APPENDIX F VISUAL IMPACT ASSESSMENT

First Solar.

Visual Impact Assessment

BERYL SOLAR FARM

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1 INTRODUCTION

NGH Environmental completed a Visual Impact Assessment of the proposed Beryl Solar Farm, proposed to be located approximately 4 kilometres (km) south of Beryl in central eastern New South Wales (refer Appendix A.1, regional location). This report has been prepared on behalf of the proponent, First Solar Pty Ltd, to assess the potential visual impacts of the proposed solar array and electrical transmission infrastructure.

As visual amenity values and visual impacts can be subjective, the assessment includes a transparent, systematic evaluation with reference to existing guidelines, to address subjectivity as much as possible.

1.1 PROJECT OVERVIEW

The Beryl Solar Farm would be a commercial scale solar photovoltaic (PV) plant which would produce up to 70 megavolt-ampere (MVA) of electricity. It would be connected directly to the Beryl substation located adjacent to the northern boundary of proposed solar farm site.

First Solar (Australia) Pty Ltd proposes to develop approximately 206ha of the 332ha proposal site (refer to Appendix A.2). The Beryl Solar Farm would include the following elements:

- PV modules mounted on either a horizontal tracking structure (likely) or fixed structure.
- Internal inverter stations to allow conversion of DC module output to AC electricity, with associated transformers.
- Onsite solar farm substation (smaller than the existing Beryl Substation).
- Overhead electricity transmission for grid connection to the adjacent existing substation (66kV).
- Underground electrical conduits and cabling to connect the inverters to the onsite substation.
- Underground and aboveground (mounted to module structure) DC cabling to connect the modules to the inverter stations.
- An access road off Beryl Road.
- Site office and maintenance building.
- Internal access tracks to allow for site maintenance.
- Perimeter security fencing.
- Native vegetation screening, where required to break up views of infrastructure to specific receivers.

During the construction period some additional temporary facilities would be located within the site boundary and may include:

- Material laydown areas.
- Temporary construction site offices.
- Temporary car and bus parking areas for construction workers transportation. Once the plant has been commissioned a small car park would remain for the minimal staff required and occasional visitors.

Environmental assessment in accordance with Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is required for the proposed solar farm. The Secretary's Environmental Assessment Requirements (SEARs), provided by NSW Department of Planning and Environment (DPE) on 9 December 2014, specify the impacts to be considered in the environmental assessment, including visual impacts.

1.2 SITE LOCATION

The proposed solar farm site is located approximately 4km south of the Beryl locality and 6km north-west of the town of Gulgong (refer Appendix A.1). Beryl is a small rural locality, accessed from the Castlereagh Highway in the Mid-Western Regional Local Government Area (LGA). The Mid-Western Regional LGA is located in eastern NSW approximately 300km from Sydney. Nearby towns in the area include Gulgong (6km), Mudgee (45km), Rylstone (94km) and Kandos (115km). The Castlereagh Highway is an important regional transport corridor near to the site.

The proposed Beryl Solar Farm location is on the edge of a rural residential area, in an area of moderate scenic quality and in close proximity (<1km) of some residences; 31 residences have been counted from aerial imagery within 1 km, including 5 rural residential locations, and 69 residences have been counted within 5km, including 2 urban and 6 rural residential locations[1].

1.3 OBJECTIVES OF THIS REPORT

This Visual Impact Assessment includes a full assessment of the visual impacts associated with the proposed Beryl Solar Farm. Specifically, it includes an assessment of:

- Landscape character and scenic vistas in the locality.
- Stakeholder values regarding visual amenity.
- Potential impacts on representative viewpoints, including residences and road corridors.

This report addresses the SEARs for the proposed Beryl Solar Farm, dated 25 January 2017, which require:

> *An assessment of the likely visual impacts of the development (including any glare, reflectivity and night lighting) on surrounding residences, scenic or significant vistas, air traffic and road corridors in the public domain, including a draft landscaping plan for on-site perimeter planting, with evidence it has been developed in consultation with affected landowners.*

Specifically, this report includes:

- An assessment of the potential visual impacts of reflectivity and glare (Section 4).
- An evaluation and discussion of potential visual impacts (Section 5.2). The evaluation uses representative viewpoints of residences and view corridors.
- A discussion of significant vistas in the locality (Section 3.3), with reference to community values and perceptions.
- A draft landscaping plan (mitigation measures in Section 6).

Air traffic is not considered in this report but it is noted that, as discussed in Section 4, glare and reflectivity are not considered an impact for air craft.

[1] Error can occur, with small houses and sheds being incorrectly counted.

1.4 TERMINOLOGY

Terminology used in this report includes:

Study area	Defined as within 16km of the proposed solar farm site.
Solar farm site / site	The lot boundaries within which the solar farm development is proposed, excluding offsite infrastructure such as transmission lines and connections.
Project	All infrastructure and activities required for the construction, operation and decommissioning of the solar farm.
Landscape Character Unit (LCU)	LCUs take into account topography, vegetation, land use, and other distinct landscape features. They are a way to categorise the existing scenic quality of the receiving environment and consider the ability of the environment to absorb visual change at the landscape scale.
Viewer sensitivity	Viewer sensitivity is subject but can be assumed based on factors such as whether the view relates to recreational or work environments, or whether the view is experienced continuously or intermittently.
Landscape Management Zone (LMZ)	LMZs are derived by combining scenic quality with viewer sensitivity and proximity to the proposed infrastructure at the landscape scale. A three-tiered management hierarchy sets out appropriate management objectives for each zone.
Zone of Visual Influence (ZVI)	ZVI modelling uses GIS modelling and topography to determine areas which would be shielded from views of infrastructure at the proposed solar site. It does not take into account other existing or proposed screening features such as vegetation or built structures.

2 METHODOLOGY

2.1 OVERVIEW

The Visual Impact Assessment has been completed in the following stages:

1. Background investigations, mapping and modelling.
2. Field survey including reconnaissance, ground truthing and photography.
3. Community consultation.
4. Impact assessment.
5. Development of a visual impact mitigation strategy.

These methods are detailed below.

2.2 BACKGROUND INVESTIGATIONS, MAPPING AND MODELLING

Background investigations included identifying key landscape features within the landscape that may be affected by the visual impacts of the proposed solar farm. This was done using existing literature and aerial photos.

Mapping and modelling were undertaken to:

- Identify and classify LCUs within 16km of the proposed solar farm. This was done based on aerial imagery and later validated with field inspection. LCUs are a way to summarise differences in landscape amenity and the sensitivity of different areas within the landscape to visual impacts.
- Define areas in which the infrastructure may be visible, using ZVI modelling. A map identifying the ZVI (or viewshed) of the proposed solar farm was produced. This method uses topographic information to determine areas in which views of infrastructure may be visible. The infrastructure was modelled as a 3m high rectangular block, equivalent to the project boundaries. Topography was based on a 25m resolution Digital Elevation Model (DEM) derived from 25m contours. Modelling does not take into account screening that may be provided by existing vegetation or structures.
- Identify key viewpoints such as major travel routes, public recreation areas, potential receivers (dwellings and other structures), and built up areas. This step excluded areas deemed not to be visible from the ZVI modelling.
- Understand the feasibility of screening to mitigate visual impacts.

