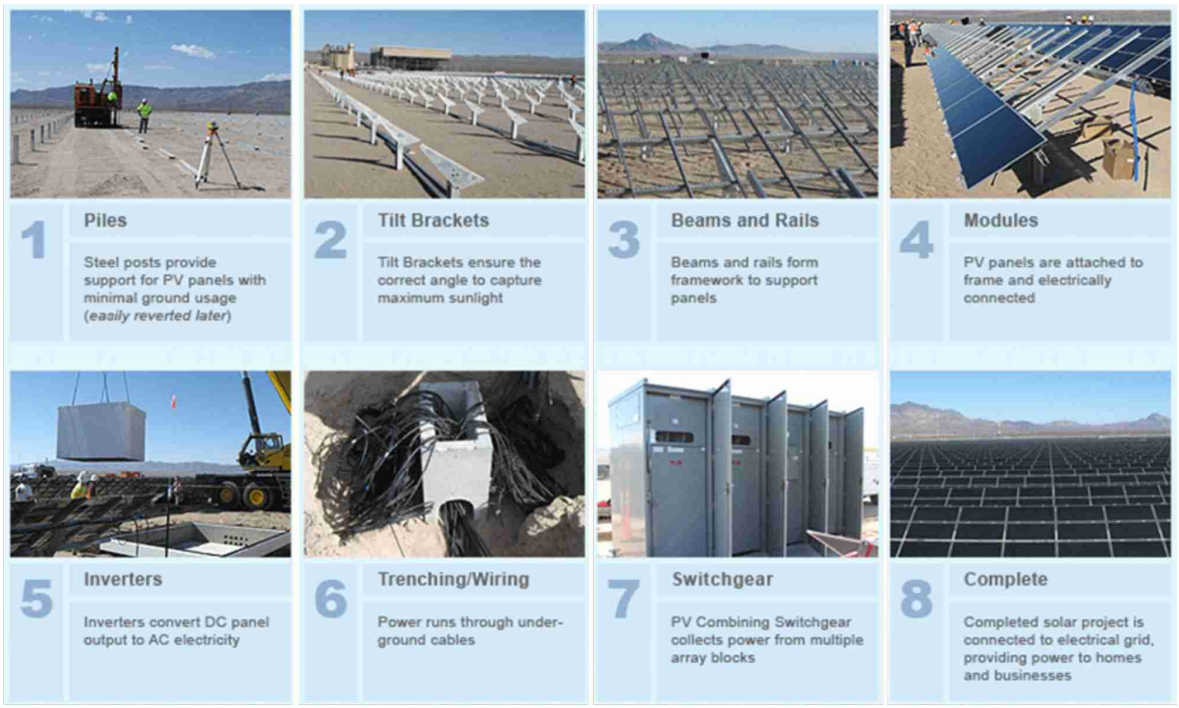


Figure 10 Construction activities on solar project site

The Broken Hill solar project is anticipated to operate for approximately 30 years. Decommissioning after this period would involve the removal of photovoltaic modules, brackets and posts, cabling and all other electrical equipment. All buildings and fencing would also be removed. The site would be revegetated as necessary to return it to its original state, as far as practicable. There will be no significant and enduring visual impacts once the solar project has been decommissioned.

2.2 Statutory Context

This section of the report describes the land use zones that the project is situated within and their implications. It also examines the local legislation that relates to the protection of landscape and visual resources in and around the project site.

2.2.1 Zoning

The proposed solar project site lies within the 'Grazing' (rangeland grazing) land use zone. Although this zone is reserved primarily for agricultural production, there are provisions for using land in this zone for other non-agricultural purposes in accordance with the need for that development.

The transmission line crosses 'Grazing' (rangeland grazing), 'Conservation area' (regeneration reserve), and 'Urban' (industrial/commercial). The purpose of the regeneration reserve is to protect environmental values whilst also reducing dust impacts to the township. The purpose of the industrial / commercial zone is to promote development in the City of Broken Hill in a manner which is compatible with its urban function. Figure 3 shows the land use zones which are intersected by the project.

2.2.2 Local planning policy framework

The solar project site is located outside Broken Hill Local Government jurisdiction, on Crown land within an unincorporated area administered by the NSW Department Primary Industries, Catchments and Lands Division. Although there are no local planning instruments applicable to the unincorporated area, those which apply to the Broken Hill area are still worthy of consideration. This is because the visual catchment of the solar project and other landscape features would extend well beyond their physical footprint and into this area.

The Broken Hill Local Environmental Plan 1996 (LEP) provides guidance on land use and development within the Local Government Area. This would include part of the transmission line route. As both the solar project and transmission line components are part of the same project, a conservative approach would be to consider the relevant provisions within the LEP as it would apply to the whole project. Those provisions which relate to the protection of landscape and visual resources are listed below:

Broken Hill Local Environmental Plan 1996

Relevant excerpts from this document are:

Part 2 General Zoning Controls

Zone 1 (A) (General Rural Zone)`

To promote the proper management and utilisation of resources by protecting, enhancing and conserving:

(iv) *trees and other vegetation in environmentally sensitive areas where the conservation of the vegetation is significant to scenic amenity, recreation or natural wildlife habitat or is likely to control land degradation.*

Zone 7 (A) (Environment Protection (Regeneration Reserve) Zone)

The objectives of this zone are to identify and protect land which is environmentally sensitive and, in particular:

(b) *to preserve hillscapes and ridgelines, and*

(c) *to promote the preservation, conservation and enhancement of major landscape features and indigenous fauna and flora in the City of Broken Hill.*

Part 3 Special Provisions

10 WHAT MUST COUNCIL CONSIDER, OTHER THAN ZONE OBJECTIVES, WHEN DECIDING WHETHER TO CONSENT TO DEVELOPMENT?

(d) *the protection of areas of significance for nature conservation or of high scenic or recreational value, and of places and buildings of archaeological or heritage significance (including Aboriginal relics and places).*

11 SUBDIVISION OF LAND GENERALLY

(2) Before granting consent for subdivision, the Council must consider:

(h) *whether the development will contribute to ribbon development or substantially change the appearance and/or character of the amenity of the area.*

(3) When considering these matters, the Council must also take into account any measures that may be taken to minimise any adverse impacts and also whether, in its opinion, the benefits of the development outweigh any adverse effect.

18 DEVELOPMENT ALONG ARTERIAL ROADS

(2) The Council must not consent to any development of land within Zone 1 (a) or 1 (c) Schedule 3 if the development will have direct access to an arterial road unless the application has been assessed having regard to:

(b) *the minimisation of distraction to drivers using the road,*

Schedule 1 Heritage Items

Among the many items listed are buildings and structures associated with the mining industry.

2.2.3 Implications of the statutory context

The main implications for the landscape and visual impact assessment arising from this statutory context are listed below:

- Removal of vegetation needs to be avoided as best as possible owing to its scenic as well as environmental values.
- Development needs to be sympathetic with the protection and enhancement of ridgelines, hillscapes and major geological features as well as views toward them.
- Other areas with high scenic and recreational value should also be protected as best as possible.
- Places (i.e. landscapes) with aboriginal heritage significance should be preserved.
- Developments along arterials roads should employ measures to reduce the potential for driver distraction.
- Measures to minimise residual visual impacts should be considered.
- Buildings and structures have the ability to record and educate the public about the history of human occupation, endeavors, attitudes and modifications on the landscape. It is for this reason that many buildings and structures associated with the mining industry appear in the heritage register.

2.3 Viewer Perceptions of Solar Technology

The degree of visual impact of a proposed development can be largely influenced by how a viewer perceives that development. Whether or not the viewer ideologically supports the project or what the project signifies to them, can have a significant influence over whether they think it is an acceptable addition to the local landscape. The degree of familiarity with the process or technology also has an influence over its acceptability.

The Broken Hill Solar Power Plant project aligns with the key directions of the Broken Hill City Council in economic, service and environmental directions. Their focus is on long term economic security and

prosperity through creation of long term employment, maintaining and improving infrastructure and developing safe and sustainable natural and built environments. Their strategy is aimed at encouraging sustainable developments with diverse and innovative business initiatives to broaden the economic base of the district. The town appears willing to invest in key industries that will preserve the city's heritage (vital for tourism) as well as supporting these other industries.

The Broken Hill community has a proud pioneering heritage. The mining industry is still the major regional source of employment along with agribusiness but diversifying into new industries could be viewed as an opportunity for the town to be a leader in a new field. Solar technology is not a new concept in outback towns owing to the intense solar exposure and the high cost of electricity supply to remote areas. Solar panels can be seen in Broken Hill's residential streets on the roofs of houses (Figure 11) and to power street lighting (Figure 12). This indicates possible local acceptance of solar technology, albeit on a small scale. There also appears to be the acceptance of other proposed renewable energy installations in the region such as Silverton Wind Farm (as discussed in *Silverton Wind Farm*).

Whilst the above information has not been used specifically to assess individual viewpoint locations, it does provide a useful basis to ascertain the overall acceptability of the solar project within the context of the local landscape of Broken Hill. Whilst the presence of the solar project may change the existing landscape character in some instances, to assume that this will be an outright negative impact to landscape and visual amenity in each case is not substantiated. On some occasions, the presence of the solar project may indeed have a positive impact, as discussed in a number of areas in this document.

Figure 11 Residence adjacent to Lunam Street with roof mounted solar panels.

Figure 12 Street lighting powered by solar panels on Kanandah Road.

3. Project Study Area

This chapter describes the way in which the study area has been defined as well as identifying some key receptors within the study area that may be visually impacted by the development.

3.1 The Visual Catchment

The project study area is based on the 'visual catchment' of the project. The visual catchment can be described as the area within which a proposed development would be easily discernible. This serves as a meaningful basis to delineate the study area for a landscape and visual impact assessment as any areas beyond are not likely to be impacted. Factors such as climate, atmospheric and lighting conditions can alter the extent of this area. For this reason, the study area should assume clear conditions and maximum visibility to accommodate a worst case scenario. This delineation is merely a guide however, as places beyond the predefined study area may sometimes need to be considered for assessment where the landscape and visual values are highly regarded. This may include locations such as elevated scenic lookouts, public recreational areas, national parks or places where iconic elements of the landscape are visible.

The solar project has potentially the greater visual footprint compared with the transmission line although the transmission poles are taller. This is because the solar panels will read as one large object from a substantial distance away whereas the poles, which will read as separate objects, have the capacity to visually integrate with other similar sized linear elements when viewed from the same distance. The physical characteristics of the solar project have therefore been used to define the study area for this assessment.

The solar project, at 1.5m to 2m tall, will have a relatively low profile and therefore low visual impact when viewed from the side at the same ground elevation. If viewed from a higher elevation looking down however, the solar project will occupy much more of one's field of vision, thereby significantly increasing the level of visual impact. It is for this reason that a study area has been selected which includes most of the prominent elevated positions near the site with potential to offer views down onto the solar project. A conservative distance of roughly 10km from the site boundary was found to be sufficient to include most of these locations. Figure 13 shows the difference in potential visual impact when viewing the solar project from the same elevation as compared with a higher elevation. Note that this figure is illustrative only and is not meant to accurately represent the profile of any specific location within the study area. Figure 14 shows the prescribed study area for this assessment.

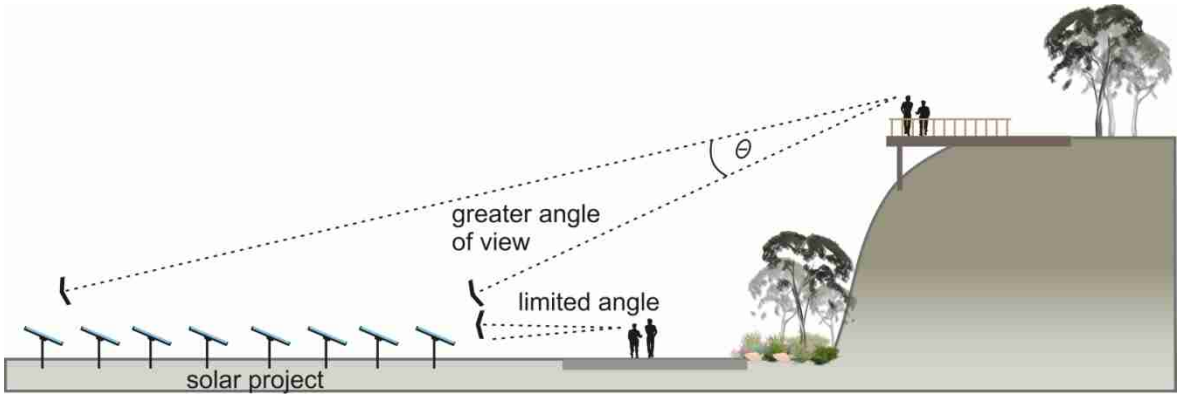


Figure 13 Views toward solar project from elevated positions (concept only).

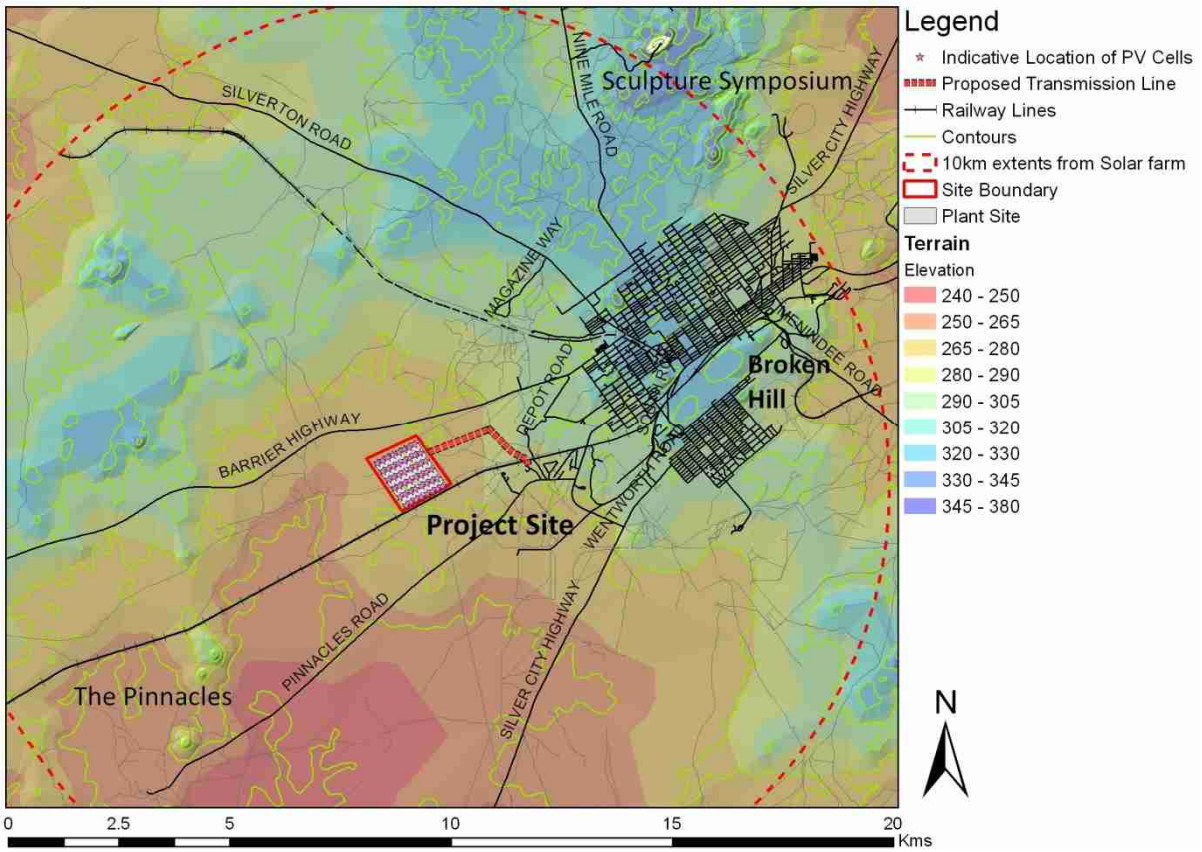


Figure 14 Project study area.

3.2 Key Visual Receptors within Study Area

'Visual receptors' is a term used to describe movement patterns on the landscape and areas that are frequented by people. The greater the numbers of people at a given location with a clear view toward the proposed development, the greater the potential visual impact, all else being equal. The purpose of the visit or journey also has a large influence over visual impact. Tourist drives, for instance are generally more sensitive to visual changes or new developments which are out of character with the landscape. Roads which are predominantly utilitarian in nature, such as access roads, are not likely to be as sensitive to these changes. The following is a discussion of the main visual receptors within the study area, with particular regard to major roads (Barrier Highway, Silverton Road and Silver City Highway), railways (Peterborough-Broken Hill Railway), flight paths (associated with Broken Hill Airport) and walking trails. Figure 15 shows their location.

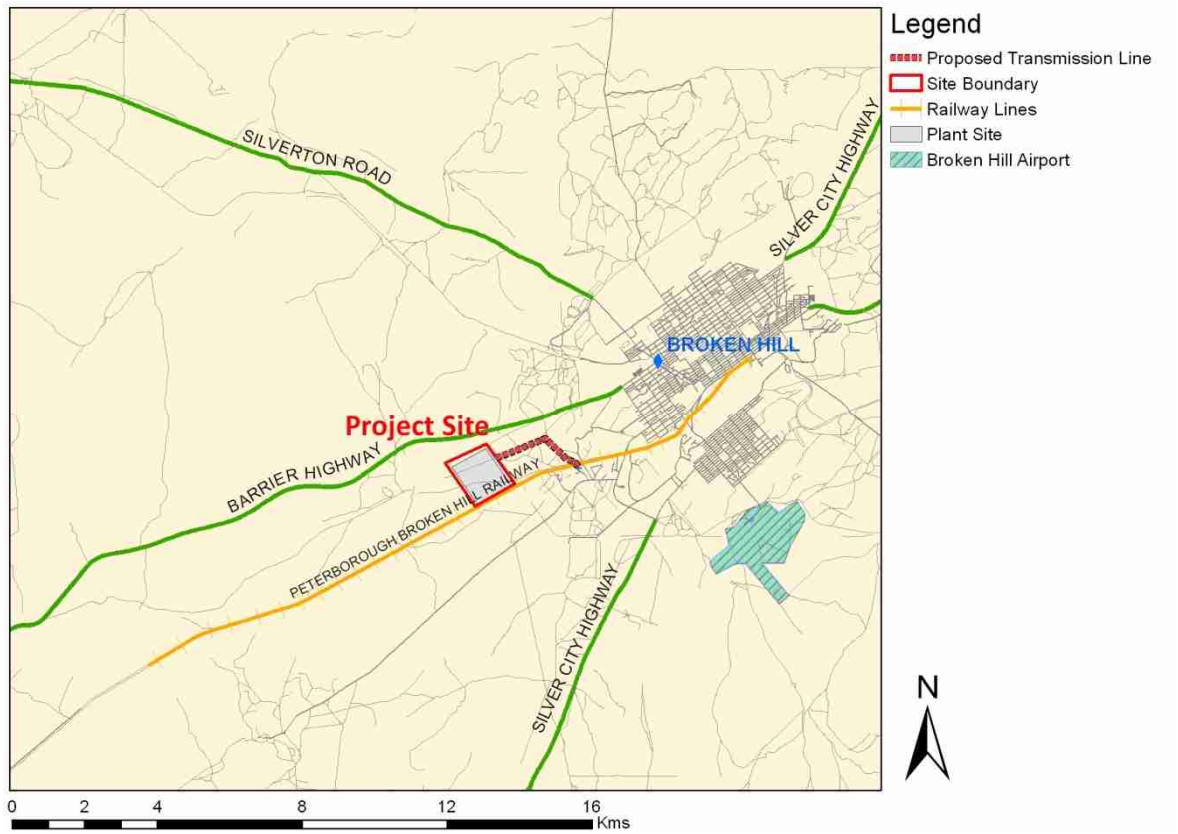


Figure 15 Visual receptors.