The results were used to inform the field survey.

2.3 FIELD SURVEY

With reference to the mapping and modelling, field reconnaissance and ground truthing was undertaken to:

- Verify and document the existing LCUs in the study area (16km).
- Identify representative viewpoints within the LCUs, including foreground, middle ground and background viewpoints.
- Understand the likely sensitivity of the LCUs to views of the proposed solar farm.

Fieldwork consisted of driving along publicly accessible roads, investigating and documenting dominant visual character elements and potential views to the proposed infrastructure. Photographs were taken at representative locations. No residences were specifically targeted however, nearby roadside viewpoints have been tagged 'residential' where they occur near a residence.

Fore ground representative view point locations are provided in Appendix A.3. All representative viewpoints are shown in Appendix B.

The property involved in the project is not represented by a specific viewpoint. Impacts on involved residences are not considered in this assessment.

2.4 COMMUNITY CONSULTATION

Community consultation specific to this assessment of visual impacts was required to:

- Understand how the community values existing visual amenity in the study area.
- Document the perceptions of the community to the proposed development.

Community consultation is being undertaken as part of the Development Application process, in accordance with a Community Consultation Plan. As part of the plan, respondents are being surveyed on their views regarding solar farm development and local visual amenity. The feedback form questions are included in Appendix C. The results are used in the impact assessment and are summarised in Section 3.4.2.

2.5 IMPACT ASSESSMENT

The impact assessment methodology used in this Visual Impact Assessment is based on the Bureau of Land Management (BLM) Visual Resource Management System, developed by the BLM, US Department of the Interior (n.d). The BLM developed a systematic process to analyse the visual impact of proposed developments. The basic philosophy states that the degree to which a development affects the visual landscape depends on the visual contrast imposed by the project.

Key steps undertaken to assess the visual impact are as follows:

- Define LMZs for the representative viewpoints, based on:
    - The scenic quality of the study area's LCUs.
    - The expected sensitivity at representative viewpoints.
    - The proximity of each representative viewpoint.
- Evaluate the degree of contrast the solar farm would result in at representative viewpoints in consideration of the management objectives of the relevant LMZ.
- Determine the acceptability of the contrast with the management objectives of the relevant LMZ; this is the resultant visual impact, rated as high, medium or low.

Criteria for scenic quality, sensitivity, proximity, contrast and visual impact are included in the assessment, in Section 5.

Mitigation measures are considered for 'high impact' receivers, for whom unmitigated impacts are considered greater than what is acceptable. For 'medium impact' receivers, the contrast is considered acceptable. For 'low impact' receivers, the contrast is considered unlikely to be perceived or acceptable.

3 EXISTING ENVIRONMENT

3.1 BERYL LOCALITY

Beryl is a small rural locality approximately 9km north-west of Gulgong. The proposed solar farm is approximately 4km south of Beryl. The locality of Beryl is accessed from the Castlereagh Highway. Several houses, three businesses, a quarry and additional working farms are located in the locality. No shops or other services are located in Beryl.

The visual outlook around Beryl is typical of many places of rural NSW. It is characterised by mainly cleared low land areas, dissected by creeks and rivers, where riparian corridors are largely retained. Surrounding forested hills and ranges rise up to contain the low lands, occurring as disconnected remnants to the north, west and south.

The Beryl locality's visual landscape is dominated by large parcels of cleared agricultural land with scattered trees; extensive grazing of horses and cattle is the predominant agricultural activity. Large lot rural residences as well as clusters of smaller lot residential subdivisions occur. Sheds, tanks and farm machinery contribute to the rural character. House and garden plantings around houses contribute to the residential character. The proposed solar farm site is currently worked agricultural land (grazing).

There was no data available from the Australian Bureau of Statistics (ABS) on population, businesses or number of dwellings in the Beryl locality, although approximately 31 residences are located within 1km of the proposed solar farm site. Appendix A.3, B.1 and B.2 show the location of the nearest residences to the proposed solar farm site.

3.2 GULGONG

The residential outskirts of Gulgong are less than 3km from the proposed solar farm site boundaries.

Gulgong has a population of approximately 1,900 people. The population of Gulgong was 2,383 in the 2011 Census (ABS 2011). The main employment source in Gulgong is coal mining at 16.6% (ABS 2011). The second highest source is education at 6.6%, supermarket and grocery stores 4.2% and sheep, beef cattle and grain farming at 3.3% (ABS 2011). The median weekly income for residents of Gulgong was 40% less than the Australian average in 2011 (ABS 2011).

Services in Gulgong include banks, supermarkets, post office, real estate, trades people, machinery and farming services, accommodation, cafes and restaurants, fire station (Gulgong Chamber of Commerce 2016).

Gulgong's main streets have a consistent historic character. Retail and residential building colours, materials and design reflect this. Narrow streets and well maintained street landscaping contribute to this effect. The Henry Lawson Centre, Centennial Hotel, Commercial Hotel and numerous retail shops and services are located in the town centre, the majority are the original buildings. There are currently 130 buildings, within the town of Gulgong, listed under National Trust classification, many still have the original verandas and iron-lace balconies (Destinations NSW 2016).

Today the town is renowned for its arts and crafts and is world famous for its clay/pottery (Mid-Western Regional Council 2015, Destinations NSW 2016). There is an abundance of community and sporting facilities and clubs in Gulgong including RSL Club, Youth Council, branch library, Billy Dunn Oval, Victoria Oval, Turf Club and Golf club (Destinations NSW 2016). Education facilities include the Gulgong Pre-school, Gulgong

Public School, Gulgong High School, All Hallows Catholic Primary School and the Red Hill Environmental Centre (Service NSW 2016).

3.3 SIGNIFICANT VISTAS

The Beryl locality contains no look outs, promoted scenic areas or formalised recreational infrastructure however, notable features that are likely to be valued for their visual character include:

- Views of the surrounding forested ranges and hill tops, hemming in the fertile alluvial landscape; occurring as disconnected remnants to the north, west and south of the proposed solar farm site, between 1 and 8km from the proposed solar farm site.
- Riparian corridors such as Wialdra Creek and Cudgegong River, including timber truss bridges and providing river access in a number of locations.
- Yarrobil National Park, accessed off Spring Ridge Road. The Yarrobil National Park is approximately 8km from the site. This National Park covers an area of 1846 ha and is an important part of the river catchment systems in the area (OEH 2014).
- The historic property of Guntawang, including race track and stables, accessed off Goolma Road, approximately 3km from the proposed solar farm site. The 280 ha property specialises in the natural rearing of thoroughbred horses.

Refer to Figure 3-6. Nearby, Gulgong's historic township offers:

- Formalised parks and lookout areas (including Flirtation Hill, which looks in the direction of the proposed solar farm site).
- Historic buildings.
- Scenic residential areas.