3.2.1 Major roads

The greatest visual impact from the project is most likely to be from the major roads surrounding the site as they carry the most number of viewers. It is important to note however, that views from a moving vehicle are constantly changing as is the relationship between a subject in the landscape and its context. These transient views are quite different to those from static viewpoints such as scenic lookouts, where one has more time to observe elements in detail. The notable roads surrounding the site include Barrier Highway, Silver City Highway and Silverton Road. These are described as follows.

3.2.1.1 Barrier highway

The Barrier Highway is the closest main road to the solar project site and passes to within 350m of the site boundary. This Highway is an east-west highway which runs through far western and central New South Wales, forming part of the inland route between Adelaide and Sydney. The Sturt Highway, to the south, would offer a more direct route between these destinations, however it is likely that many people choose the Barrier Highway as an alternative route through Broken Hill and the more remote areas of NSW.

Within the South Australian border, the Barrier Highway has many flat, straight sections which look out over mostly featureless plains. If one is approaching Broken Hill travelling from Adelaide, a motorist would first see 'The Pinnacles', a visually prominent natural landmark, on the right before coming over a crest and seeing Broken Hill laid out in the distance approximately 10km away. At this point the solar project would also first come into view. With the backdrop of Broken Hill Township and the mine sites, the solar project could act as a gateway icon, symbolising a new frontier industry of renewable energy within the region. This viewpoint is discussed in more detail under *Viewpoint 1 – Barrier Highway #1*.

There currently exists a gateway icon on Barrier Highway approximately 1.2km from the western edge of town. It consists of a mining headframe which has been installed on the northern side of the road with a greeting message on one side and a farewell message on the other. It is a prominent visual signature which symbolises the mining heritage of the town and marks the gateway into and out of Broken Hill. Figure 16 shows the headframe.

Figure 16 Gateway icon on Barrier Highway, west of town.

3.2.1.2 Silver city highway

Silver City Highway connects Mildura (to the south) with Broken Hill and many northern destinations such as Sturt National Park, Cameron Corner and the village of Tibooburra in the remotest, northwest corner of New South Wales. There is a high probability of tourists using this road to access those outback destinations. Upon approaching Broken Hill, the road offers mostly unimpeded views over gently undulating plains. The Pinnacles are also a prominent landmark viewable from this road. Views toward the solar project site are mostly constrained by topography. A viewpoint analysis from this location is discussed in more detail under *Viewpoint 13 – Silver City Highway #1*.

3.2.1.3 Silverton road

Silverton Road is a secondary road connecting Broken Hill to Silverton, a notable tourist destination which is located approximately 20km to its north west. The road skirts the foothills of the Barrier Ranges and gradually rises to offer elevated views toward the project site. A more detailed analysis is outlined under *Viewpoint 19 – Silverton Road #2*.

3.2.1.4 Rail

The main rail line of interest to this study is the Peterborough-Broken Hill Railway line. From Adelaide, it approaches Broken Hill from the south west, running immediately adjacent to the southern boundary of the solar project site before continuing through to the central part of Broken Hill Township adjacent to Line of Lode mine. From the centre of town it continues in a north easterly direction toward Sydney. Passenger rail services using this line include Indian Pacific and Broken Hill Outback Explorer. More commonly than passenger services, the rail line provides for transport of minerals and other resources extracted from mining to the Ports of Adelaide for export.

The Indian Pacific is one of the last coast to coast rail journeys in the World and the longest train trip in Australia. It is mainly promoted as a leisure trip and a chance to experience the Australian landscape. The total distance from Perth via Adelaide to Sydney covers 4,352km and takes approximately 3 days. Services run twice weekly from Perth to Sydney and twice weekly in the other direction. This means that a train passes the solar project site 4 times a week. The key selling points of the journey are the diversity of the terrain, historic mining towns, agricultural landscapes, the red earth of the outback and a 478 kilometer straight section through the Nullabor Plain, which is claimed to be the world's longest length of straight railway track. The diversity of viewing experiences is the main selling point of the service, possibly to offset the tedium of a 3 day train journey. Views toward the solar project would therefore be a welcome addition to the viewing experience. It may also act as a gateway icon to passengers travelling from Adelaide.

CountryLink Outback Explorer runs between Sydney and Broken Hill and does not pass the solar project site. This service has therefore not been considered in this assessment. Figure 17 shows a view toward the rail yards adjacent to Broken Hill Township. Rail transport infrastructure and rolling stock associated with mining is a dominant visual element in this view indicating the primary function of the rail line.

Figure 17 Rail transport Infrastructure adjacent to Broken Hill Township.

3.2.1.5 Air travel

Broken Hill Airport is located to the south of Broken Hill Township and services Regional Express, The Royal Flying Doctors Service of Australia, chartered planes and helicopters as well as scenic flight operators. The major (sealed) runway is aligned from south west to north east and the solar project will not be in direct line of sight for pilots of fixed-wing aircraft landing or taking off. Helicopters however are able to approach from any direction. Reflectivity from the solar project is discussed in further detail in *Reflectivity*. Figure 18 shows the orientation of the main runway and its relationship with the project site.

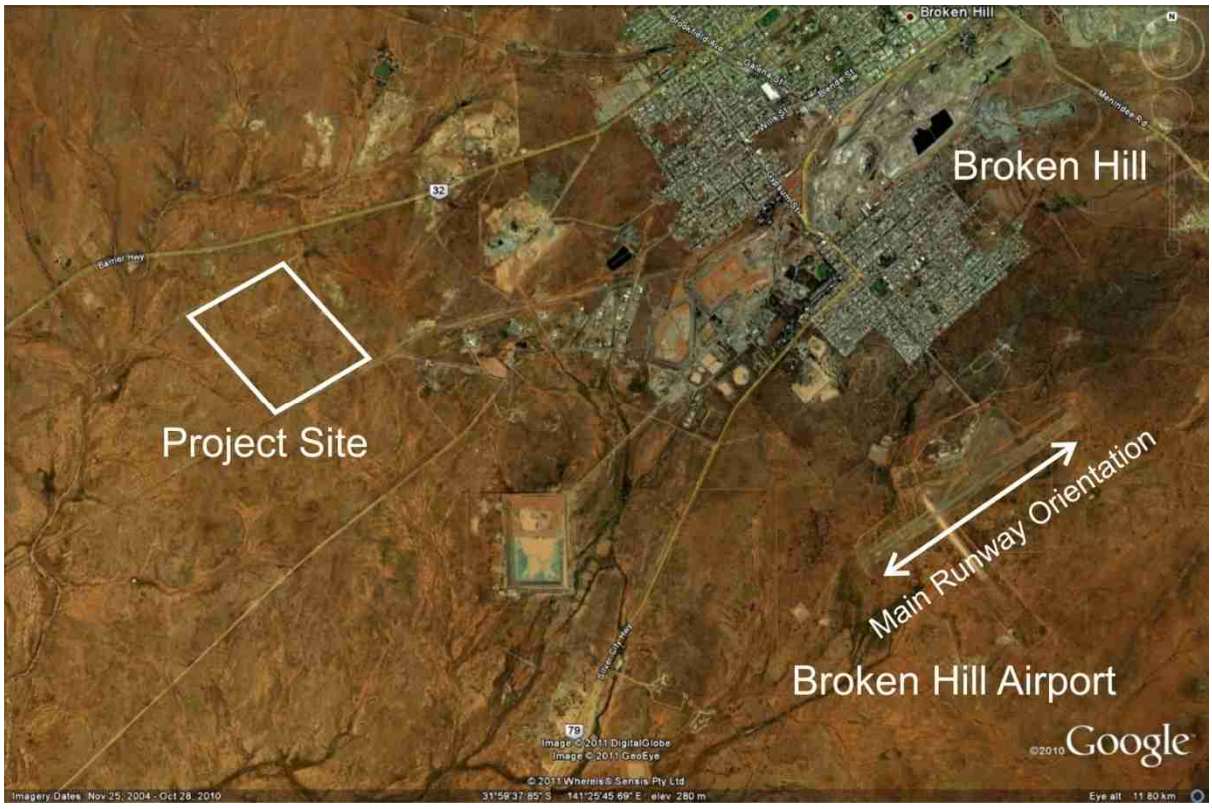


Figure 18 Broken Hill Airport showing orientation of main runway. (Source: Google Maps)

For operators of scenic flights, the solar project will have a large visual footprint when seen from directly above. This provides an opportunity for operators to incorporate the site as part of the tour. Helipro, operators of helicopter scenic flights in Wellington New Zealand, regularly incorporate a tour of nearby Makara wind farm from the air. Figure 19 shows a photo that was taken during a scenic flight. Operators are usually keen to incorporate any new elements on the landscape which enhance the viewing experience of passengers.

Figure 19 Makara wind farm, Wellington. Photo taken during scenic flight.

3.2.1.6 Walking trails

Recreational walking trails and bike paths are usually established for the express purpose of allowing users to engage with the landscape and scenery on a more intimate basis. There were no signposted or designated trails observed within near vicinity of the project site. The walking trail to the Sculpture Symposium is discussed in more detail under *Viewpoint 20 – Sculpture Symposium Lookout* in Section 5.2.

4. Landscape Baseline Conditions

This chapter describes the landscape characteristics within the study area in terms of geology and landform, vegetation and climate. The various landscape types as well as their associated sensitivity to visual changes are also defined. This information will be used as a basis to assess visual impact.

4.1 Landscape Characteristics

This section describes the baseline landscape conditions in terms of geology and landform, vegetation and local climate and atmospheric conditions and its implications for visual impact.

4.1.1 Geology and landform

Broken Hill and its surrounds lie within a portion of western NSW which is geologically unique. Many of the rocks and minerals found in the region are of considerable interest and economic importance, and geology exerts a strong influence on the landscape. The region contains more than 2,000 mineral rich locations, the most famous being the Broken Hill main lode, one of the world's largest silver, lead and zinc deposits. It is these economic forces which have caused much of the landform in this area to be transformed through mining activity and the associated visual expression of this activity.

The Barrier Ranges, to the north of Broken Hill, are a block of metamorphic and deformed sedimentary rocks forming ridges rising up to 300 m above, and create vantage points over the surrounding plains. The foothills of these ranges extend into the northern and central areas of Broken Hill and also offer views across the landscape. Hard rock outcrops occur in many other areas as strike ridges and remnant pinnacles standing above long shallow slopes. ‘The Pinnacles’, which are approximately 5km to the south west of the solar project site, is a highly prominent example of this formation. The Pinnacles have local indigenous and non-indigenous significance to the Broken Hill and the wider community. Other areas, particularly around the project site, consist of gently undulating through to flatter alluvial plains with a network of ephemeral watercourses and drainage lines.

The landscape has a distinctive weathered appearance commonly associated with the Australian outback. This is due to the rock-weathering processes which have been operating continuously in the region for more than 90 million years. Shallow, stony soils and stony desert pavements are widespread in outlying areas and often form contoured patterns of soil and vegetation in less exposed areas. Deep red sands exposed from vehicular traffic and mining activity as well as wide open spaces is also characteristic of this dramatic landscape.

The solar project site is set on the northwest facing side of a shallow ridge. The highest point is 280m AHD on the south east corner which drops away to approximately 270m on the northwest corner of the site. This ridgeline helps to conceal views toward the site from areas to the south and east. The transmission line route climbs up a gentle slope from the solar project site to a height of 282m before turning south east and

reaching an elevation of approximately 290m at the railway crossing. Figure 20 shows the terrain within the study area.

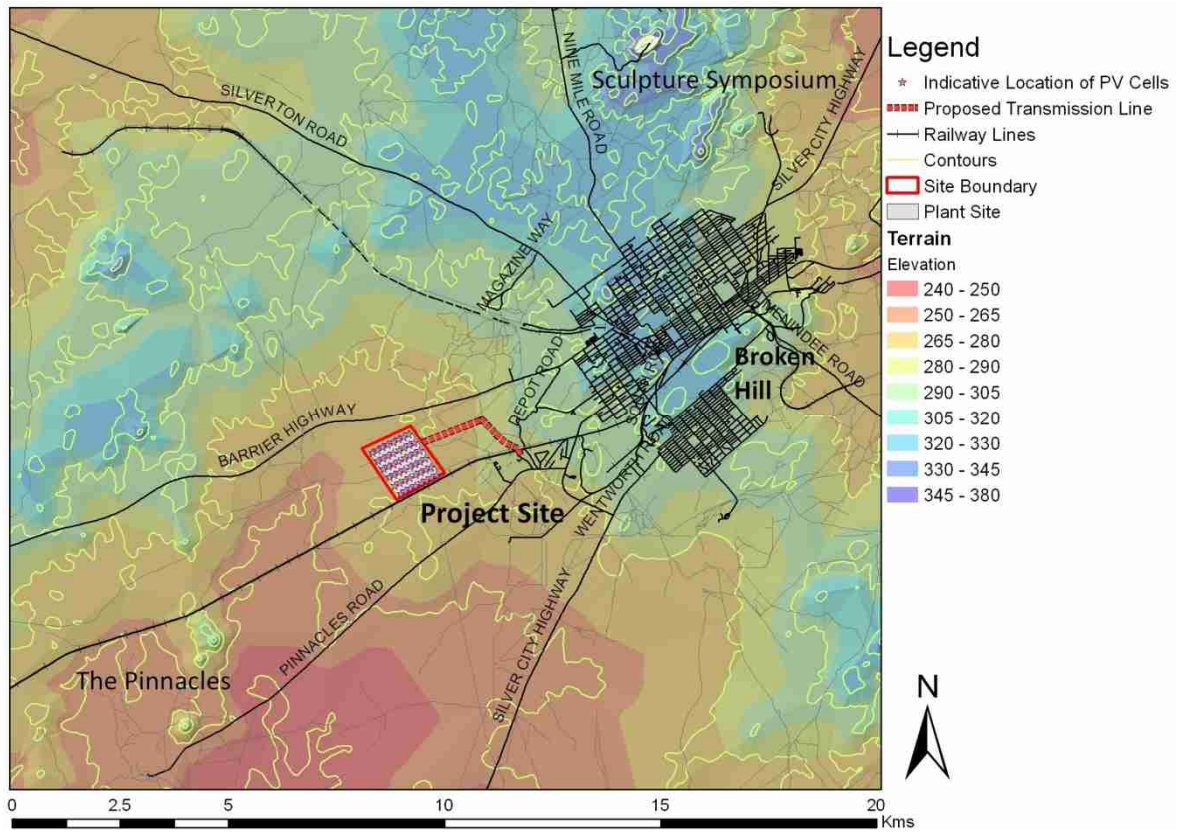


Figure 20 Landform within the study area.

4.1.2 Vegetation

The natural vegetation communities around the Broken Hill area mainly comprise Mulga (*Acacia aneura*) communities coupled with chenopod shrubland composed of saltbush, bluebush and native grasses. Range crests have sparse vegetation including mulga, dead finish (*Acacia tetragonophylla*) and scattered bluebush (*Maireana sp.*). Vegetation is more abundant and diverse on the deeper loamy soils of the footslopes and valleys, where there is more moisture. Most plants are very sensitive to available soil moisture and runoff patterns largely control vegetation distribution (along creek lines etc). Larger stream channels support larger trees such as River Red Gum (*Eucalyptus camaldulensis*), some Coolabah (*Eucalyptus microtheca*) and river cooba (*Acacia stenophylla*).

The vegetation surrounding the project site is mainly composed of shrubland and grasses with a few isolated trees sparsely scattered throughout. Any established taller species are most likely to have been cleared through decades of grazing activity. There is minimal visual screening of the proposed solar project and transmission line site provided by existing vegetation near the site, and long distance views over the landscape are possible from most of these areas.

Closer to Broken Hill Township, there are instances of large established banks of trees along roadsides and also in the conservation areas on the periphery of the town. Views toward the project site are usually inhibited by the terrain in most cases where these trees occur. Figure 21 shows the vegetation in the vicinity of the solar project site and Figure 22 show the roadside vegetation along the Silver City Highway.

Figure 21 Vegetation in the vicinity of the solar project site.

Figure 22 Roadside vegetation along Silver City Highway

Anecdotal evidence has suggested that the area around Broken Hill was unusually green at the time of the site visit owing to the abundant rain in the period leading up to it. The cover of vegetation is usually sparse with much of the surface comprising of exposed earth. It is for this reason that conservation areas were established at the town's periphery to help reduce dust impacts from the surrounding region.

With less vegetation cover during normally dry periods, the landscape would exhibit higher degrees of tonal and colour variation as well as visual scarring. Under such conditions, the visual absorption capacity of the landscape for a new development would potentially be higher as less vegetation would need to be removed. Figure 23 shows a photo taken at the time of the site visit that demonstrates the level of vegetation cover on the landscape. Figure 24 shows a photo taken from the same location at another time. Note that disturbances to the landscape such as tracks are much more visually apparent in Figure 23.

Figure 23 View toward Pinnacles taken from Sculpture Symposium during site visit

Figure 24 Photo from the same location taken at another time.

4.1.3 Climate and atmospheric conditions

Climate and atmospheric conditions will have an influence on the degree of visibility of a development. Under bright, clear conditions, an object will be visible over a much longer range than under an overcast, hazy day. Although this assessment has assumed clear conditions and maximum visibility, it is nevertheless worthwhile to consider how often these conditions occur within the Broken Hill area.

The Broken Hill climate is usually hot and dry as it lies within the NSW semi arid zone. Dust and rain in the atmosphere has the potential to reduce visibility over extended distances. Data from The Bureau of Meteorology between 1998 and 2008 for Broken Hill Airport indicates that there are:

- 151 clear days (annual mean average)
- 68 cloudy days (annual mean average)
- 27 days of rain (annual mean average)

This data indicates that there would be clear visibility towards the solar project and transmission line for a large proportion (approximately 40%) of the time.