Figure 3-1 Scenic vistas in the study area

Left to right from top: Views of the surrounding forested ranges and hill tops, Riparian corridors and creek access, Yarrobil National Park, Guntawang property (source: Gutawang 2016), Gulgong's historic township.

3.4 COMMUNITY VALUES

3.4.1 General attitudes to solar infrastructure

A high percentage (77%) of Australian's believe that large scale solar farms could supply a significant source of Australia's energy requirements (IPSOS 2015). Attitudes in Australia are greatly divided about the visual impacts of large scale solar farms; 30% agree and 26% disagree that large-scale wind farms have a negative visual impact (IPSOS 2015). The large scale solar energy sector is still at a relatively early stage of development in Australia, however. While most members of the community are aware of large scale solar energy, many do not know a great deal about their impacts (IPSOS 2015), including visual impacts.

Three approaches to improving community understanding of the visual impacts of large scale installations include:

- Provision of images (from many angles) of large scale solar facilities, particularly in the early stages of a proposal.
- Understanding the similarities between highly supported domestic scale installations and large scale facilities.
- Understanding the current function of the land proposed to hold the facility and the additional value the installation allows for.

(Source: extracted from IPSOS 2015).

This report endeavours to address these issues.

3.4.2 Values of the local community

Community consultation undertaken to inform the assessment and design of the proposal is summarised in Section 5.5 of this EIS. Comments relevant the community's perception about solar farms and visual values have been included below.

- Surrounding landowners are generally supportive of the project.
- Residents in the locality were generally supportive and showed interest in the consultation process.
- One resident raised concerns regarding the impacts of glare and heat of the proposal on his property.
- Visual screening as a means to minimise views of infrastructure was discussed at the open house event.
- One resident raised concerns regarding the potential impact to the value of adjacent land (currently used for grazing and cropping).

Important local values to the respondents of the feedback forms included:

- To be living in a close community
- Country lifestyle
- The peace and quiet.

The visual landscape values considered important to respondents included:

- The farming landscape
- Views of elements including trees, sky, hills, large paddocks and cattle.

One of the concerns raised by members of the community was potential for visual impacts.

3.5 LANDSCAPE CHARACTER UNITS

LCUs take into account topography, vegetation, land use, and other distinct landscape features. They are a way to summarise differences in the receiving environment that may affect the visual impact of the proposed solar farm at different locations.

Four key LCUs were identified within 16km of the proposed solar farm site:

- Agricultural (most commonly, grazing lands).
- Native vegetation remnants (includes roadside corridors, riparian areas and surrounding ranges).
- Rural residential (mostly large RU1 Primary Production lots but including some smaller R5 Village lots to the north and west of the site).
- Urban (Gulgong town centre and residential areas).

The scenic quality was rated in each LCU as follows:

- A high scenic quality rating describes areas with outstanding, unusual or diverse features.
- A moderate scenic quality rating applies to areas with the features and variety normally present in the character type.
- A low scenic quality rating is given for areas lacking features and variety.

The four LCUs identified within 16km of the proposed solar farm site are characterised in Table 3-1 in terms of their scenic quality and illustrated in the following plates.

Table 3-1 Landscape Character Units within 16km of the Beryl Solar Farm

Landscape Character Unit	Key visual features and scenic quality
Agricultural	**Visual features** The pastures with scattered trees are of low relief to undulating, dissected by riparian and road side remnants, bounded by surrounding hills and ranges. Pastures are brilliant green through beige and brown with the season, limited cropping occurs in the locality. Irrigation from the waterways and the fertile alluvial soils produce a lush looking landscape. Scattered trees are often very mature with thick grey brown trunks and forest green to olive foliage. The colour of surrounding ranges would change during the day from grey-green to deeper grey-blue-green. The provide a strong visual contrast to the low relief pastures. Unsealed roads and bare paddocks are light beige-orange-salmon. Most local roads are however, sealed. Local roads, and even Castlereagh Highway, have frequent minor bends. This produces relatively short sight lines and frequently changing rural views. Small rises and remnant vegetation increase this effect.

Landscape Character Unit	Key visual features and scenic quality
	In contrast, long straight sections of electricity transmission line along roadsides and through paddocks produce a repeated linear element. They approximate the height of local eucalypts at about 20m. Residences within this landscape are sparsely distributed and commonly associated with additional landscape plantings. Some higher density areas occur to the immediate south-east of the solar site and to the immediate north (south of the Wialdra Creek). Property gates are often sign posted with property names and tree lined avenues on private access roads. Other infrastructure includes sheds, farm machinery and low open fences. **Scenic quality** Scenic quality is moderate. Natural landscape elements (ranges and alluvial flats) have visually pleasing elements and contrast. View locations are varied, given the short sightlines and framing influence of local topography and remnant vegetation. However, built elements are clearly production related and include low density supporting infrastructure; linear fences, powerlines, roads and agricultural buildings and rural houses. This LCU is common in the study area, but has features and variety. The proposed solar farm site is located within this LCU, but is on the edge of the rural residential LCU.
Native vegetation remnants	**Visual features** Remnant native vegetation, occurring along roadsides such as Annie's Rock Road, and extending to riparian corridors such as Wialdra Creek and Cudgegong River, and into surrounding ranges and hill tops, acts to break up views of pastures and other agricultural features. The river corridors particularly, snake through the lower landscape, limiting view extent in many parts of the landscape. The pattern is low and curving, contrasting with straighter road sections, fences and transmission lines. The vegetation is usually lacking midstorey and often mature and gnarled appearance. Due to the height of trees in these remnant (approximately 15-22m), viewed at distance from an elevated position, the landscape appears more vegetated than it is, with light green pasture patches visible through the dense dark greens of the taller woodland remnants. **Scenic quality** Scenic quality is low. Forms are generally uniform, lacking variety, but are organic rather than straight, and of low elevation and provide a pleasing visual contrast to the agricultural LCU. Colour variation is low. The extent of the remnants acts to reduce sight lines and view extent, framing shorter duration views. This LCU is common in the study area.
Rural residential	**Visual features** Rural residential allotments are mostly large RU1 Primary Production lots but including some smaller R5 Village lots to the north and west of the site. In these areas, the modified gardens, tree lines entrances, farm dams, residences and associated domestic and rural buildings dominate the surrounding agricultural scenic character. Built forms are varied. Roofs, cladding, water tanks and sheds are not consistent but reds, greys, browns and greens predominate. Vehicles, yards and gardens produce a residential character. These areas are often separated from the surrounding expansive

Landscape Character Unit	Key visual features and scenic quality
	agricultural areas with rectilinear fencing, creating small boxed in allotments within the broader landscape. Streets and access roads are usually unsealed and feature vegetation, either native remnants or planted feature trees or avenues. **Scenic quality** Scenic quality is considered moderate. These areas have variety in colour and form. Built elements and landscaping contribute to the character type. This LCU is not common in the study area.
Urban	**Visual features** Gulgong's main streets have a consistent historic character. Retail and residential building colours, materials and design are sympathy with the settlement period: red brick, cream and ochre timber, red, green and white details, red and green iron rooves. Residential and commercial frontages feature well maintained gardens, often prolifically flowering, as well as period character fences. Abundant street and yard trees area present in the town. Views to the surrounding ranges are sometimes visible through long tree lines streets. Streets are sealed and often incorporate curbing and footpaths. The linear form is broken up in some sections by bends in road, particularly the very narrow main street. **Scenic quality** Scenic quality is considered high. These areas have variety in colour and form. They contribute to a unique historic character type. Elements include recreational aspects; parks and gardens. The character is important in defining the town and contributes to its local economy. This LCU is not common in the study area.

Agricultural LCU plates








Native vegetation remnants LCU plates








Rural residential LCU plates

Urban LCU plates








3.6 VIEWPOINT SENSITIVITY

3.6.1 Identifying viewpoints

The BLM methodology requires identification of representative viewpoints in the study area. These may be travel routes such as roads, waterways and recreational tracks, residential areas, tourist facilities, houses and farmland.

The ZVI modelling produced a set of maps that estimated the areas that would be shielded from views of infrastructure at the proposed solar farm site, based on topography (Appendix B). A height of 3m was used to model onsite infrastructure. This is realistic approximation of the height of panels and PV containers, which may actually be 2.3m and 3.4m, respectively. Viewpoints were not selected in areas predicted to be shielded from views of the solar farm. Twenty-two representative viewpoints were identified within the ZVI and are mapped in Appendix B.

3.6.2 Rating proximity and assessing sensitivity of viewpoints

The predicted sensitivity of each viewpoint can be determined, considering its proximity to the proposed solar farm site and factors such as use, scenic quality and regional significance.

Criteria for proximity are as follows:

- Foreground 0 – 1 kilometres
- Middle ground 1 – 5 kilometres
- Background 5 – 16 kilometres

Criteria for sensitivity are as follows:

- High sensitivity:
  - high use routes or areas, or
  - routes or areas of national or state significance, or
  - areas with high scenic quality
- Moderate sensitivity:
  - moderate use routes or areas, or
  - routes or areas of regional or local significance, or
  - areas with moderate scenic quality
- Low sensitivity:
  - low use routes or areas, or
  - routes or areas of low local significance, or
  - areas with low scenic quality

Sensitivity also considers view duration; for access roads and working farms this would be less than for residential and recreational areas.

Considering the sensitivity of local viewpoints, the following assessments were made:

- Generally, within the Agricultural LCU, whether viewed from pastures, roadside or residences, these viewpoints were assessed to be of low sensitivity. These are low use roads in a production dominated landscape. View extents are often limited or broken up by existing native vegetation remnants and house plantings. Sensitivity to contrast is expected to be low. The exception to this may be elevated residences that are oriented to take in the pastoral view.
- Where viewpoints within the Native vegetation remnants LCU have a recreational component, such as creek access or lookouts, or where residences occur, a moderate sensitivity has been assigned. In other areas, these are considered low sensitivity, reflecting low use and a low level of 'uniqueness'. Further, view extents are often limited or broken up by existing native vegetation in these areas.
- Generally, rural residential viewpoints have been assigned a moderate sensitivity. In areas, a village character is developing and they are considered to have some local significance.
- Residential and recreational viewpoints in urban areas were assigned high sensitivity. These are located in high use areas and the unique historic character of the Gulgong township has local significance.

The sensitivity of each viewpoint is tabulated below. The location of each viewpoint is shown in Appendix B.

Table 3-2 Representative viewpoints and assessed proximity, scenic quality and sensitivity

ID	LCU	View location	Proximity	Scenic quality	Sensitivity
1	Agricultural	Road	Foreground	Moderate	Low
2	Agricultural	Residential	Middle ground	Moderate	Low
3	Agricultural	Road	Foreground	Moderate	Low
4	Agricultural	Residential	Middle ground	Moderate	Low
5	Agricultural	Road	Middle ground	Moderate	Low
6	Agricultural	Road	Middle ground	Moderate	Low
7	Agricultural	Road	Middle ground	Moderate	Low
8	Remnant	Creek	Foreground	Low	Moderate
9	Remnant	Residential	Middle ground	Low	Moderate
10	Remnant	Road	Foreground	Low	Low
11	Remnant	Road	Foreground	Low	Low
12	Remnant	Road	Foreground	Low	Low
13	Remnant	Road	Middle ground	Low	Low
14	Remnant	Recreation	Middle ground	Low	Moderate
15	Rural residential	Road	Foreground	Moderate	Moderate
16	Rural residential	Residential	Middle ground	Moderate	Moderate
17	Rural residential	Residential	Foreground	Moderate	Moderate
18	Rural residential	Residential	Foreground	Moderate	Moderate
19	Rural residential	Residential	Foreground	Moderate	Moderate
20	Rural residential	Road	Foreground	Moderate	Moderate
21	Urban	Recreational	Middle ground	High	High
22	Urban	Residential	Middle ground	High	High

4 VISUAL CHARACTERISTICS OF KEY INFRASTRUCTURE COMPONENTS

The key infrastructure components of the proposed Beryl Solar Farm, with reference to the stage of the project and the potential visual amenity impacts they may generate are discussed below and referenced in the visual impact assessment, Section 5.

4.1 INFRASTRUCTURE COMPONENTS

The key infrastructure for proposal would include:

- PV modules mounted on either a horizontal tracking structure (likely) or fixed structure.
- Internal inverter stations to allow conversion of DC module output to AC electricity, with associated transformers.
- Onsite solar farm substation (smaller than the existing Beryl Substation).
- Overhead electricity transmission for grid connection to the adjacent existing substation (66kV).
- Underground electrical conduits and cabling to connect the inverters to the onsite substation.
- Underground and aboveground (mounted to module structure) DC cabling to connect the modules to the inverter stations.
- An access road off Beryl Road.
- Site office and maintenance building.
- Internal access tracks to allow for site maintenance.
- Perimeter security fencing.
- Native vegetation screening, where required to break up views of infrastructure to specific receivers.

During the construction period some additional temporary facilities would be located within the site boundary and may include:

- Material laydown areas.
- Temporary construction site offices.
- Temporary car and bus parking areas for construction worker's transportation. Once the plant has been commissioned a small car park would remain for the minimal staff required and occasional visitors.

These components are discussed in terms of their visual impacts potential below.

4.1.1 Construction components

Construction impacts would be temporary, confined to approximately 12 months. Visual impacts could be generated during this time by:

- Establishment of construction compounds
- Potential for construction waste
- Construction traffic and equipment
- Creation of bare ground

Development of site compound areas, site offices and stock piles, located within the site boundaries, would include steel structures. These can generate reflectivity and glare although would be a similar look to existing farm sheds. Material stockpiles may detract from visual amenity, particularly if dispersed across broad areas. Laydown areas for steel posts and rails may produce reflectivity and glare.

Construction litter (such as packaging materials and food/drink packaging from onsite staff), if not controlled, could affect nearby properties.