4.2 Landscape Types

This section describes the various landscape types within the study area. Landscapes can be classified on the basis of their visual characteristics; which are typically influenced by factors such as vegetation cover, topographic variation, underlying geology, evidence of human modifications and other intrinsic features. A summary table with a description of each type together with its associated sensitivity to visual change is given at the end of the chapter. These classifications will also be used to assess the predicted magnitude of visual impacts in *Viewpoint Analysis*

. Figure 25 shows the location and extents of each landscape type considered in the viewpoint analysis.

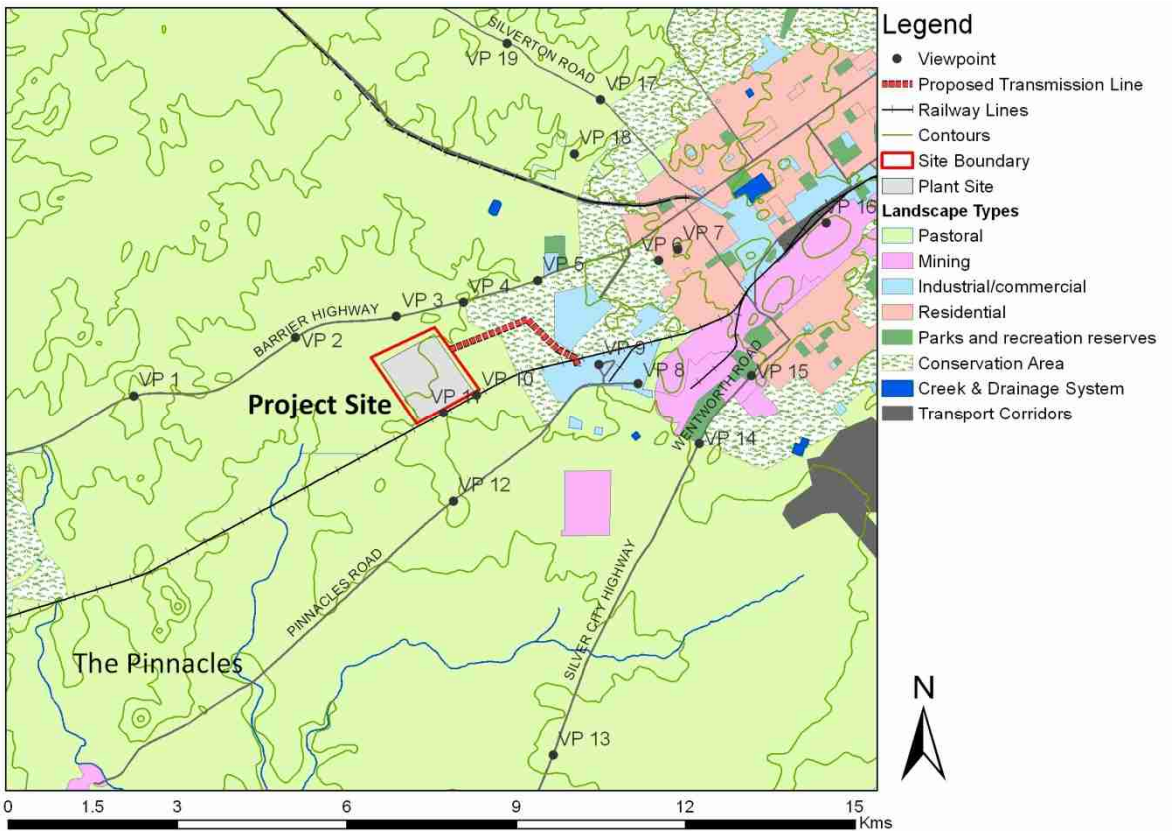


Figure 25 Landscape types within the study area.

4.2.1 Pastoral

The Pastoral (or grazing) landscape is the most dominant type within the study area. It is mostly devoid of large trees owing to decades of broad acre farming practices and typically exhibits artificial elements such as fence lines, power lines, unsealed tracks, utility sheds, water tanks, machinery and sparsely placed residential dwellings. Views across this landscape type are extensive. The gently undulating topography has a low shrubby covering interspersed with native grasses. This vegetation has a tendency to be reduced to mostly exposed red earth during dry periods. It is a friable and brittle landscape which is susceptible to erosion from wind and rain. Scarring induced from factors such as vehicle movement over bare ground can take years to fade and can start a chain of events that may be irreparable. Figure 26 shows a view over this landscape type.

Figure 26 Pastoral landscape.

4.2.2 Mining

The mining landscape type is characterised by large areas of exposed earth associated with the stockpiling of spoil and extensive excavated areas. It is a highly degraded landscape, devoid of vegetation or any naturalistic forms with very low visual amenity except for interpretive and educational value. Large areas of this landscape type are prominent in the town and an area to the south east of the site. Figure 27 shows a view toward the Perilya mine located approximately 2km from the solar project site.

Figure 27 Mining landscape.

4.2.3 Industrial and commercial

The industrial area comprises a large area to the south west periphery of the town which is roughly bordered by Kanandah Road, Pinnacles Road, the Broken Hill Mineral Separation Plant and the Railway Line. In these areas the landscape has been significantly modified with development with many electrical power lines and other infrastructure in view. The Broken Hill substation is also contained within this area. The scenery is dominated by large warehouse buildings associated with manufacturing, distribution, waste management and recycling. There is some intervening roadside vegetation and scattered trees although there are still views out to the surrounding landscape between buildings and along road centerlines. Figure 28 shows a view along Kanandah Road which exhibits this landscape type.

Figure 28 Industrial landscape along Kanandah Road.

The main commercial precinct within the township is flanked with 'grand' Victorian period architecture, most of the buildings being of a well maintained appearance. Commercial signage is generally low key and sympathetic to the historic streetscape, which is dominated by public bars, a legacy of the mining era. Views out toward the project site from these areas are constrained by buildings, terrain and vegetation.

Figure 29 Commercial landscape (Corner of Argent Street and Oxide Street).

4.2.4 Residential

The main residential areas of interest with potential views toward the site are on the western periphery of Broken Hill Township.

Creedon Street runs from a north west to south easterly direction and is adjacent to a conservation area on its western side. There are no other built up areas between this street and the site. The dwellings in this area appear to be government commission housing or similar. At the time of the site visit, many of the windows facing the street were boarded up. The rear of the properties (which face the site) are demarcated by high corrugated iron fences. There was no observable evidence of decking or recreation areas designed to capitalise on the views to the west. The conservation area also contains many mature native trees which filter views toward the site. Figure 30 shows a view north west and south east, respectively at the rear of these residences.

Figure 30 Rear of residential area at Creedon Street.

Lunam Street is located approximately 330m north east of Creedon Street, at the top of a hill which is at an elevation of 320m AHD. From this residential area, there are broad views across the landscape to the north, west and south. The project site is clearly visible to the south west, as are the Pinnacles as well as mining and industrial facilities. The views to the north have far less artificial elements within the view and the foothills of the Barrier Ranges can be easily seen. Figure 31 shows the broad views to the west offered from this location. Both the Creedon Street and Lunam Street viewpoints will be assessed in more detail under *Viewpoint Analysis*

.

Figure 31 View west from Lunam Street residential area.

Other residential precincts within Broken Hill are not likely to have views toward the site. There are many streets with avenue planting of mature native specimens which would effectively inhibit any views across the broader landscape. Figure 32 shows a view along Ryan Street in the western part of town, which is one of many examples of these tree-lined streets.

Figure 32 View along Ryan Street.

4.2.5 Parks and recreation reserves

Parks and recreation reserves are usually highly valued for both their landscape and visual amenity. Broken Hill contains a number of well maintained green open spaces, however there were no designated parks observed within the town which permit unimpeded views toward the project. There were, however examples which made use of mining relics for historical interpretation. As discussed in *Scenic Lookouts* in Section 6.2.3, this is another connection to the mining industry being strongly expressed in the urban fabric. Figure 33 shows a view of 'Kintore Headframe' which is a prominent feature of the park adjacent to Blende Street.

Figure 33 Historic Kintore head frame

The Living Desert and Sculpture Symposium are highly promoted recreation reserves located approximately 5km north from the edge of Broken Hill Township. The reserve offers walking trails, 12 sandstone artworks, a flora and fauna sanctuary, an Indigenous cultural display and a picnic area. The Sculpture Symposium is located at the peak of a hill which rises to an elevation of 380m. It is another site which is advertised as a key vantage point for observing the spectacular desert sunsets over the Mundi Mundi Plains to the west. The peak offers views in all directions, taking in Broken Hill Township, The Pinnacles and the project site, although these subjects are in the far distance view range. Views to the project site are examined in more detail in *Viewpoint 20 – Sculpture Symposium* in Section 5.2. Figure 34 shows a view of the Sculpture Symposium.

Figure 34 Sculpture Symposium.

4.2.6 Conservation area

Broken Hill has a suite of designated conservation areas located around its periphery. These areas represent a concerted planning initiative to minimise the impacts of dust storms on the town, an omnipresent hazard during excessively dry periods. These areas are mostly protected from public access to reduce the risk of environmental damage. Vegetation on these reserves is composed of sparsely distributed native trees with an understorey of low shrubs and groundcovers. Figure 35 shows the conservation area adjacent to Creedon Street, on the western edge of the town.

Figure 35 Conservation area adjacent to Creedon Street.

4.2.7 The Pinnacles

The Pinnacles are a visually prominent natural landmark with special significance to the Broken Hill and local indigenous communities. They act as a gateway icon to those travelers entering Broken Hill from the south along Silver City Highway and also from the south west along Barrier Highway and the Peterborough-Broken Hill Railway line. The land that they occupy is privately owned and inaccessible to the public. It is connected with a mining operation located a short distance to the west of the Pinnacles. Anecdotal evidence has suggested that the Pinnacles are a highly protected resource and recently attracted intense public scrutiny when the landmark came under threat from mining operations. Figure 36 shows a view of the Pinnacles from a rise on Pinnacles Road approximately 5km away from them.

Figure 36 View of Pinnacles from Pinnacles Road.

4.2.8 Creeks and drainage systems

The landscape around the project site is dissected with a network of ephemeral watercourses and drainage channels. The majority of these are undetectable to the untrained eye except perhaps after a major rainfall event. Large native trees such as River Red Gum tend to follow the course of the waterway and provide some visual filtering. There were no dedicated walking trails or scenic lookouts along waterways observed during the site visit. Figure 37 shows a view along an ephemeral creek bed adjacent to Pinnacles Road.

Figure 37 Ephemeral Creek Bed.

4.2.9 Landscape sensitivities

The table below provides a summary of the sensitivities of each landscape type to visual changes brought about by built works. The ratings range from Low to High sensitivity to visual change. These will be used to assess the degree of potential visual impact arising from the solar project and transmission line as described in *Methodology*

.

Landscape Type	*Comments*	*Sensitivity*
Pastoral	Exhibits numerous signs of modifications and is able to visually absorb further modifications. It is not perceived to be a pristine landscape where further changes are unacceptable, however it is environmentally fragile and is often valued for its 'outback' scenic qualities.	Low to Medium
Mining	A highly degraded landscape devoid of vegetation and other naturalistic forms. Typically many visually dominant structures present. Not valued for scenic qualities.	Low
Industrial / Commercial	Significantly modified landscape with many utilitarian buildings and infrastructure dominating the view. Commercial areas with heritage buildings provide greater visual amenity but is still a highly modified landscape. Visual changes are a common and expected occurrence.	Low to Medium
Residential	Residential areas typically have a higher sensitivity rating owing to resident's sense of attachment to the landscape. There are some residential areas with clear views to project site and surrounds, however many disturbances to the landscape are also in view.	Medium to High
Parks & Recreation Reserves	Typically have medium to high sensitivity to visual changes depending on the nature of activities undertaken (passive or active recreation). Also depends on available views out across the landscape. Often perceived to be a respite from built up environments.	Medium to High
Conservation Area	The identified conservation areas are utilitarian in nature and not specifically designed for landscape and visual amenity. Sparse tree cover permits views across landscape. Conservation areas are sometimes hard to discern from the pastoral landscape.	Medium
The Pinnacles	Highly valued topographical feature with indigenous and non-indigenous significance. The Pinnacles are a local icon. Perceived threats to visual amenity of this landform may face opposition from local community.	High
Creeks and Drainage Systems	Due to their ephemeral nature, they are often difficult to distinguish from the pastoral landscape. They can sometimes however, be highly regarded for their aesthetic value. Nature walks along the creeks can be an important indication of this amenity value, however no nature walks were observed during the site visit.	Medium

5. Assessment of Impacts

This chapter discusses the results and interpretations of the viewshed analyses undertaken as well as a viewpoint analysis. The viewpoint analysis covers 20 key locations within the study area with views toward the site and describes the view as well as providing a statement of visual impact from each location. A summary of visual impacts is also given at the end of the chapter.

5.1 Viewshed Analysis

A viewshed analysis is a GIS mapping process which calculates areas on the terrain which offer a clear line of sight toward one or several points. Within the software, these points can be positioned to represent various elements of the proposed development and offset at specific heights above the terrain, reflective of the proposed heights of the structures. An offset height can also be given to represent the viewing height in the surrounding landscape. Typically this is 1.7m to represent the average height of a person. This is a quantitative analysis using terrain alone and does not take into consideration any site specific conditions, such as existing vegetation or buildings. In effect, it disregards their presence, resulting in a conservative analysis which displays a worst-case scenario. A viewshed analysis was carried out separately for both the solar project and transmission line components.

The viewshed analysis for the solar project was conservatively based on the top of the solar panels being 2m above ground level. The terrain data used for the analysis was out to an extent of 10km from the solar project site boundary. Viewpoint 20, at the Sculpture Symposium, is located just beyond this 10km extent, however site observations had revealed that it offered clear views to the project site. A nominal number of points were used to represent blocks of solar modules so as to manage the processing time. The results are colour coded to show the number of points (solar panels) viewable from each area with the dark blue regions representing the areas with the most visual exposure to the solar project. Figure 38 shows the results of the viewshed analysis for the solar project.

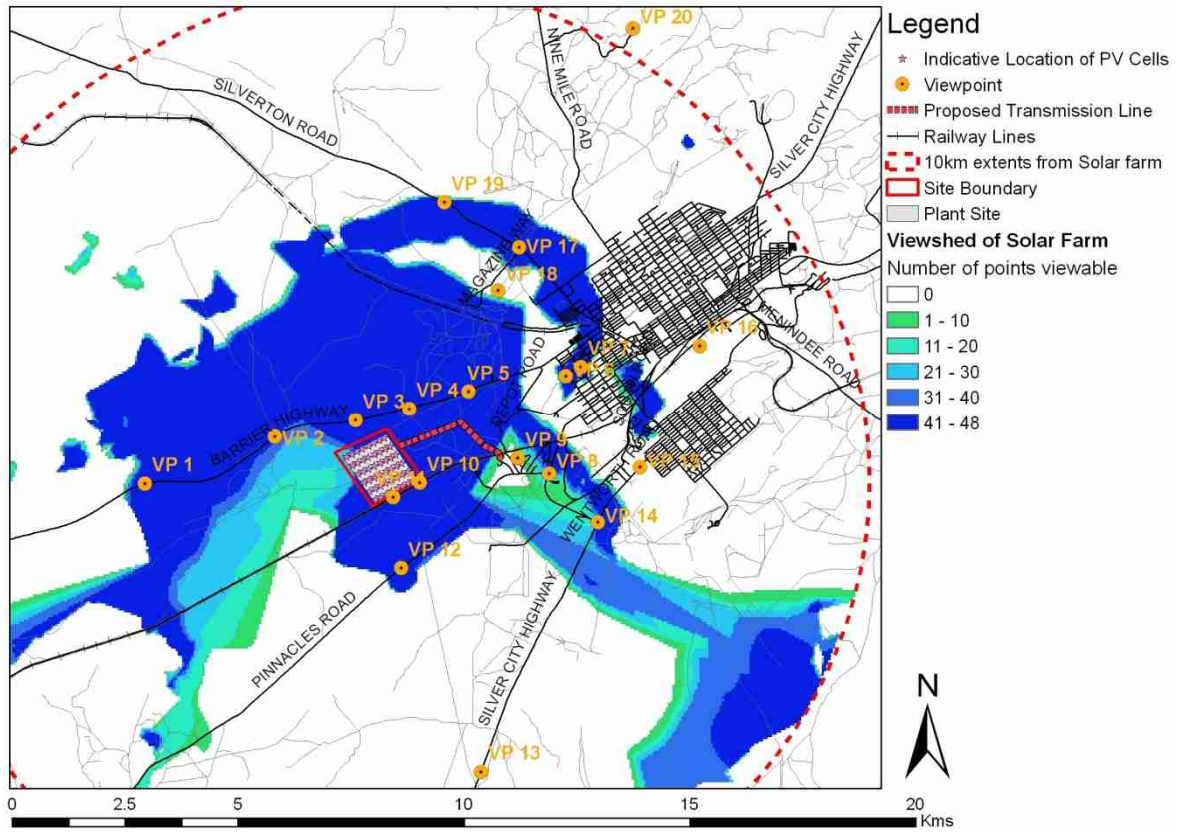


Figure 38 Viewshed analysis of Solar Project.

The roads with highest visual exposure include Barrier Highway and to a lesser extent, Pinnacles Road and Silverton Road. The Peterborough-Broken Hill Railway line also has high exposure where it runs immediately adjacent to the site. The rail line to the north is not used for passenger services. Other areas with high exposure are Wentworth Road and the elevated residential areas of Lunam Street. The large dark blue areas to the south east are not accessible and were not investigated during the site visit. The viewpoints which were analysed cover most of the key accessible areas of visual exposure. It should be noted that as the viewshed analysis is conservative, there were many areas observed on site which did not permit views although this was indicated as such in the analysis. This was primarily due to intervening vegetation, buildings and minor topographical features not accounted for in the GIS data.

The viewshed analysis for the transmission line was undertaken in a similar way with the transmission towers given a conservative height of 14m and a spacing of 100m apart. The results are generally similar except with a greater degree of visual exposure along Silver City Highway. As per the results for the solar project, there are similar levels of exposure along Barrier Highway, Pinnacles Road, Silverton Road and Lunam Street. Figure 39 shows the results of the analysis for the transmission line.

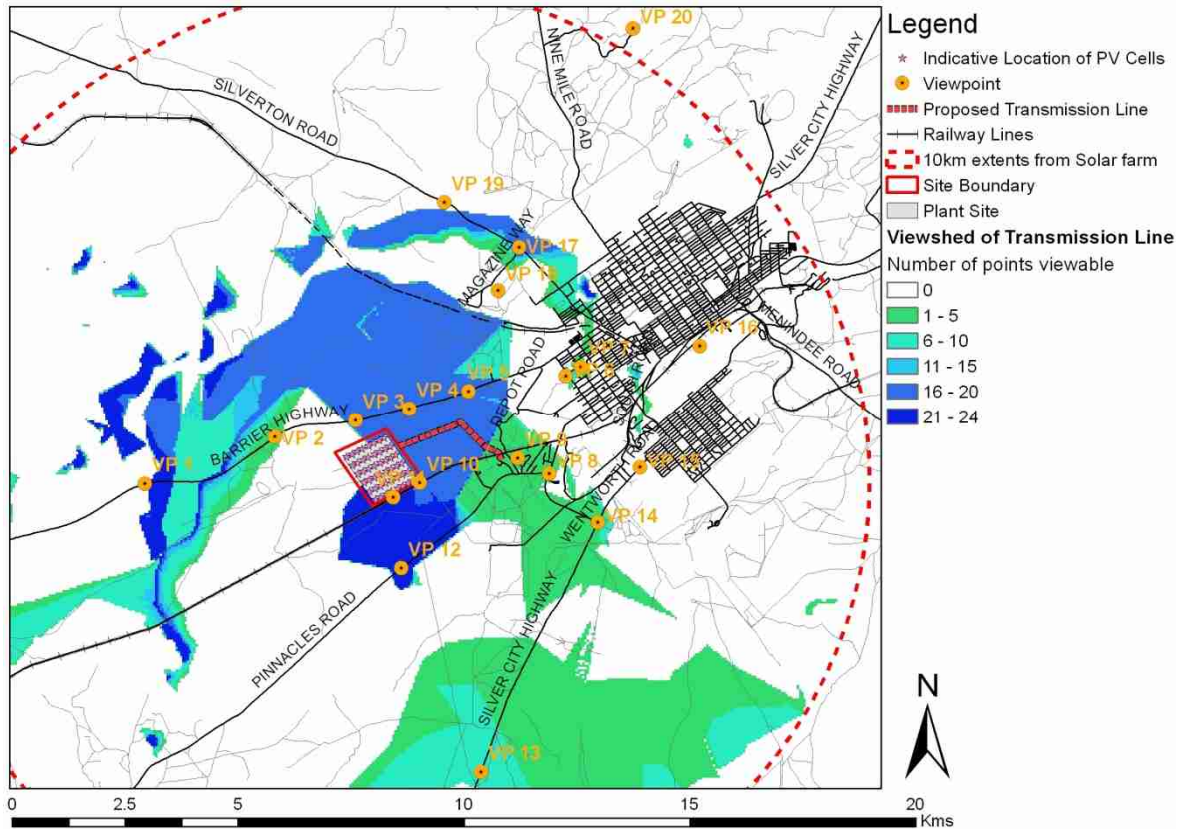


Figure 39 Viewshed analysis of transmission line.

5.2 Viewpoint Analysis

In order to assess the visual impacts associated with the solar project and transmission line, a range of representative viewpoints (20 in total) have been selected from key publicly accessible locations as well as locations adjacent to residences. These were selected to form a representative sample of viewpoints toward the proposed development from within the study area. From each viewpoint, the existing landscape is described and analysed and an assessment is made as to the degree of visual impact of both project components at that location.

A common tool for forecasting the degree of visual change from a particular viewpoint is the generation of photomontages. These are computer generated images that compare how a proposed development to the landscape will appear after its completion against the existing landscape. Two photomontages have been prepared and are included in *Appendix A: Photomontages*.

Figure 40 shows the locations of all viewpoints which were assessed in this analysis. These are described in detail in the following sections. A summary of impacts is also given at the end of this chapter.

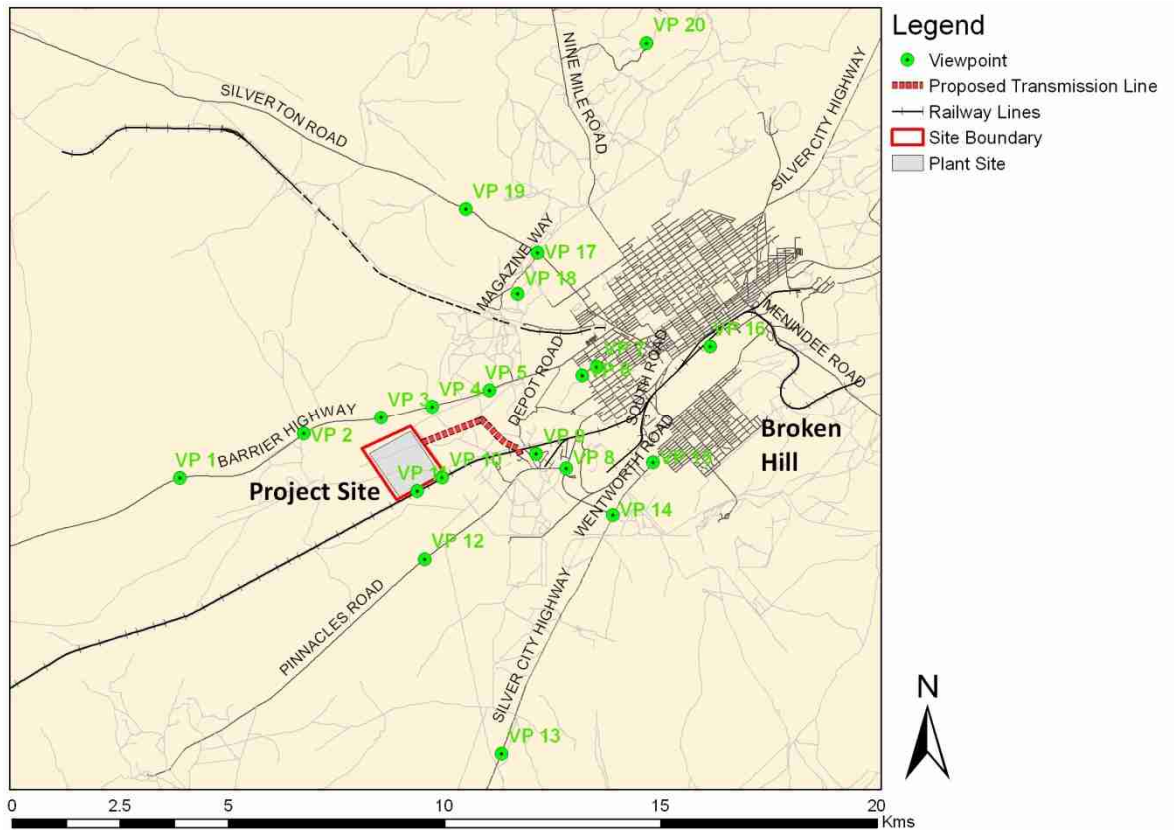
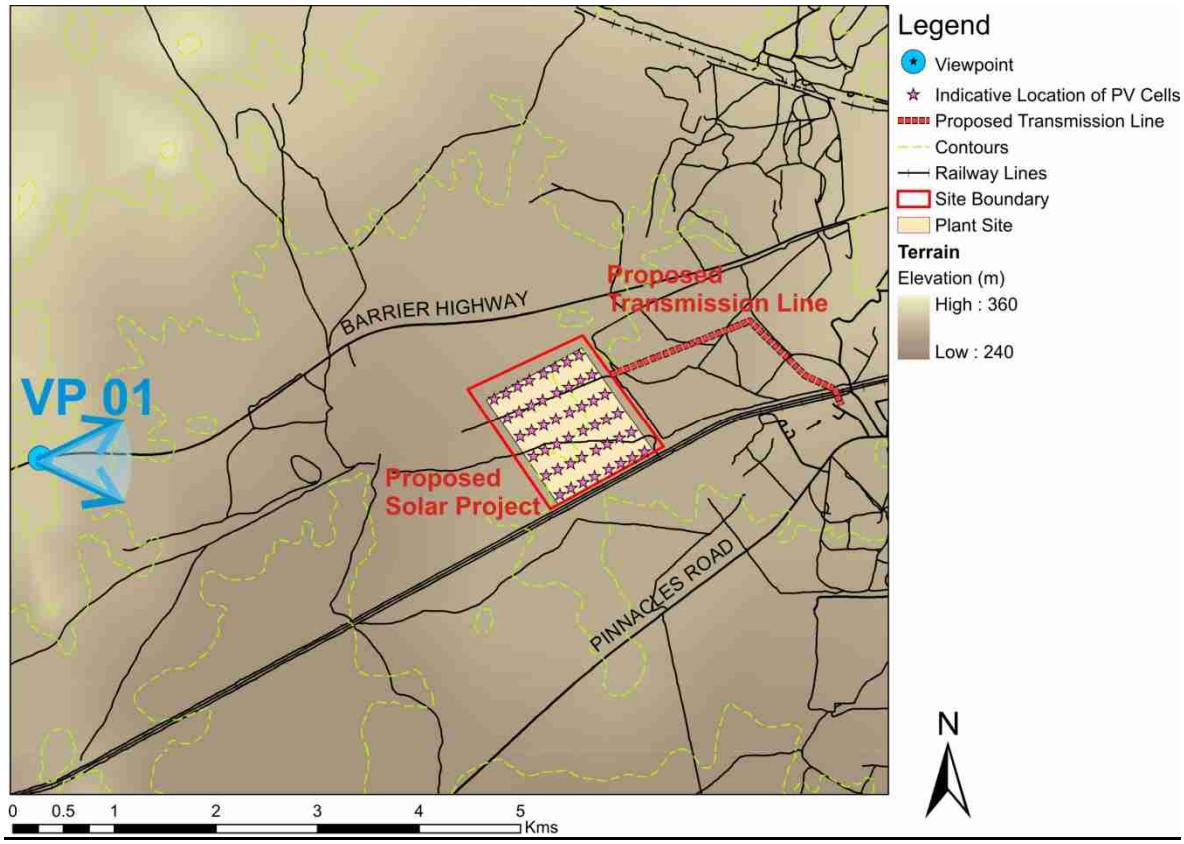


Figure 40 Location of all viewpoints.

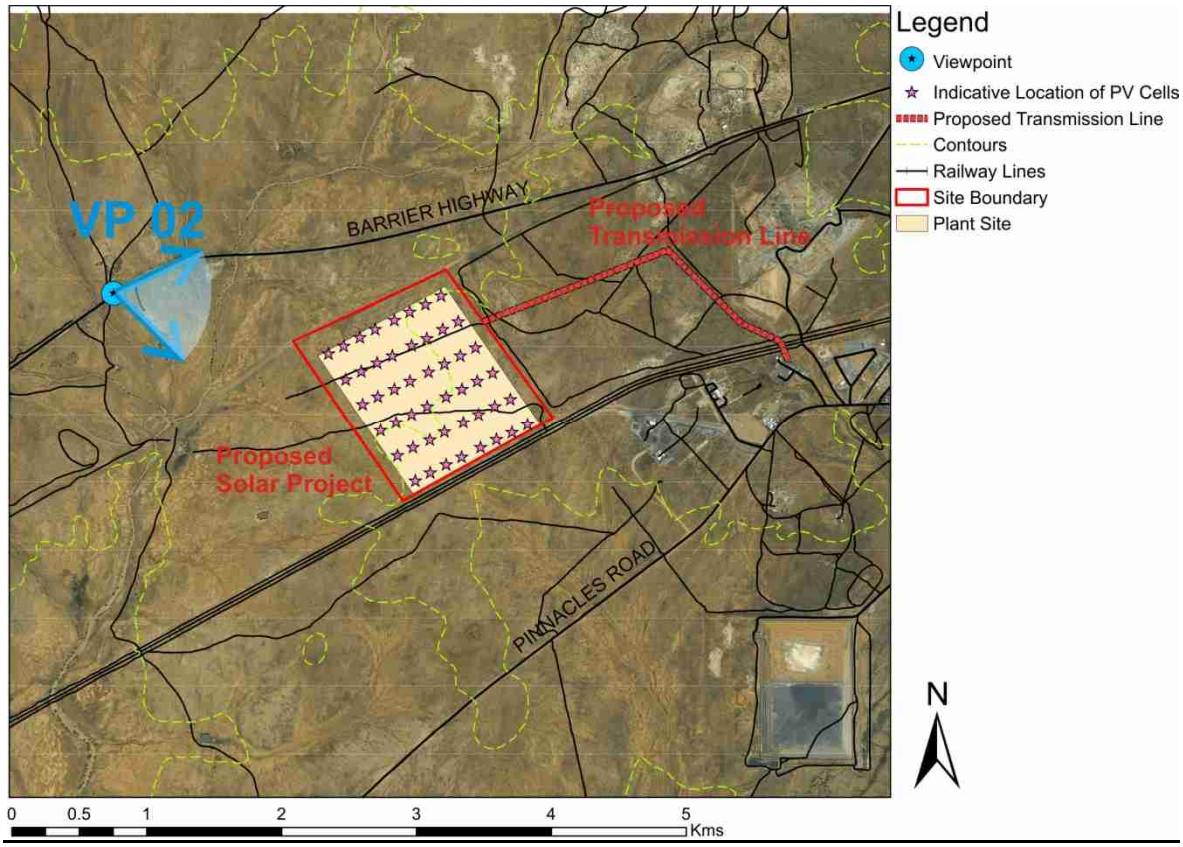
Viewpoint 1 – Barrier Highway #1



Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Barrier Highway (west of site)	E 531750 N 6460539 Alt 300 m	4,439 m (Solar Project) 5,691 m (Trans Line)	East

Landscape Type (s)	Pastoral	*Sensitivity*	Low to Medium
Exposure	High		
Description	View toward site from Barrier Highway heading east toward Broken Hill. Transmission lines also in view. Mining activity, towers and other disturbances viewable in the distance.		
Comments	This would be the first initial sighting of the Solar Project from the Barrier Highway while heading east towards Broken Hill. The Solar Project will appear against other modifications to the landscape. The transmission line will not be discernible.		
Overall Visual Impact			
Solar Project	Low, due to distance away and relatively low landscape sensitivity.		
Transmission line	Negligible, due to distance away.		

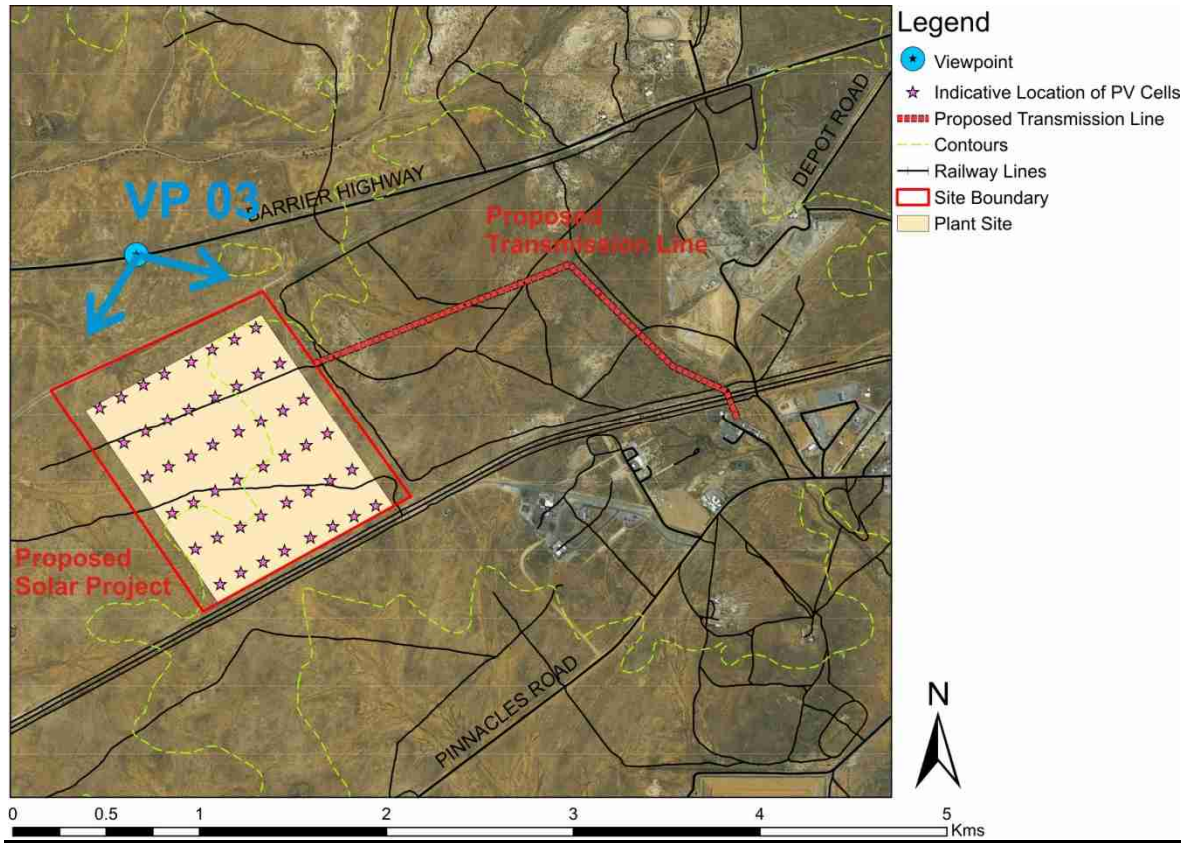
Viewpoint 2 – Barrier Highway #2



Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Barrier Highway (north west of site)	E 534624 N 6461575 Alt 272 m	1,585 m (Solar Project) 2,752 m (Trans Line)	Southeast

Landscape Type (s)	Pastoral	*Sensitivity*	Low to Medium
Exposure	High		
Description	View from Barrier Highway across site with Broken Hill Mineral Separation Plant on over crest. Existing transmission towers and other infrastructure also in view.		
Comments	The solar project would occupy large proportion of the view, however it will be low in profile. The transmission line will visually integrate with other existing transmission lines viewable in the distance. Potential for the solar project to act as a gateway icon (see *Barrier Highway*)		
Overall Visual Impact			
Solar Project	Low to Positive, due to low landscape sensitivity and potential as gateway icon.		
Transmission line	Low, due to distance away.		