Construction traffic would increase visual impacts and could add to dust generation on unsealed local roads. It is expected that all construction traffic would be confirmed to the sealed Beryl Road, off the Castlereagh Highway, and thereby limit impacts of construction traffic. Onsite parking areas would be visible from surrounding properties and roads including Beryl Road and Spring Ridge Road.

Equipment used during construction would include earth-moving equipment for civil works, diesel generators, trucks and cranes with similar noise outputs to farm machinery such as tractors.

Pile driving of the solar panel foundations would be undertaken using a machine which screws or hammers poles into the ground, similar to that used for driving farm fence poles into the ground.

Areas of bare soil created through grading access tracks, establishing the substation bench, trenching cables and excavation of footings for inverter stations could contribute to dust and detract from visual amenity until they are rehabilitated. The ground disturbance from pile foundations would be less than 1% (approximately 1ha) of the total site area. These areas would be visible to surrounding properties and from Beryl Road and Spring Ridge Road (and potentially the low use Perseverance Lane).

While no broad scale land levelling is proposed, it is expected that the combined effect of the onsite construction activities will have an adverse impact on the amount of ground cover, producing dust and detracting from the visual amenity of the site. Dust is manageable and maintaining ground cover beneath the panels once construction is completed is an objective of the proposal; any disturbed areas would be restored to grassed ground cover post construction.

4.1.2 Operational components

Operational impacts centre on the look of the solar farm, once construction is complete. The main visible infrastructure would be:

- The solar arrays
- Inverters
- Substation
- Access tracks
- Security fencing
- Overhead transmission line

The up 2.7m high solar modules would be installed on a single-axis tracker in rows aligned in north south arrangement (approximately 3600 tracker units). The tracker will have an estimated tracking range of 120 degrees, or +/- 60 degrees from the horizontal.

Inverters (up to forty) are most likely to be housed in containers. These metal structures would be evenly spaced across the site – approximately 12m x 2.5m x 2.9m.

An additional substation would be located adjacent to the existing Beryl substation. The excavated bench would be gravel and security fencing would be required. The area is likely to be up to 30m x 30m.

Internal solar farm access tracks would be 6m wide and constructed of compacted but unsealed gravel.

Perimeter security fencing would be required for the substation and solar array sites. The fencing would be up to 2.3m high and likely to require barbed strands near to the top.

A new overhead transmission line would be constructed over a length of approximately 300 metres from the new on site substation north to the existing TransGrid Beryl Substation. The new line would be constructed in a similar manner to the existing on site transmission lines utilising either timber or concrete poles, cross member, insulators and strung conductor.

Glare and glint

The potential for glare associated with non-concentrating photovoltaic systems which do not involve mirrors or lenses is relatively limited. PV solar panels are designed to reflect as little sunlight as possible (generally around 2% of the light received; Spaven Consulting 2011), resulting in negligible glare. The reason for this is that PV panels are designed to absorb as much solar energy as possible in order to generate the maximum amount of electricity or heat. The panels will not generally create noticeable glare compared with an existing roof or building surfaces (NSW Department of Planning 2010). Seen from above (such as from aircraft) they appear dark grey and do not cause a glare or reflectivity hazard. Solar photovoltaic farms have been installed on a number of airports around the world.

Other onsite infrastructure that may cause glare or reflections depending on the sun angle, include:

- Steel array mounting - array mounting would be steel or aluminium.
- Construction site offices, sheds.
- Containerised PV boxes.

This infrastructure would be relatively dispersed and is considered very unlikely to present a glare or reflectivity hazard to motorists or aircraft.

With the exception of the power poles, infrastructure would be of low height, up to approximately 3m. In a low relief landscape, relatively easily screened as part of the project. Examples of the look of some of the key infrastructure components are provided in Figure 4-1 below; taken from other similar projects.

a) Driven piles (these may also be screwed into the ground).

b) Operational array.

c) Containerised inverter

d) Substation

e) Internal access tracks

f) Perimeter fencing

g) Overhead 66kv transmission line – similar to existing design onsite.

Figure 4-1 Images representative of infrastructure components proposed

5 IMPACT ASSESSMENT

The visual impact assessment was undertaken considering:

- The infrastructure components, described in Section 4.
- Their potential to be viewed from representative viewpoints.
- The degree of contrast they would have within identified LMZs.

LMZs were assigned to each viewpoint and the contrast at that viewpoint was evaluated, as described below.

5.1 DEFINITION OF LANDSCAPE MANAGEMENT ZONES

Visual LMZs were assigned to each viewpoint. The zones were derived by combining scenic quality (from the LCU, Section 3.2), viewer sensitivity and the distance to the proposed solar farm site (from Section 3.3). Combined they produce a three-tiered management hierarchy: A – C, as shown in Table 5-1.

Table 5-1 Visual Landscape Management Zone decision matrix

		Proximity / sensitivity						
		Foreground High	**Middle ground High**	**Background High**	**Foreground Moderate**	**Middle ground Moderate**	**Background Moderate**	**Foreground Low**
Scenic quality	**High**	A	A	A	A	B	B	B
	Moderate	A	B	B	B	B	C	C
	Low	B	B	B	B	C	C	C

Each zone has associated objectives to guide management of visual change and to help evaluate proposed project impacts. These are shown in Table 5-2:

Table 5-2 Visual Landscape Management Zone management objectives

Management priority	Management objectives
A	Maximise retention of existing visual amenity. Landscapes are least able to absorb change. Developments may lead to a major change.
B	Maintain existing visual amenity, where possible. Protect dominant visual features. Developments may be allowed to be visually apparent.
C	Less importance for retaining existing visual amenity. Landscapes are able to absorb change. Developments may be allowed to dominate but should reflect existing forms and colours where possible.

5.2 VISUAL IMPACT ASSESSMENT AT REPRESENTATIVE VIEWPOINTS

5.2.1 Evaluation criteria

The ratings for the degree of contrast created by the proposed solar farm infrastructure for each viewpoint have the following definitions (BLM n.d.).

- High contrast: the proposed solar farm would be dominant within the landscape and generally not overlooked by the observer, the visual change would not be absorbed.
- Medium contrast: the proposed solar farm would be moderately dominant and noticed, the visual change would be partially absorbed.
- Low contrast: the proposed solar farm would be seen but would not attract attention, the visual change would be well absorbed.
- Indistinct: contrast would not be seen or would not attract attention, the visual change would be imperceptible.

For the proposed solar farm, this rating is given considering the generally low height of infrastructure, and its likely visible horizontal extent from the viewpoints. This also considers topography and intervening vegetation that may affect the proposed solar farm's visibility from the viewpoints.

To determine whether the objectives of the visual LMZs zone are met, the contrast rating for the viewpoint is compared with the relevant management objectives to give a visual impact level. The visual impact level is consequently defined as:

- High impact: contrast is greater than what is acceptable.
- Medium impact: contrast is acceptable.
- Low impact: visual contrast is little or not perceived and is acceptable.

For high impact viewpoints, mitigation must be considered.

Table 5-3 below evaluates the representative viewpoints. They are ordered in terms of highest visual impact rating. The result summary is presented in Section 5.2.2.