Viewpoint 3 – Barrier Highway #3



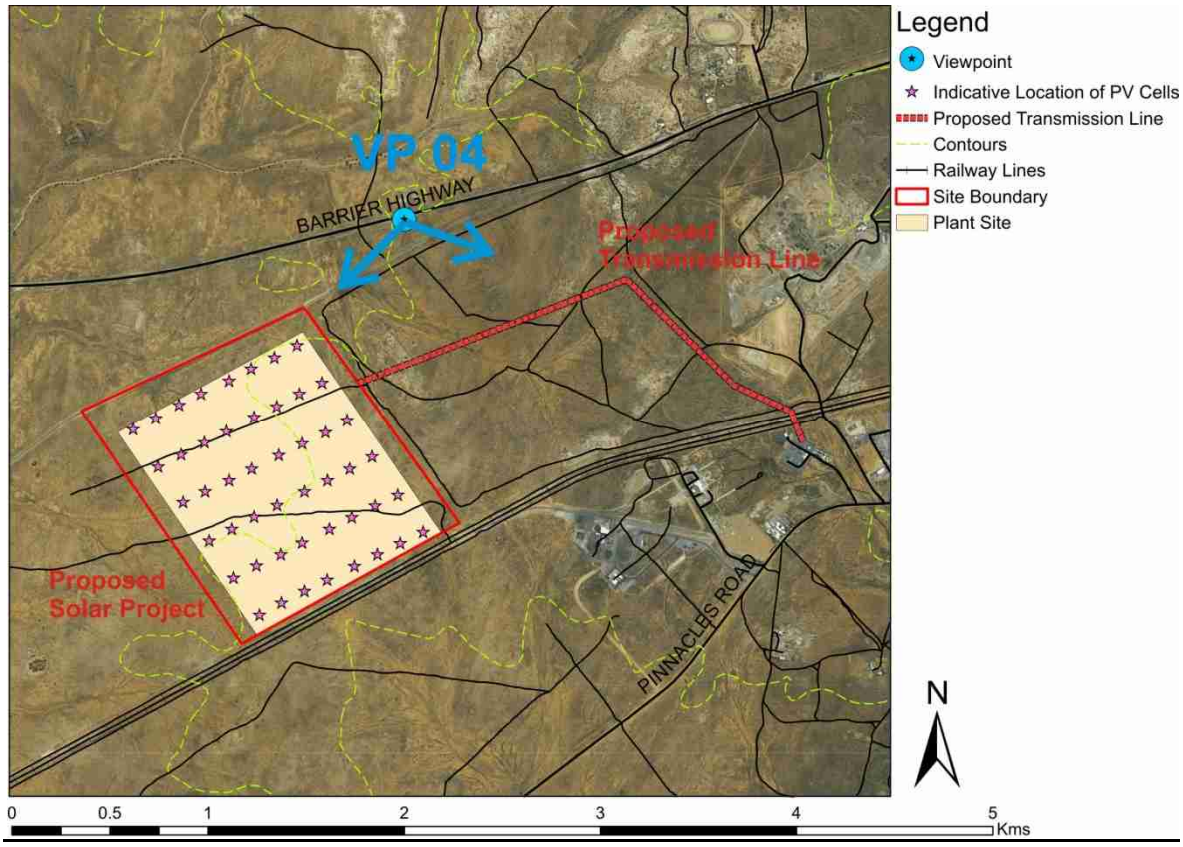
Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Barrier Highway (north of site)	E 536412 N 6461949 Alt 280 m	594 m (Solar Project) 1,114 m (Trans Line)	Southeast

View south east

View south west

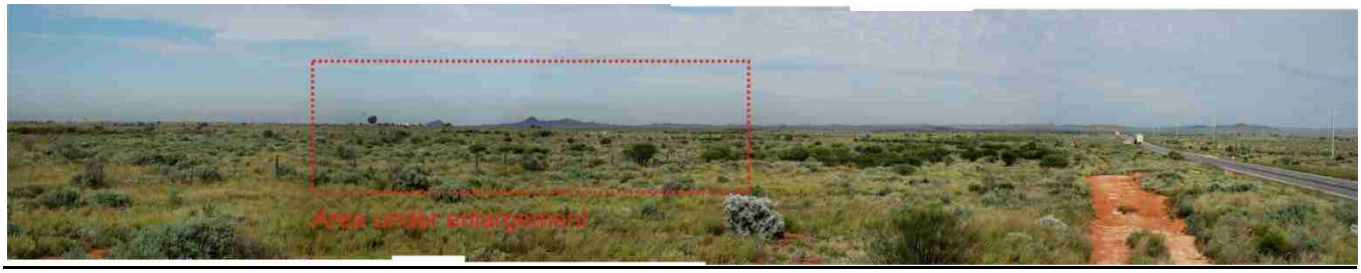
Landscape Type (s)	Pastoral	*Sensitivity*	Low to Medium
Exposure	High		
Description	View from Barrier Highway directly adjacent to the site. Broken Hill Mineral Separation Plant also seen from this location.		
Comments	The solar project would occupy most of the horizontal field of view. Views across the solar project would provide visual interest as one drives along. Potential for the solar project to act as a gateway icon (see *Barrier Highway*). The transmission line will visually integrate with other existing transmission lines viewable in the distance.		
Overall Visual Impact			
Solar Project	Low to Positive, due to low landscape sensitivity and potential as gateway icon.		
Transmission line	Low, due to distance away.		

Viewpoint 4 – Barrier Highway #4



Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Barrier Highway (north east of site)	E 537597 N 6462202 Alt 280 m	773 m (Solar Project) 695 m (Trans Line)	Southeast to southwest

View south east

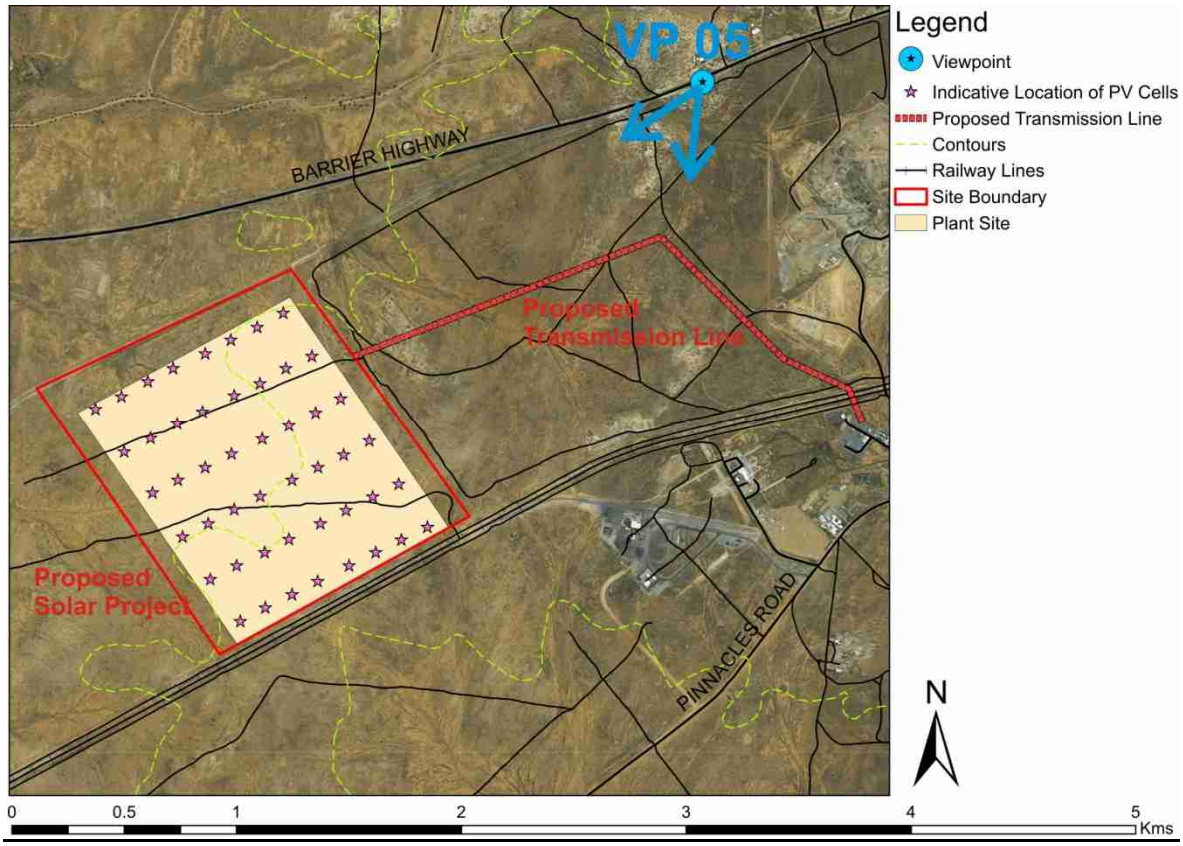


View south west

Landscape Type (s)	Pastoral and Pinnacles	*Sensitivity*	Low to High
Exposure	High		
Description	View south west takes in the Pinnacles and an area of the landscape which is relatively undisturbed apart from small fences. Small transmission line in view in the distance to the south. The silo of the mineral separation plant is also visible.		
Comments	This view has relatively high scenic value for motorists heading west along the Barrier Highway. The solar project would cover most of the ground beneath the Pinnacles and result		

	in a major change to the visual characteristics. The transmission line would visually integrate with other existing transmission lines in the vicinity. Photomontages have been prepared from this location and are included in *Appendix A: Photomontages.*
Overall Visual Impact	
Solar Project	High, due to close proximity and it is in direct line of sight to The Pinnacles.
Transmission line	Low, due to low landscape sensitivity and presence of existing transmission line.

Viewpoint 5 – Barrier Highway #5



Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Barrier Highway (north east of site)	E 538916 N 6462585 Alt 285 m	2,079 m (Solar Project) 721 m (Trans Line)	Southwest

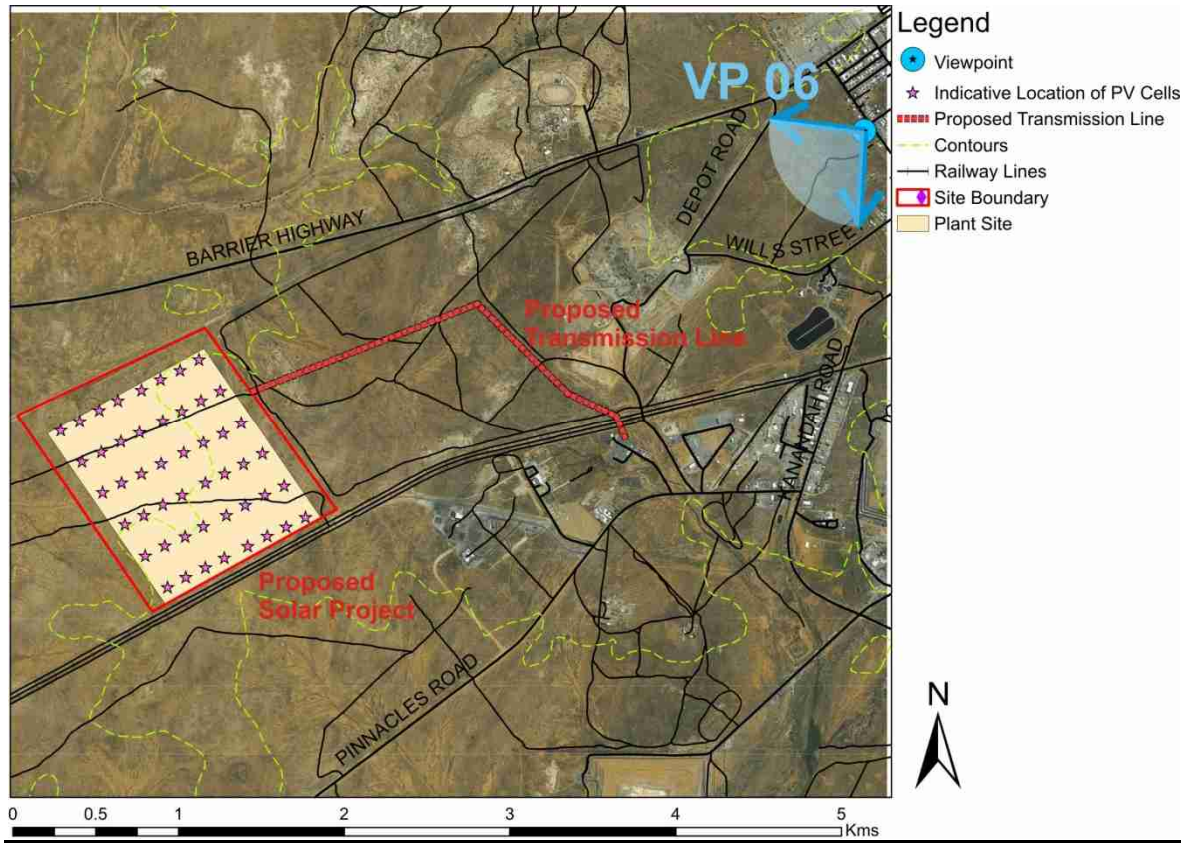
View southwest

View south

Landscape Type (s)	Pastoral and Industrial	*Sensitivity*	Low to Medium
Exposure	High		
Description	View southwest along Barrier Highway with Pinnacles in the far distance. Existing transmission line in view on crest to the south. Larger 220kV transmission line also in view in far distance.		

	Refuse area and TransGrid substation in view beyond hill.
Comments	The solar project would be partially hidden by terrain. The transmission line would visually integrate with other existing transmission lines in the vicinity. View toward proposed transmission line partially degraded by refuse area.
Overall Visual Impact	
Solar Project	Low, due to presence of intervening ridgeline partially inhibiting view.
Transmission line	Low, due to presence of existing transmission line and refuse area.

Viewpoint 6 – Creedon Street



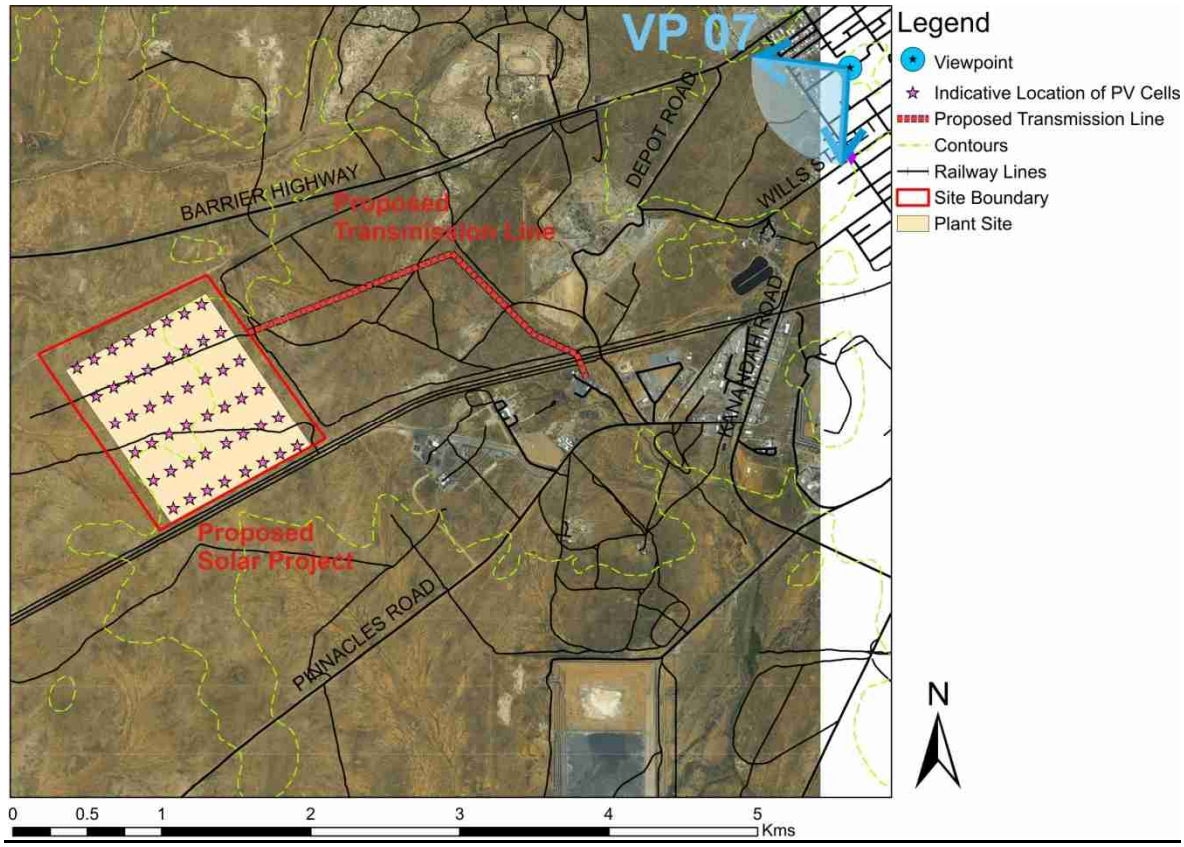
Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Creedon Street Residential Area (north east of site)	E 541065 N 6462937 Alt 311 m	3,931 m (Solar Project) 2,276 m (Trans Line)	Southwest

View northwest to west

View west to southeast

Landscape Type (s)	Conservation Area	*Sensitivity*	Medium
Exposure	Low		
Description	View from the rear of residential properties adjacent to Creedon Street. Views west look out across a conservation area toward the project site. Numerous existing transmission lines in view. Broken Hill Mineral Separation Plant also just in view. This location is not meant to and does not appear to be frequented by people.		
Comments	The solar project and transmission line would not be visible from this location		
Overall Visual Impact			
Solar Project	Nil, due to intervening ridgeline completely inhibiting view.		
Transmission line	Nil, due to intervening ridgeline completely inhibiting view.		

Viewpoint 7 – Lunam Street



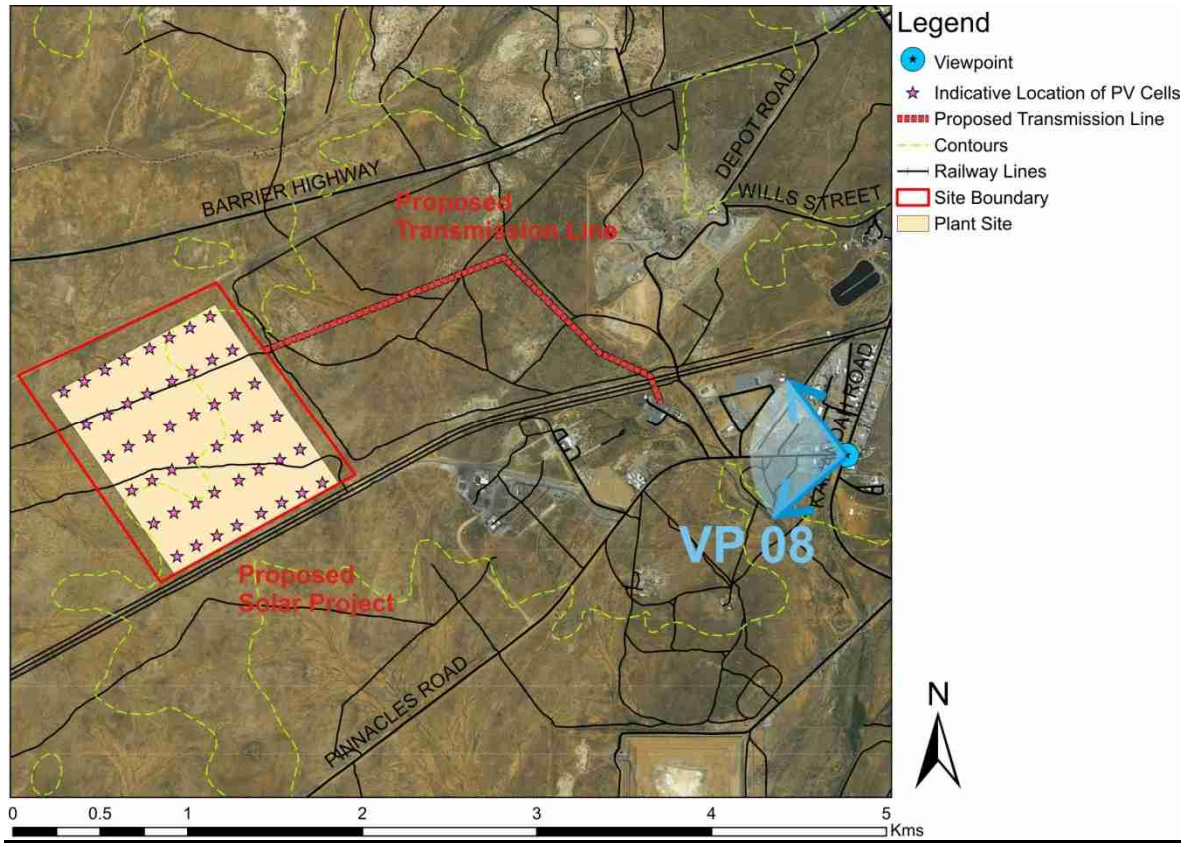
Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Lunam Street Residential Area (north east of site)	E 541401 N 6463137 Alt 320 m	4,310 m (Solar Project) 2,646 m (Trans Line)	Southwest

View west to south

Landscape Type (s)	Pastoral, Mining, Residential and Pinnacles	*Sensitivity*	Low to High
Exposure	High		
Description	Views look out in a southwesterly direction from residential area, taking in the pastoral landscape, mining and industrial activity, and transmission lines with a backdrop of the Pinnacles.		
Comments	The solar project would appear as a narrow dark band in the distant landscape below The Pinnacles. The transmission line would visually integrate with the numerous vertical elements across the landscape. Photomontages have been prepared from this location and are included in *Appendix A: Photomontages.*		

Overall Visual Impact	
Solar Project	Low, due to presence of other manmade modifications and distance.
Transmission line	Negligible, due to distance.