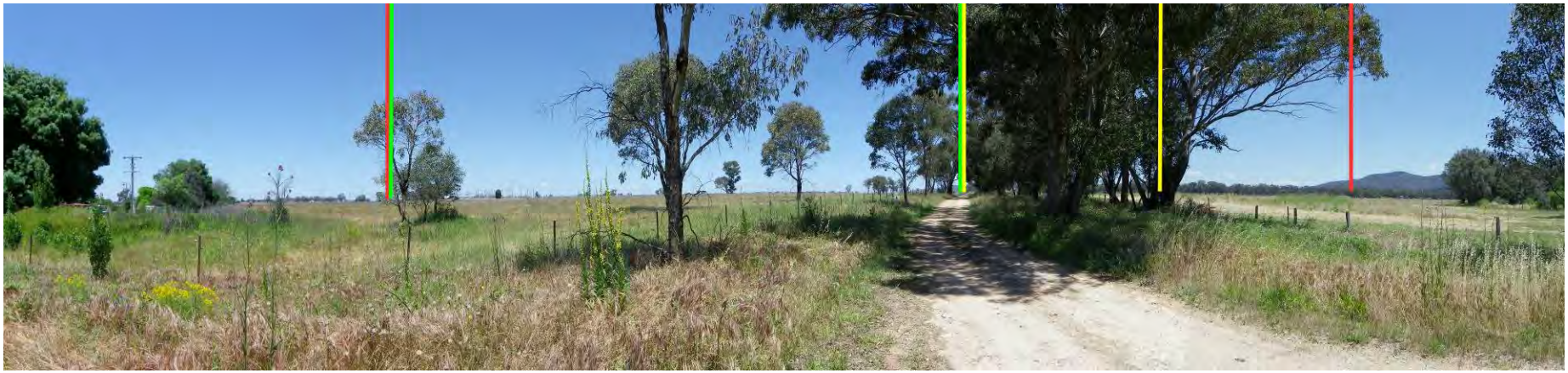
Representative photos (including panoramas for selected locations) of the existing views are provided below. The location of panoramic photos is provided in Appendix B.3. In the panoramas below, the visual extent of the 'worst case infrastructure layout'[2] is shown as follows:

- Green is the estimated visible extent of arrays, excluding shielding by trees/infrastructure: this is the extent of the array most likely to be observable.
- Yellow areas are likely to be shielded by trees/infrastructure: infrastructure in this area is unlikely to be visible.
- Red is the estimated extent of the solar farm site boundary within the view field.

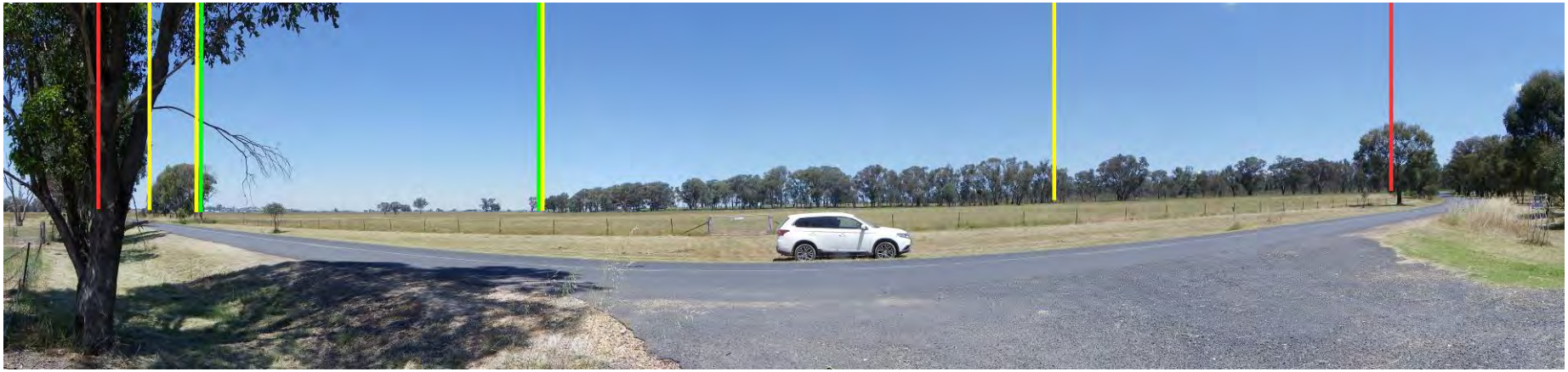
[2] This is the infrastructure footprint prior to reducing the western extent of the array. The most up to date layout is provided in Appendix A of this report however, panorama extents were based on the earlier layout and are in this case conservative; actual view extents would be less from some locations.

Table 5-3 Visual impact at representative viewpoints with reference to the Beryl Solar Farm, in order of highest impact

ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
17	Rural residential	Residential	Foreground	B Protect dominant visual features	Medium	Medium	The infrastructure would be moderately dominant from this location. The horizontal view of infrastructure would be limited due to exiting vegetation. Views would be broken up to a minor extent by existing roadside vegetation. This landscape can absorb some change but dominant visual features should be protected. The contrast of the low height solar array infrastructure is considered acceptable. **Mitigation is recommended but not required.** Additional vegetation planting on the site's northern boundary would minimise visual impacts further.



ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
18	Rural residential	Residential	Foreground	B Protect dominant visual features	Medium	Medium	The infrastructure would be moderately dominant from this location. The horizontal view of infrastructure would be limited due to the location of existing vegetation and placement of infrastructure. Views would be screened to a minor extent by existing roadside vegetation This landscape can absorb some change but dominant visual features should be protected. The contrast of the low height solar array infrastructure is considered acceptable. **Mitigation is recommended but not required.** Additional vegetation planting on the site's north-east corner would minimise visual impacts further.



ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
19	Rural residential	Residential	Foreground	B Protect dominant visual features	Medium	Medium	The infrastructure would be moderately dominant from this location. The horizontal view of infrastructure would be limited by topography and existed vegetation. Views would be screened to a minor extent by existing roadside vegetation. This landscape can absorb some change but dominant visual features should be protected. The contrast of the low height solar array infrastructure is considered acceptable. **Mitigation is recommended but not required.** Additional vegetation planting on the site's northern boundary would minimise visual impacts further.

ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
20	Rural residential	Road	Foreground	B Protect dominant visual features	Medium	Medium	The infrastructure would be moderately dominant from this location. The horizontal view of infrastructure from the closest receiver at this location (which backs onto the solar site) may be expansive. Views would be broken up to a minor extent by existing buildings and vegetation. This landscape can absorb some change but dominant visual features should be protected. The contrast of the low height solar array infrastructure is considered acceptable. **Mitigation is recommended but not required.** Additional vegetation planting on the site's northern boundary would minimise views further.

ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
1	Agricultural	Road	Foreground	C Landscapes are able to absorb change	Medium	Medium	The infrastructure would be dominant and noticed from this location. The horizontal view of infrastructure would be expansive. Views would be of short duration (by motorists and agriculturalists working in paddocks) and screened to a minor extent by existing roadside vegetation. This landscape can absorb change. The contrast is acceptable. **No mitigation required**

ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
11	Remnant	Road	Foreground	C Landscapes are able to absorb change	Medium	Medium	The infrastructure would be dominant and noticed from this location. The horizontal view of infrastructure would be expansive. Views would be of short duration (by motorists and agriculturalists working on properties) and screened to a minor extent by existing roadside vegetation. This landscape can absorb change. The contrast is acceptable. **No mitigation required**




ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
10	Remnant	Road	Foreground	C Landscapes are able to absorb change	Medium	Low	The horizontal view of infrastructure would be limited. Views would be of short duration and screened by existing roadside vegetation. This landscape can absorb change. The contrast is acceptable. **No mitigation required**
3	Agricultural	Road	Foreground	C Landscapes are able to absorb change	Medium	Low	The infrastructure would be dominant and noticed from this location. Views would be attenuated by distance. The landscape can absorb change. The contrast is acceptable. **No mitigation required**
12	Remnant	Road	Foreground	C Landscapes are able to absorb change	Medium	Low	The infrastructure would be dominant and noticed from this location. The horizontal view of infrastructure would be limited by existing vegetation. Views would be of short duration and screened to a minor extent by existing roadside vegetation. The landscape can absorb change. The contrast is acceptable. **No mitigation required**

ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
21	Urban	Recreation	Middle ground	A Landscapes are least able to absorb change.	Low	Low	The view point is a high use area where the agricultural and rural character of the locality can be viewed. It is elevated and therefore provides a greater view of the proposed solar farm. However, at this distance, the site would not attract attention. Panels would be perceived as dull grey-blue, in keeping with the dark remnant vegetation and surrounding hill sites. The contrast is acceptable. **No mitigation required**

15	Rural residential	Road	Foreground	B Protect dominant visual features	Low	Low	The infrastructure would not be dominant from this location. The horizontal view of infrastructure would be limited by existing vegetation. Views would be of short duration and screened to a minor extent by existing roadside vegetation. The contrast is acceptable. **No mitigation required**

ID	LCU	Viewpoint	Proximity	LMZ objective	Contrast	Visual impact	Comment
16	Rural residential	Residential	Middle ground	B Protect dominant visual features	Low	Low	The infrastructure would not be dominant from this location. The horizontal view of infrastructure would be limited by existing vegetation. Views, if discernible, would be of short duration and screened to a minor extent by existing roadside vegetation. The contrast is acceptable. **No mitigation required**
2	Agricultural	Residential	Middle ground	C Landscapes are able to absorb change	Low	Low	The infrastructure is unlikely to attract attention given the rise between the site and the viewpoint. Views would be attenuated by distance. The is landscape can absorb change. The contrast is acceptable. **No mitigation required**.
4	Agricultural	Residential	Middle ground	C Landscapes are able to absorb change	Indistinct	Low	The infrastructure would not be seen or discernible. The landscape can absorb change. The contrast is not perceived. **No mitigation required**
5	Agricultural	Road	Middle ground	C Landscapes are able to absorb change	Indistinct	Low	The infrastructure would not be seen or discernible. The landscape can absorb change. The contrast is not perceived. **No mitigation required**
6	Agricultural	Road (local)	Middle ground	C Landscapes are able to absorb change	Indistinct	Low	The infrastructure would not be seen or discernible. The landscape can absorb change. The contrast is not perceived. **No mitigation required**
7	Agricultural	Road	Middle ground	C Landscapes are able to absorb change	Indistinct	Low	The infrastructure would not be seen or discernible. The landscape can absorb change. The contrast is not perceived. **No mitigation required**
9	Remnant	Residential	Middle ground	C Landscapes are able to absorb change	Indistinct	Low	The infrastructure would not be discernible, through existing vegetation. The contrast is not perceived. **No mitigation required**

ID	LCU	Viewpoint	Proximity	LMZ objective		Contrast	Visual impact	Comment
13	Remnant	Road	Middle ground	C	Landscapes are able to absorb change	Indistinct	Low	The infrastructure would not be seen or discernible. The landscape can absorb change. The contrast is not perceived **No mitigation required**
22	Urban	Residential	Middle ground	A	Landscapes are least able to absorb change.	Indistinct	Low	The infrastructure would not be seen or discernible. The landscape can absorb change. The contrast is not perceived. **No mitigation required**
8	Remnant	Creek access	Foreground	B	Protect dominant visual features	Indistinct	Low	The infrastructure would not be discernible, through existing riparian vegetation. The contrast is not perceived. **No mitigation required**
14	Remnant	Recreation	Middle ground	C	Landscapes are able to absorb change	Indistinct	Low	The infrastructure would not be seen or discernible. The landscape can absorb change. The contrast is not perceived. **No mitigation required**

5.2.2 Results summary

The highest predicted impacts were identified for four rural residential viewpoints, one agricultural viewpoint and one remnant viewpoint. All are located in the foreground proximity; within 1km of the proposed solar farm site.

Table 5-4 Highest visual impact: summary

ID	LCU	Viewpoint	Visual impact
17	Rural residential	Residential	Medium
18	Rural residential	Residential	Medium
19	Rural residential	Residential	Medium
20	Rural residential	Road	Medium
1	Agricultural	Road	Medium
11	Remnant	Road	Medium

In all cases, these locations have expansive views of the proposed infrastructure and, while the landscapes can absorb some change and the contrast is considered acceptable, some further screening could be effective in further 'breaking up' views of the infrastructure. This would assist to protect the dominant visual features, which include native vegetation and planted landscaping. This is particularly warranted where residences and residential access ways are affected; view points 17, 18, 19 and 20.

In all cases, the contrast of the proposed infrastructure is considered acceptable, but mitigation is recommended. Proposed onsite screening locations are provided in Appendix D specifically aiming to address impacts from these locations.

Generally, the visibility of low lying infrastructure (less then 3m) is low. This is on account the generally flat terrain, meaning that the view diminishes rapidly with distance from the site. It is noted however, that local rises in some cases assist to screen the site (receivers to the north-east and south) and in some cases may expand the view of the site (elevated receivers to the north, north of Wialda Creek, looking down on the site). Generally, the visibility is further by existing roadside vegetation and native vegetation remnants, including the riparian corridors that surround the site to the north, west and south (refer to Appendix A.3). Impacts in all other locations have been assessed as low and acceptable. No mitigation has been recommended for these locations.

5.3 CUMULATIVE IMPACTS

Adverse cumulative impacts occur when the infrastructure or activities at the proposed solar farm site exacerbate the negative impacts of other infrastructure or activities occurring nearby.

5.3.1 Construction

During construction, the additional haulage traffic impact creates the greatest potential for cumulative visual impacts. The Castlereagh Highway is a high use road corridor and likely to carry a substantial proportion of heavy and oversized vehicles. The visual impact of increased traffic movements to the site would be predominantly limited to construction (approximately 12 months).