Viewpoint 8 – Kanandah Road



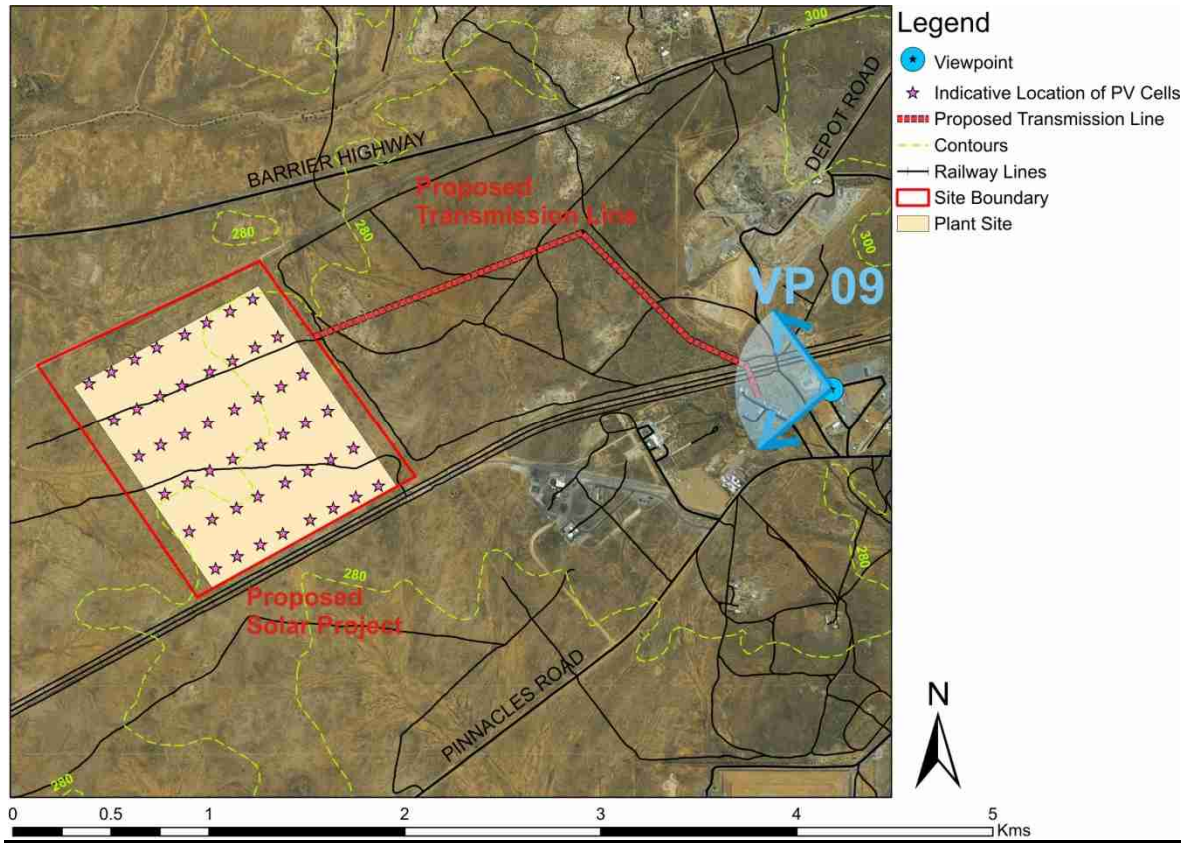
Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Intersection of Pinnacles and Kanandah Roads (east of site)	E 540696 N 6460762 Alt 290 m	2,822 m (Solar Project) 1,109 m (Trans Line)	West

View southwest

View west toward project site

Landscape Type (s)	Industrial	*Sensitivity*	Low
Exposure	Medium		
Description	Kanadah and Pinnacles road are flanked with industrial factories and sheds. High chain wire mesh security fencing is a common feature within the view. Small transmission lines line both sides of the roads.		
Comments	Views toward the project site would be constrained by terrain , buildings and vegetation.		
Overall Visual Impact			
Solar Project	Nil, due to intervening elements in the landscape.		
Transmission line	Nil, due to intervening elements in the landscape.		

Viewpoint 9 – Pinnacles Place

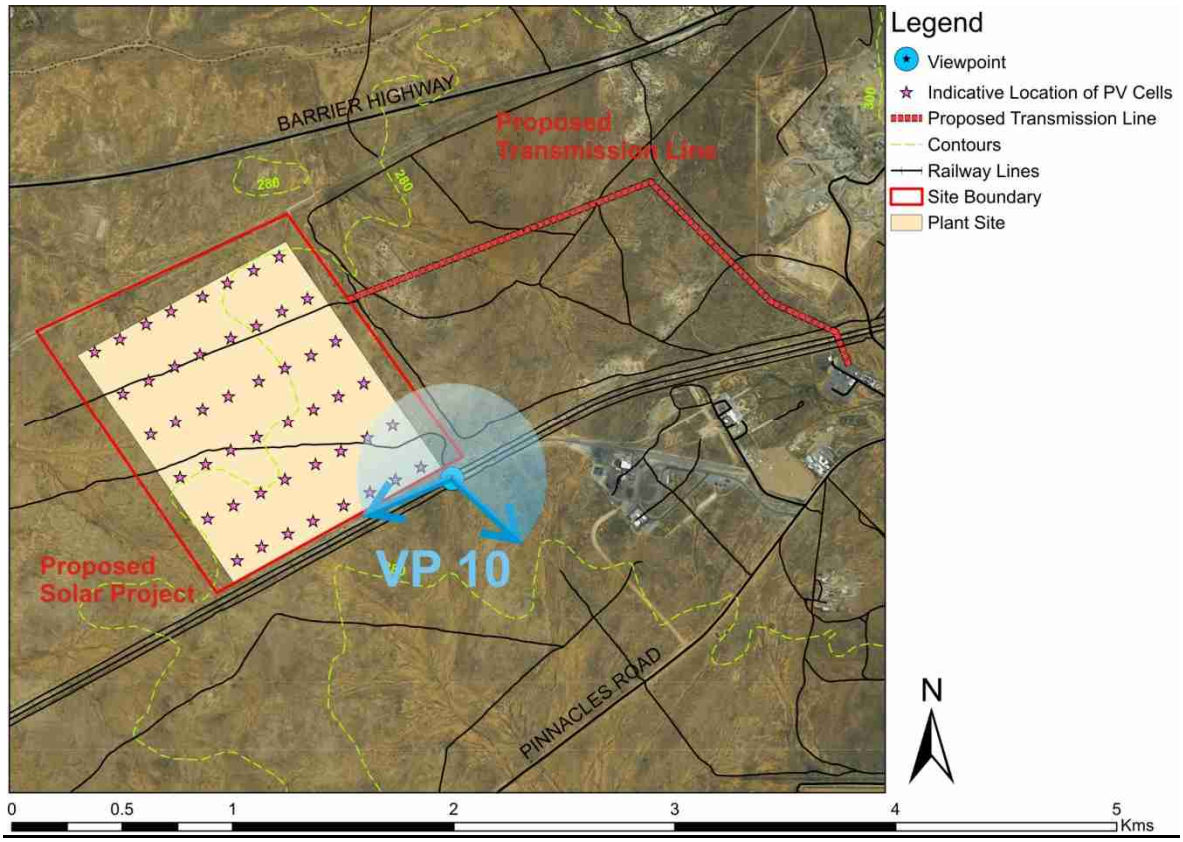


Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Pinnacles Place - eastern connection point of transmission line (east of site)	E 540003 N 6461099 Alt 286 m	2,173 m (Solar Project) 377 m (Trans Line)	West

View west toward Transgrid Broken Hill substation

Landscape Type (s)	Industrial	*Sensitivity*	Low
Exposure	Medium		
Description	Location is dominated by views of a crane and bus depot, large warehouses and the existing substation with small 22kV and large 220kV transmission lines. Chain wire security fencing lines are a common element with minimal vegetation around the area. Train line runs beside the substation.		
Comments	The new transmission line would cross the train line before connecting with the substation. It would be difficult to discern the new transmission line through the existing infrastructure in the foreground. No views to the solar project are possible from this location.		
Overall Visual Impact			
Solar Project	Nil, due to intervening terrain.		
Transmission line	Negligible, due to presence of existing substation (low landscape sensitivity).		

Viewpoint 10 – Railway Line #1



Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Peterborough - Broken Hill Railway On boundary corner (east of site)	E 537833 N 6460554 Alt 280 m	65 m (Solar Project) 940 m (Trans Line)	Southwest to southeast

View southwest

View northwest toward solar project

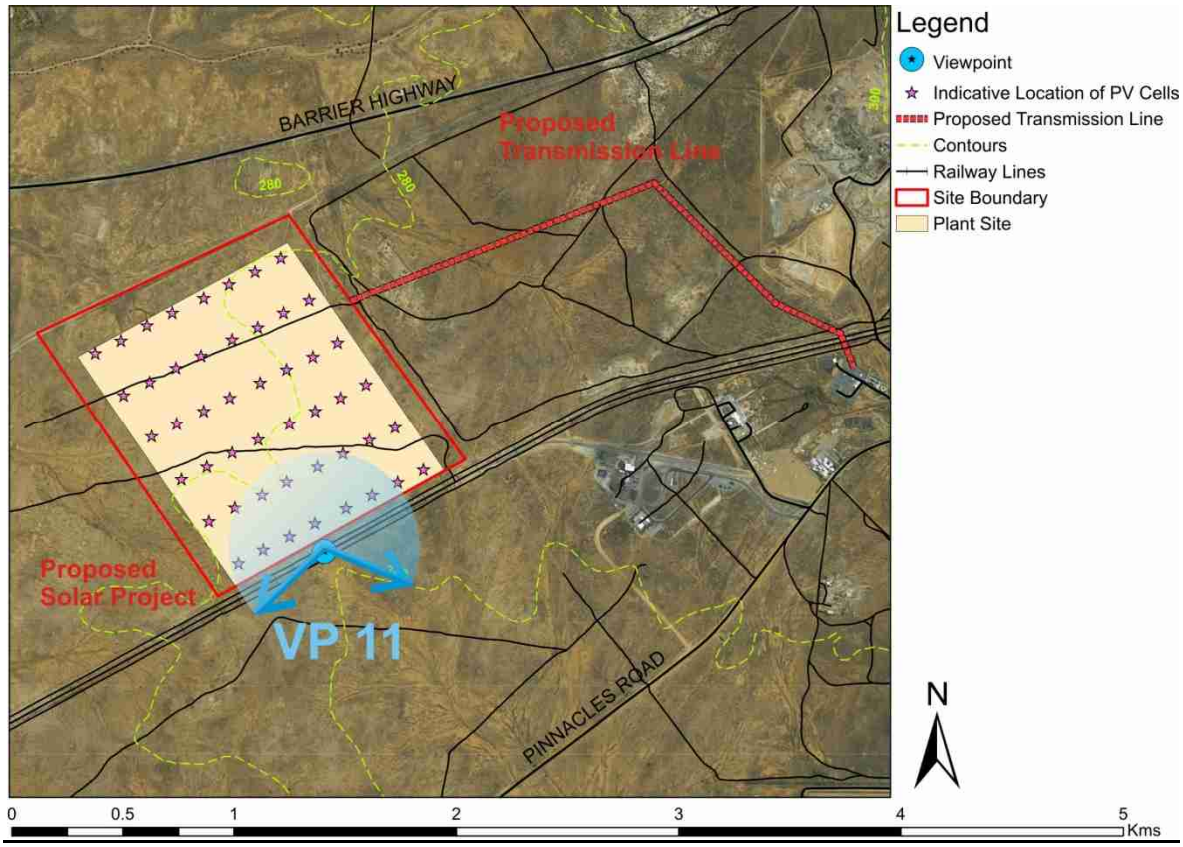
View north east

View southeast

Landscape Type (s)	Pastoral and Mining	*Sensitivity*	Low to Medium

Exposure	Medium
Description	Views take in the Mineral separation plant, 220kV and 22kV transmission lines, fence lines and access tracks. Pinnacles are viewable in the distance but not in direct line of sight to solar project.
Comments	This view would be mainly experienced by passengers on board the Indian Pacific for whom the solar project may provide an interesting visual experience. The transmission line will visually integrate with power lines already present.
Overall Visual Impact	
Solar Project	Low to Positive, due to low landscape sensitivity and potential to add to viewing experience.
Transmission line	Low, due to presence of existing transmission line in foreground.

Viewpoint 11 – Railway Line #2



Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Peterborough - Broken Hill Railway On south east boundary (south of site)	E 537246 N 6460236 Alt 280 m	60 m (Solar Project) 1,138 m (Trans Line)	Southwest to southeast

View northeast

Vie southeast

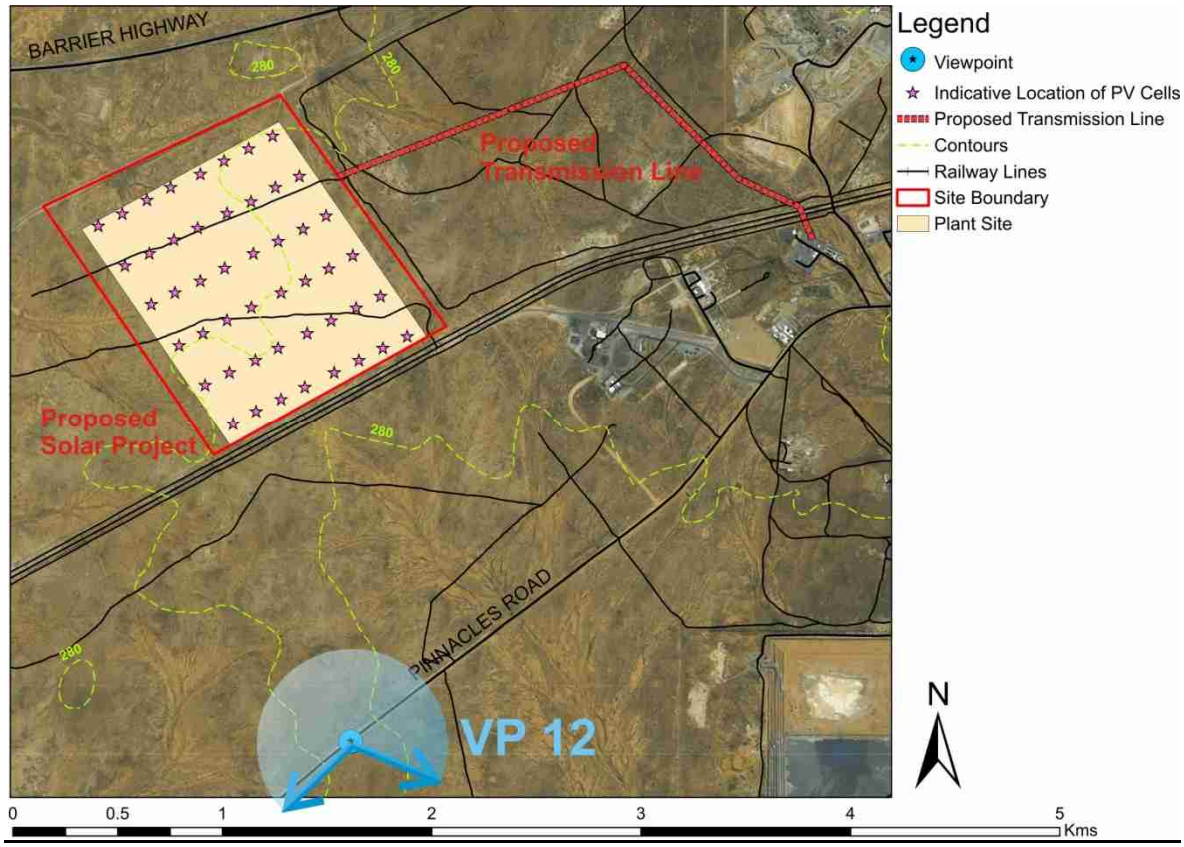
View southwest

View northwest

View northeast

Landscape Type (s)	Pastoral and Mining	*Sensitivity*	Low to Medium
Exposure	Medium		
Description	Views take in the Mineral separation plant, 220kV and 22kV transmission lines, fence lines and access tracks. Pinnacles are viewable in the distance but not in direct line of sight to solar project.		
Comments	This view would be mainly experienced by passengers on board the Indian Pacific for whom the solar project may provide an interesting visual experience. The transmission line will visually integrate with power lines already present.		
Overall Visual Impact			
Solar Project	Low to Positive, due to low landscape sensitivity and potential to add to viewing experience.		
Transmission line	Low, due to presence of existing transmission line in foreground.		

Viewpoint 12 – Pinnacles Road



Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Pinnacles Road south of site On rise in hill	E 537423 N 6458665 Alt 280 m	1,522 m (Solar Project) 2,705 m (Trans Line)	Southwest to southeast

View southwest toward The Pinnacles

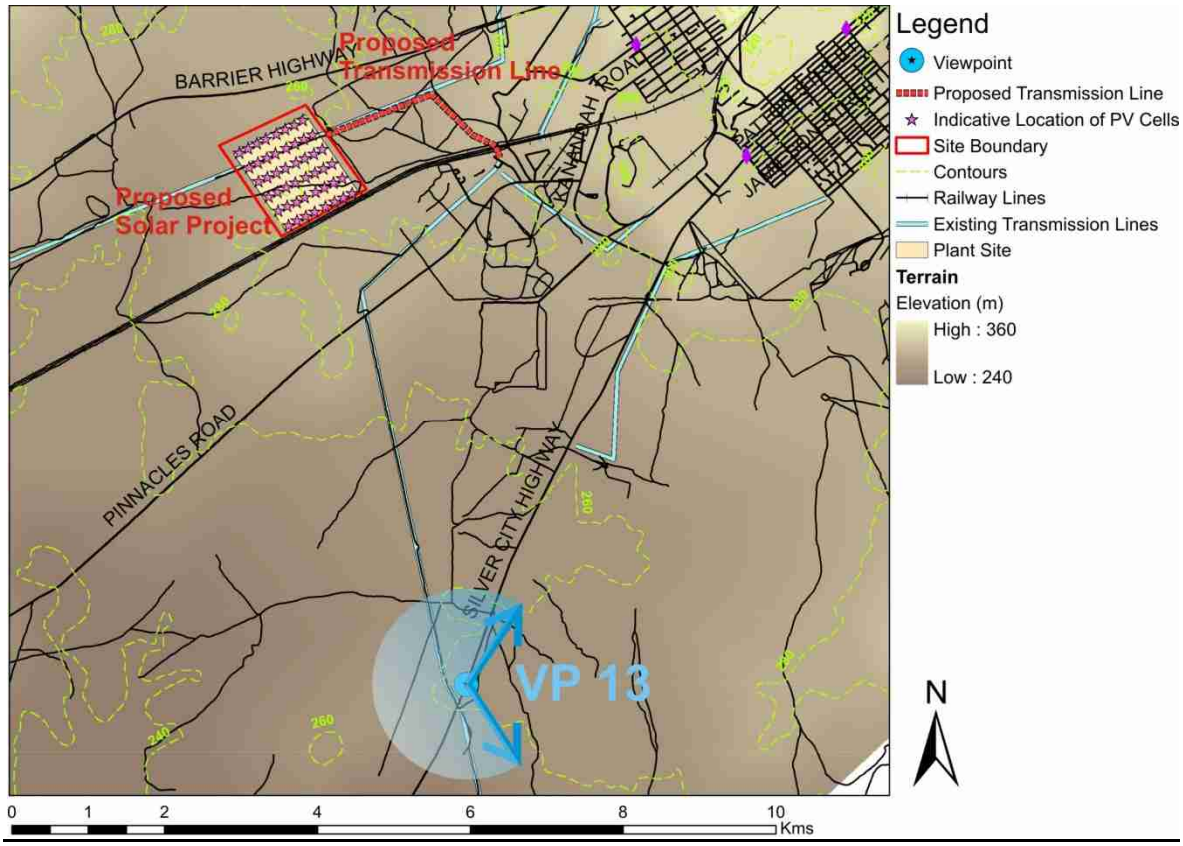
View north

View northeast

Landscape Type (s)	Pastoral and Mining	*Sensitivity*	Low to Medium
Exposure	Low		
Description	Views take in mining activity, Mineral Separation Plant, 220kV transmission lines and the Pinnacles. The Pinnacles are not viewed in the same direction as the project site however. Little used dead end dirt track mainly used by utility vehicles.		

Comments	The solar project would not be visible from this location owing to an intervening ridgeline to the north. The elevation difference was too slight to be taken into account in the viewshed analysis. The transmission line would be visible only at the northern most point where it connects with the substation, however it would be some way off in the distance.
Overall Visual Impact	
Solar Project	Nil, due to presence of intervening ridgeline.
Transmission line	Negligible, due to distance away and presence of other structures.

Viewpoint 13 – Silver City Highway #1



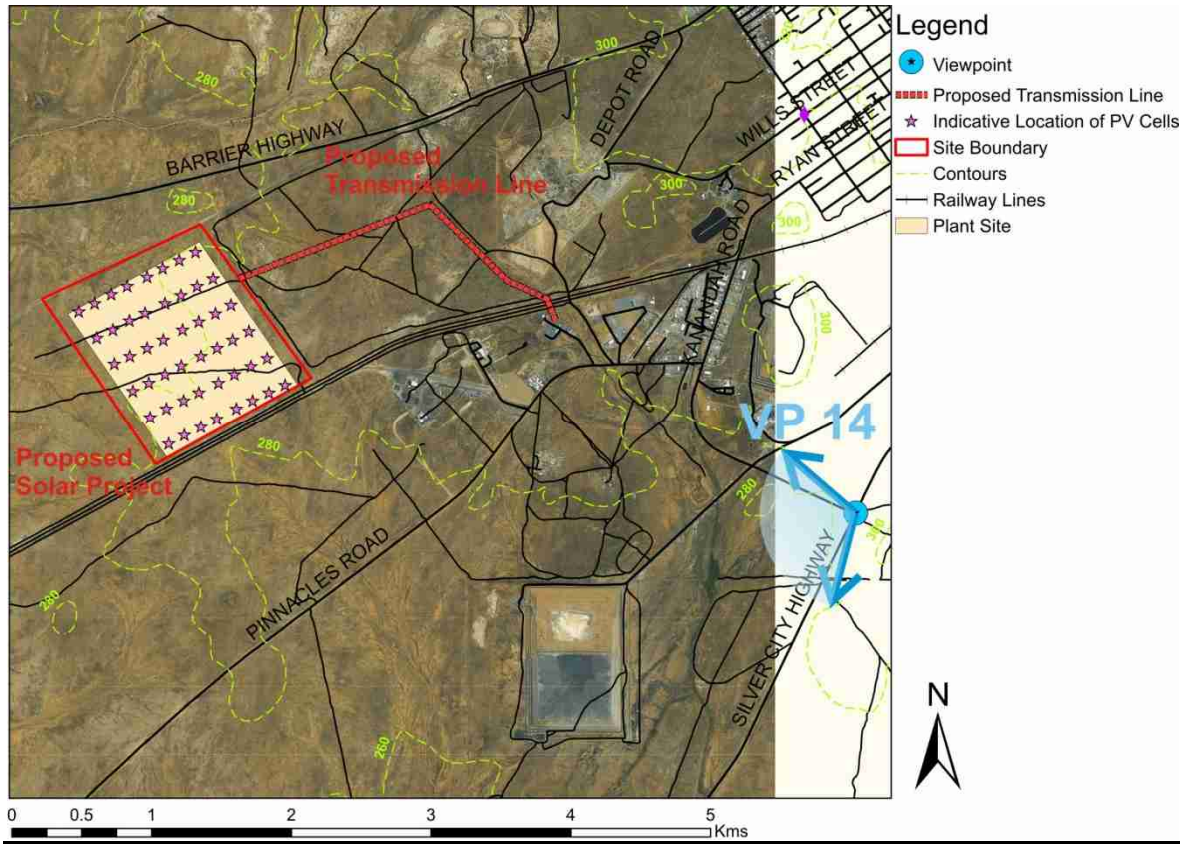
Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Silver City Highway Southeast of Site	E 539193 N 6454167 Alt 260 m	6,321 m (Solar Project) 6,898 m (Trans Line)	Southeast to northeast

View southeast toward crossing point of existing 220kV transmission line

View north toward the project site

Landscape Type (s)	Pastoral	*Sensitivity*	Low to Medium
Exposure	High		
Description	Views toward the project site take in the relatively flat expanse of the pastoral landscape as well as the existing 220kV transmission line and Perilya mine site. Views toward the Pinnacles are not in direct line of sight with the project site.		
Comments	The Solar plant would not be visible. The transmission line might be viewable from this view point although well beyond easily discernible range.		
Overall Visual Impact			
Solar Project	Nil, due to intervening terrain.		
Transmission line	Negligible, due to distance and presence of 220kV transmission line in foreground.		

Viewpoint 14 – Silver City Highway #2

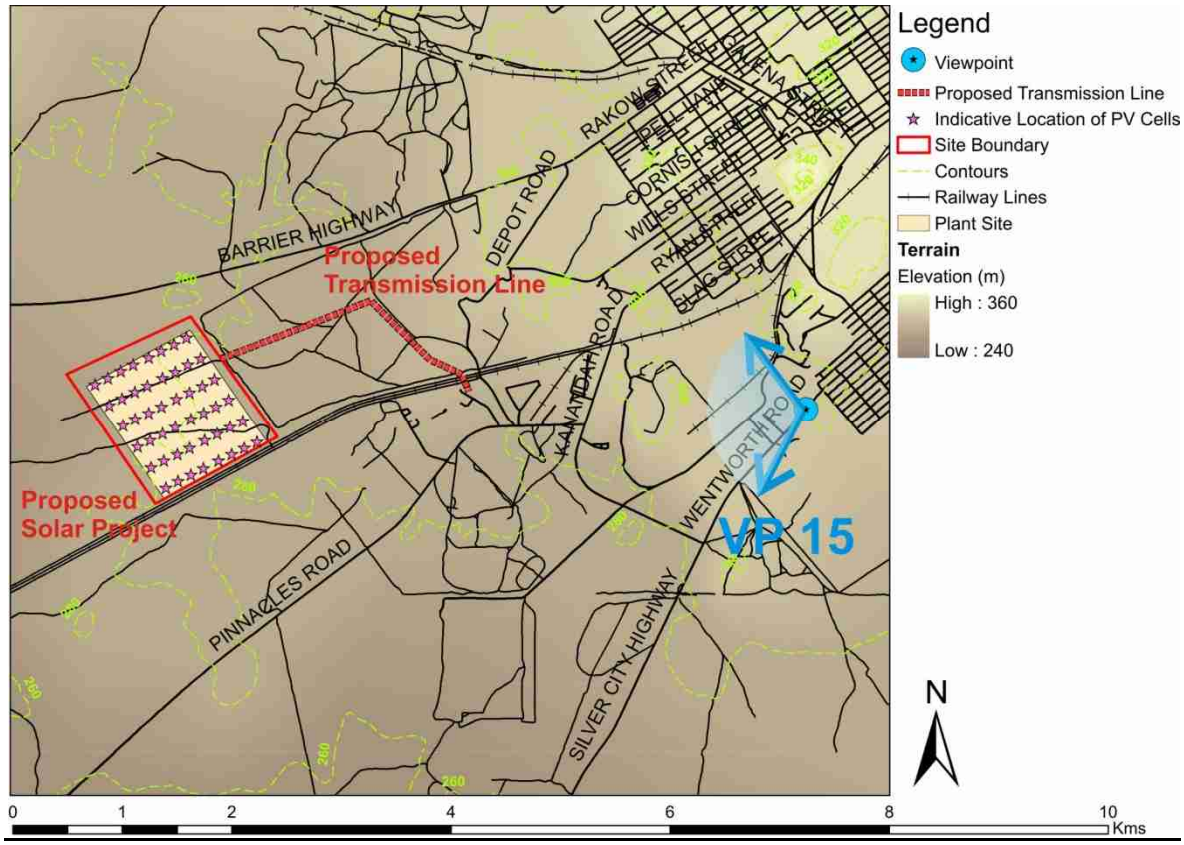


Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Intersection of Silver City Highway and Kanandah Road	E 541779 N 6459685 Alt 287 m	4,007 m (Solar Project) 2,552 m (Trans Line)	Northwest to southwest

View northwest toward project site

Landscape Type (s)	Pastoral and Mining	*Sensitivity*	Low to Medium
Exposure	High		
Description	View of Perilya mine in the middle distance. Small utility shed in view in the foreground.		
Comments	The solar project would not be visible from this location owing to an intervening ridgeline. The transmission line would be mostly hidden by roadside vegetation.		
Overall Visual Impact			
Solar Project	Nil, due to intervening terrain.		
Transmission line	Negligible, due to intervening vegetation.		

Viewpoint 15 – Wentworth Road

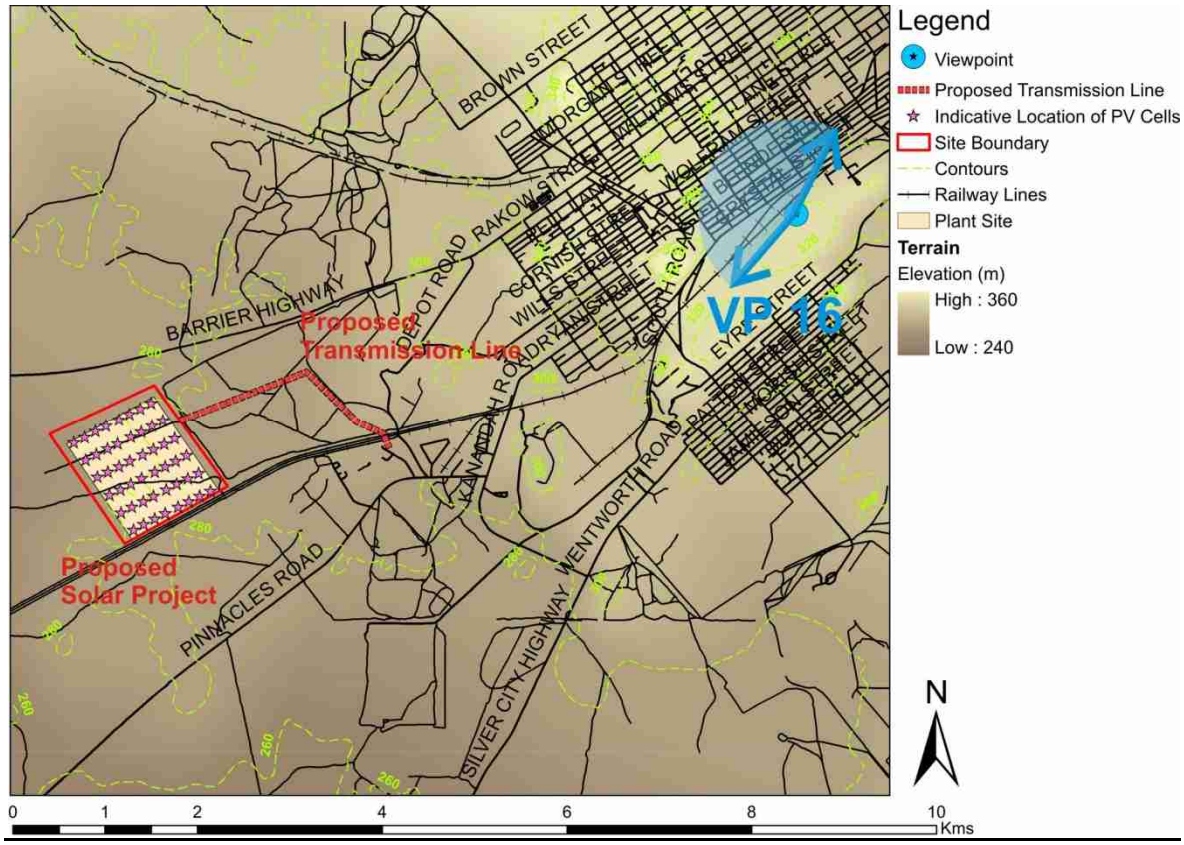


Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Wentworth Road at south western periphery of Broken Hill township Twin Lakes	E 542708 N 6460905 Alt 300 m	4,846 m (Solar Project) 3,093 m (Trans Line)	Southwest to northwest

View west

Landscape Type (s)	Parks and Recreation Reserves	*Sensitivity*	Medium to High
Exposure	High		
Description	Park with lake and water feature. Twin Lakes is managed by Perilya mining operation.		
Comments	Established tall roadside vegetation effectively inhibits all views to the project site.		
Overall Visual Impact			
Solar Project	Nil, due to intervening vegetation and terrain.		
Transmission line	Nil, due to intervening vegetation and terrain.		

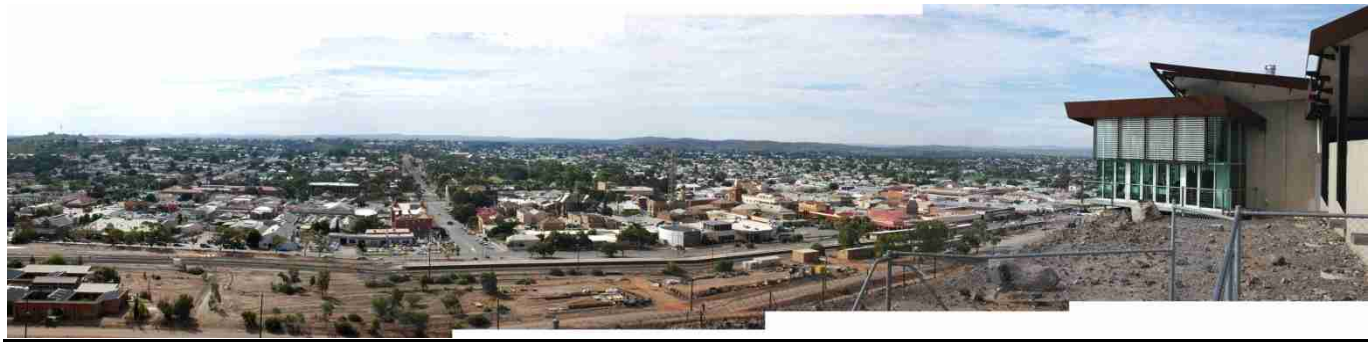
Viewpoint 16 – Line of Lode Lookout



Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Line of Lode Lookout	E 544032 N 6463605 Alt 320 m	6,825 m (Solar Project) 5,066 m (Trans Line)	Southwest to northeast

View southwest toward project site.

Enlargement view

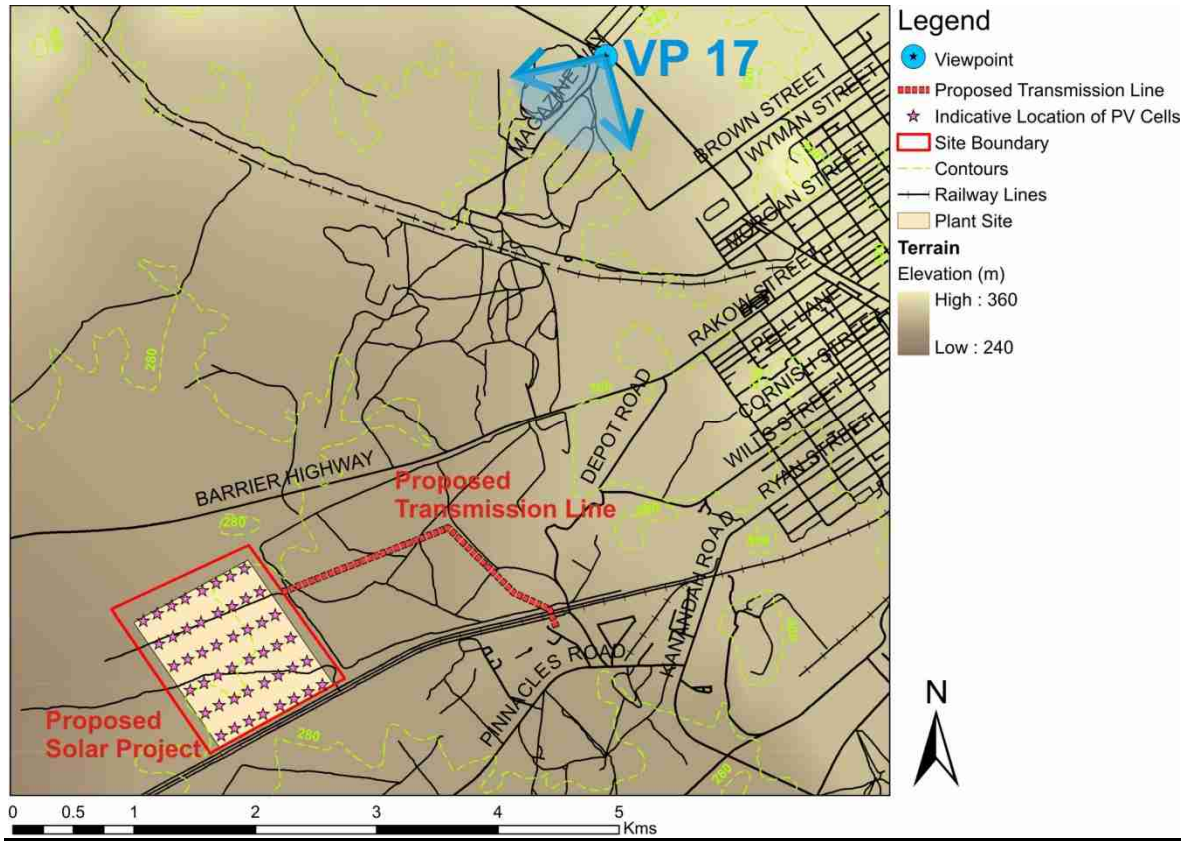


View north toward Broken Hill Township

Landscape Type (s)	Residential, Industrial, Pastoral and	*Sensitivity*	Low to High

	The Pinnacles		
Exposure	High		
Description	A widely promoted lookout within Broken Hill. Views take in Broken Hill Township, train station, rail yards, water tanks, transmission lines and other infrastructure.		
Comments	The proposed development would appear between The Pinnacles and the water tanks in the far distance. The solar project and transmission line would be hard to discern from this distance.		
Overall Visual Impact			
Solar Project	Negligible, due to distance and presence of manmade modifications (predominantly low landscape sensitivity).		
Transmission line	Negligible, due to distance and presence of manmade modifications (predominantly low landscape sensitivity).		

Viewpoint 17 – Silverton Road #1



Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Intersection of Silverton Road and Magazine Way	E 540031 N 6465784 Alt 313 m	5,010 m (Solar Project) 4,111 m (Trans Line)	Southwest to southeast

View southwest

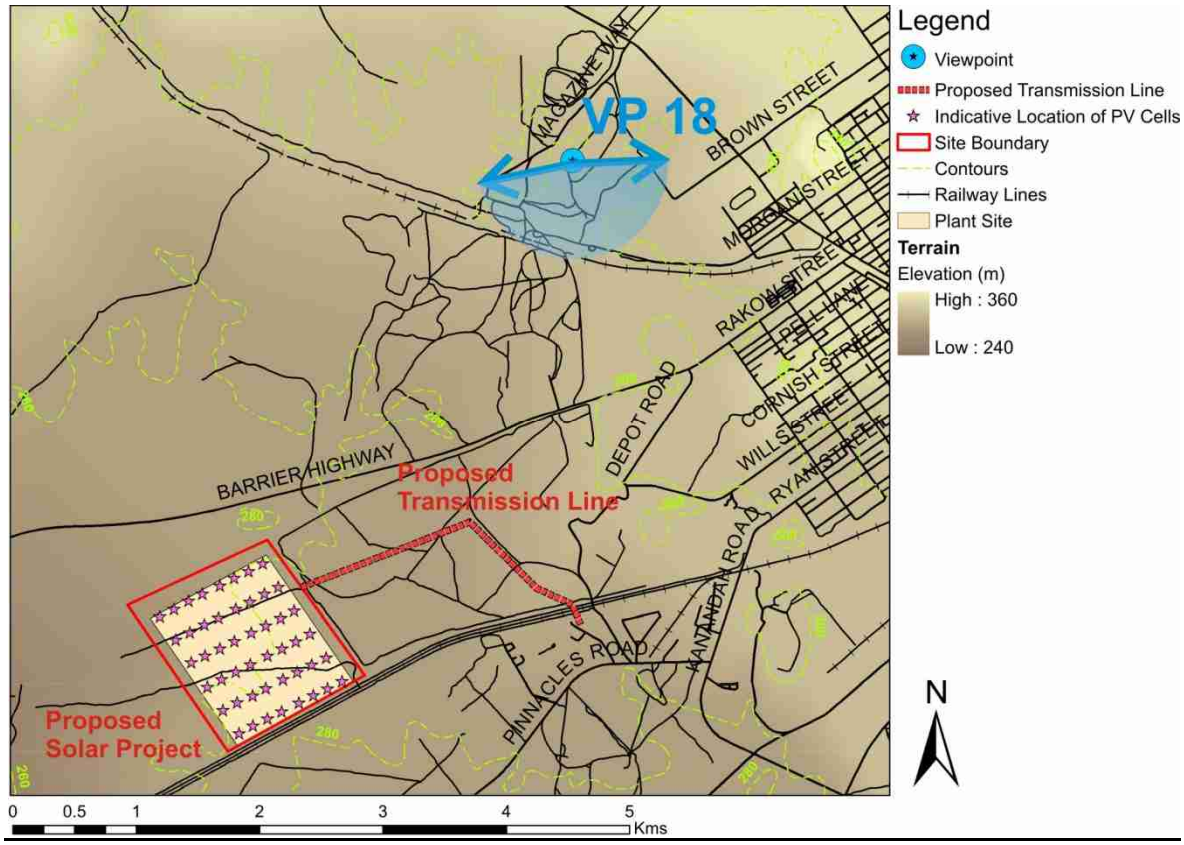
Enlargement

View north

Landscape Type (s)	Pastoral and Pinnacles	*Sensitivity*	Low to High
Exposure	High		
Description	Views toward the site take in farming sheds, fencelines tracks and The Pinnacles in the distance.		

Comments	The Solar project would be discernible as a dark band to the left of The Pinnacles. View of the site residence in line with The Pinnacles. This location is one of few along Silverton Road with breaks in roadside vegetation allowing such views. The transmission line would be barely discernible from this distance. The residence on the eastern side of the road would not have views toward the solar project owing to the roadside vegetation.
Overall Visual Impact	
Solar Project	Medium, due to distance away and presence of other structures (medium landscape sensitivity).
Transmission line	Negligible, due to distance away and presence of intervening vegetation.

Viewpoint 18 – Magazine Way



Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Side track off Magazine Way	E 539566 N 6464828 Alt 300 m	3,957 m (Solar Project) 3,062 m (Trans Line)	Southwest to southeast

View southwest

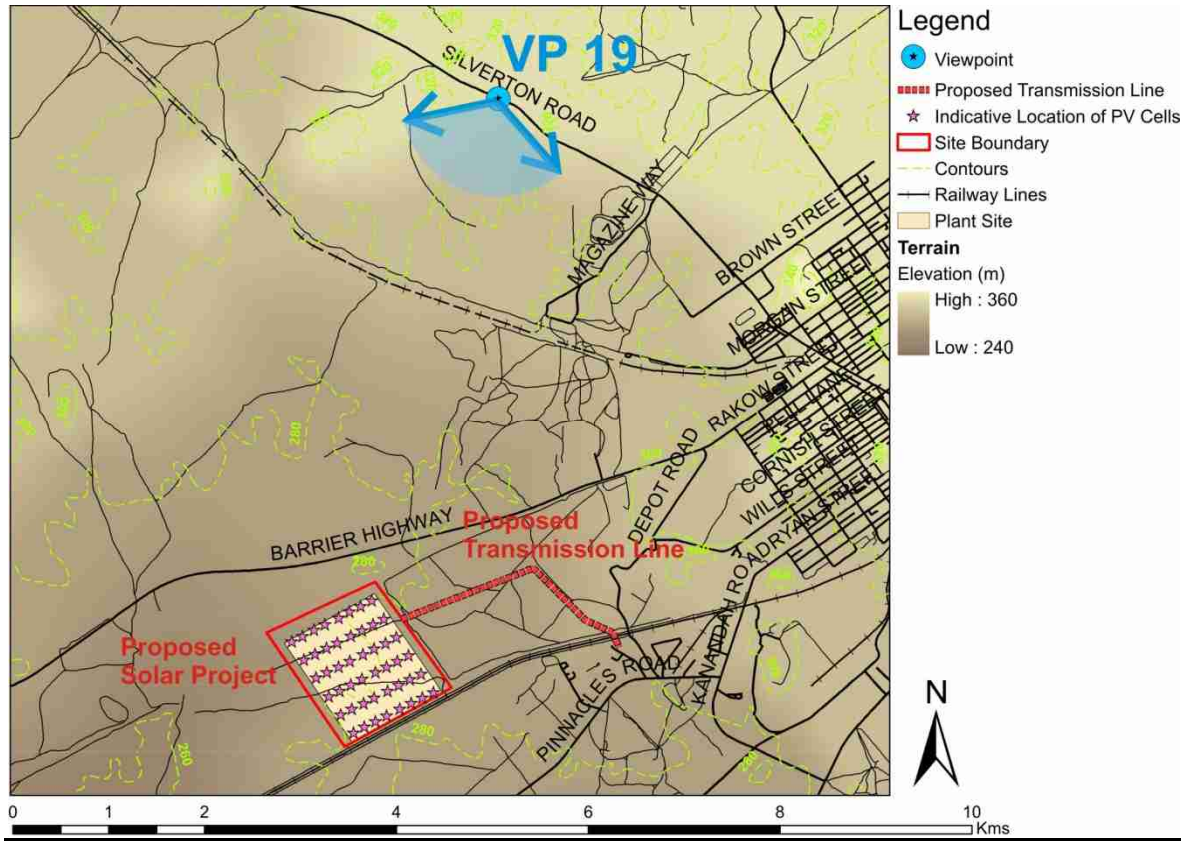
Enlarged view toward site

View southeast

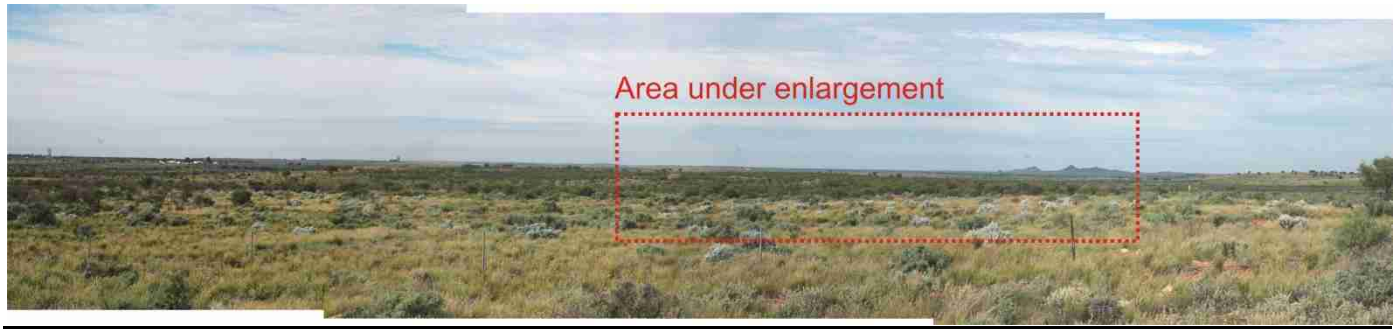
View of farm sheds immediately adjacent to this location.

Landscape Type (s)	Pastoral and The Pinnacles	*Sensitivity*	Low to High
Exposure	Low		
Description	This view is from a little used track running from Silverton Road. It may however, potentially be developed in future to accommodate urban growth. The Pinnacles are a prominent visual element in this view.		
Comments	The solar project would appear directly beneath the Pinnacles, however there will be few visitors to observe the change in the landscape. The transmission line would be visually integrate with the numerous vertical elements in the distance and would be difficult to discern.		
Overall Visual Impact			
Solar Project	Medium, due to distance, high landscape sensitivity but low exposure.		
Transmission line	Negligible, due to distance and presence of existing transmission line on horizon.		

Viewpoint 19 – Silverton Road #2



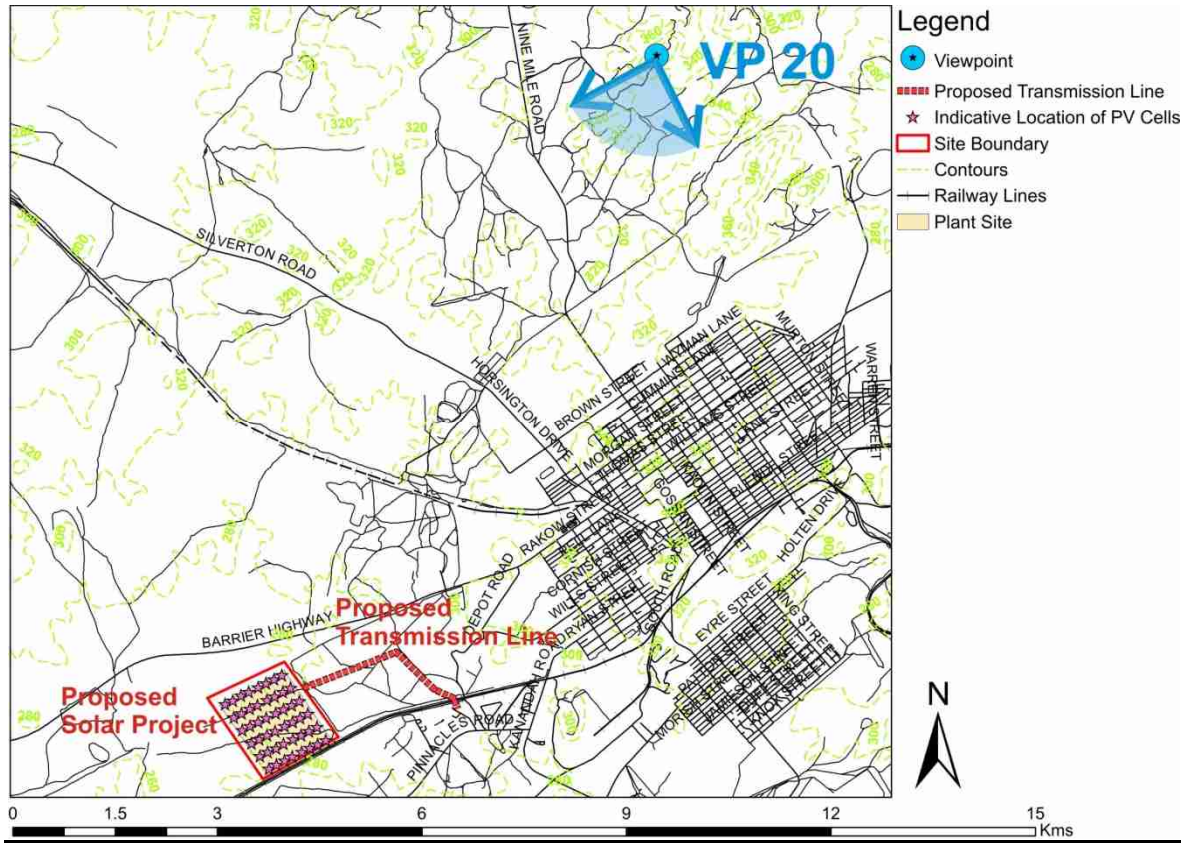
Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Silverton Road north of site	E 538373 N 6466786 Alt 320 m	5,189 m (Solar Project) 4,902 m (Trans Line)	Southwest to southeast



View southwest toward project site

Landscape Type (s)	Pastoral and The Pinnacles	*Sensitivity*	Low to High
Exposure	High		
Description	This view along Silverton road offers elevated views across the gently undulating pastoral landscape toward the project site.		
Comments	The Solar plant would be visible, however it will not be in direct line of sight of The Pinnacles. There is little evidence of manmade modifications viewable from this location however. The transmission line would be hard to discern from this location.		
Overall Visual Impact			
Solar Project	Medium, due to distance and not being in direct line of sight of The Pinnacles.		
Transmission line	Negligible, due to distance and presence of existing transmission lines on horizon.		

Viewpoint 20 – Sculpture Symposium Lookout



Location	*Coordinates (Z 54)*	*Distance from site*	*View Direction*
Sculpture Garden near Nine Mile Road Lookout at Sculpture Symposium in the Living Desert	E 542551 N 6470634 Alt 380 m	10,438 m (Solar Project) 9,553 m (Trans Line)	Southwest to southeast

View southwest (taken with 100mm telephoto lens)

Enlarged view

Landscape Type (s)	Pastoral and The Pinnacles	*Sensitivity*	Low to High
Exposure	High		
Description	This is a highly promoted vantage point for views across the landscape surrounding Broken Hill. 180 degree views take in Broken Hill Township, mining activity, Barrier ranges and surrounding plains. The Pinnacles and the mineral separation plant are also observable.		
Comments	The photographs were taken with a 100mm telephoto lens. The solar project may just be discernible in the far distance but would only be seen in one direction whereas the visual experience covers 180 degrees. It would therefore not greatly change the visual experience from this vantage point. The transmission lines would be difficult to detect.		
Overall Visual Impact			

Solar Project	Negligible, due to distance away.
Transmission line	Negligible, due to distance away.

5.3 Summary of Assessment

The viewpoint analysis has revealed that generally, the solar project would have a low or negligible visual impact. The only area where it would have a high impact is along the Barrier Highway viewing southwest toward The Pinnacles. A medium impact has been assigned to locations along Silverton Road and Magazine Way which offer similar views of the Pinnacles. The transmission line would have a very low visual signature especially for locations beyond 1km away. In many cases it will visually integrate with many other transmission lines which exist in the area. A summary of visual impacts is given in the following table:

Viewpoint	Location	Visual Impact	
		Solar Project	Transmission Line
1	Barrier Highway #1	Low	Negligible
2	Barrier Highway #2	Low to Positive	Low
3	Barrier Highway #3	Low to Positive	Low
4	Barrier Highway #4	High	Low
5	Barrier Highway #5	Low	Low
6	Creedon Street	Nil	Nil
7	Lunam Street	Low	Negligible
8	Kanandah Road	Nil	Nil
9	Pinnacles Place	Nil	Negligible

10	Railway Line #1	Low to Positive	Low
11	Railway Line #2	Low to positive	Low
12	Pinnacles Road	Nil	Negligible
13	Silver City Highway #1	Nil	Negligible
14	Silver City Highway #2	Nil	Negligible
15	Wentworth Road	Nil	Nil
16	Line of Lode Lookout	Negligible	Negligible
17	Silverton Road #1	Medium	Negligible
18	Magazine Way	Medium	Negligible
19	Silverton Road #2	Medium	Negligible
20	Sculpture Symposium Lookout	Negligible	Negligible