5.3.2 Operation

The operational view of the solar farm may generate a cumulative impact with the existing substation and powerlines. The array site and substation require security fencing and steel dominated infrastructure. The mitigation recommended in this report will act to reduce the cumulative impact. Screen planting would be undertaken onsite but outside the perimeter fencing to minimise views of the fence as well.

It is possible another large scale development could be approved within view of the proposed solar farm, however none are known to be proposed at this time.

Generally, adverse cumulative visual impacts are anticipated to be manageable due to the ability to effectively screen infrastructure in this low relief landscape.

6 MITIGATION STRATEGY

A Visual Impact Management Plan is recommended to address the 'as built' visual impacts of the proposed solar farm. The plan would include:

- Onsite vegetation screening, guided by the proposed screening, provided in Appendix D. This would be aimed at 'breaking up' not blocking views of onsite infrastructure. Generally, the screen would be sparsely planted, in keeping with existing road corridor native vegetation, not creating an unnatural hedge effect.
- Involvement of the most affected landowners (relevant to medium impact view locations). This may include increased onsite planting density in specific locations suggested by the landowners (for example, where the proposed solar farm would be visible from outdoor recreational areas).
- General methods to reduce visual impact. This would centre on the colour and form of infrastructure, to reduce the overall visual contrast of the project.
- Verification of predicted and actual impacts. This would improve the reliability of the measures and provide a trigger to undertake additional mitigation if required.

Guidance regarding these measures is provided below. They are considered feasible, in that the proponent has agreed the measures can be implemented as part of the project. They are considered effective, as the measures would be implemented post construction and in consultation with affected landholders (where relevant). It is noted that vegetation screens can take time to grow, grow differently than expected or expire before effective height is achieved. Furthermore, the as built infrastructure may differ from that assessed in this report, predicted impacts may be found to be different to actual impacts. For this reason, a verification process and monitoring requirements are included in the plan.

6.1 SCREENING

6.1.1 Screen location

The location of proposed onsite screening is provided in Appendix D.

6.1.2 Screen requirements

- Onsite plantings would be 1-2 rows deep and be located on the outside of the security fence, where feasible, so that it breaks up views of the fencing as well as onsite infrastructure.
- The plant species to be used in the screen are recommended to be native, derived from the naturally occurring vegetation community in this area. Species selection could be undertaken in consultation with affected near neighbours and a botanist or landscape architect, taking into account the impact of shading on the array.
- Planting should be undertaken as soon as practical in the construction process, as it will take time for the plants to establish and become effective as a screen. Seasonal requirements for planting should also be considered.

- A post construction audit would be undertaken to assess the effectiveness of the screening layout with reference to the final constructed infrastructure and augment the former as required.
- The screen would be maintained for the operational life of the solar farm. Dead plants would be replaced. Pruning and weeding would be undertaken as required to maintain the screen's visual amenity and effectiveness in breaking up views.
- The aim of plant screens is to break up the view and not eliminate it. Relatively sparse plantings, rather than a formal 'hedge' effect, is considered more appropriate to the existing environment.

6.2 GENERAL MEASURES

The following measures are recommended to reduce the general visual impact of the development for all other receivers:

6.2.1 Design

- If feasible, underground rather than overhead power lines would be considered.
- If feasible, co-location of powerlines would be undertaken to minimise the look of additional power poles. If additional poles are required, these would match existing pole design as much as possible.
- The materials and colour of onsite infrastructure will, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that will blend with the landscape. Where practical:
    - Buildings will non-reflective and in eucalypt green, beige or muted brown.
    - Pole mounts will be non-reflective.
    - Security fencing posts and wire would be non-reflective; green or black rather than grey would reduce the industrial character of the fence.

6.2.2 Construction

- During construction, dust would be controlled in response to visual cues.
- Parking areas, material stock piles and other construction activities would be located as far as practical from nearby residences or screened (by existing vegetation or constructed screens) for the period of construction.
- Areas of soil disturbed by the project would be rehabilitated progressively or immediately post-construction, reducing views of bare soil.
- Ground cover would be maintained beneath the panels and within the site boundary, to break up views of the infrastructure from the side and back views.
- Night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations).

7 CONCLUSION

This report has been prepared to assess the potential visual impacts of the proposed Beryl Solar Farm. A systematic evaluation has been undertaken to address subjectivity as much as possible. The report was informed by background investigations, mapping and modelling, field survey including reconnaissance, ground truthing and photography and the results of project-specific community consultation.

The proposed Beryl Solar Farm is located on the edge of a rural residential area, in an area of moderate scenic quality and in close proximity (<1km) of some residences; 31 residences have been counted from aerial imagery within 1 km, including 5 rural residential locations, and 69 residences have been counted within 5km, including 2 urban and 6 rural residential locations[3].

The highest predicted impacts were identified for four rural residential viewpoints, one agricultural viewpoint and one remnant viewpoint. All are located in the foreground proximity; within 1km of the proposed solar farm site. In all cases, these locations have expansive views of the proposed infrastructure and, while the landscapes can absorb some change and the contrast is considered acceptable, some further screening could be effective in further 'breaking up' views of the infrastructure. In all cases, the contrast of the proposed infrastructure is considered acceptable, but mitigation is recommended specifically aiming to address impacts from these locations. Impacts in all other locations have been assessed as low and acceptable. No mitigation has been recommended for these locations.

General measures to reduce impacts for all receivers have also been recommended. These centre on use of design elements to reduce visual contrast, mitigation of construction impacts such as dust and traffic that may reduce visual amenity and mitigation of operation impacts, such as maintaining ground cover beneath the panels, to break up side on and back views of infrastructure and soften the appearance of the facility.

Large scale solar farms are still relatively new in Australia. While they enjoy support from many in the community, provision of information on expected visual impacts and involvement in mitigating impacts (for affected receivers) is considered very important to obtaining social license to operate. With the involvement of the affected landowners in the mitigation strategy set out in Section 6, the visual impacts of the proposed solar farm are considered acceptable and manageable.

[3] Error can occur, with small houses and sheds being incorrectly counted.

8 REFERENCES

ABS, 2011, Gulgong 2011 Quickstats, accessed 31 October 2016 from http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/quickstat/SSC11041Australian Renewable Energy Agency (ARENA) no date. Establishing the social licence to operate large scale facilities in Australia; insights from social research for industry.

BLM (n.d.) BLM Visual Resource Management System. Available online from the Bureau of Land Management, US Department of the Interior. (www.blm.gov).

Casliber , n.d, accessed 15 November 2016 from , https://commons.wikimedia.org/w/index.php?curid=48329249

Destinations NSW, 2016, Gulgong, accessed 31 October 2016 from http://visitmudgeeregion.com.au/explore-absorb/towns-and-villages/gulgong .

Guntawang, 2016, accessed 15 November 2016 from http://www.guntawang.com.au/about-us/

Gulgong Chamber of Commerce, 2016, What to see & do in historical Gulgong, accessed 31 October 2015 from https://gulgong.com.au/

IPSOS, 2015, *Establishing the social licence to operate large scale solar facilities in Australia: insights from social research for industry*, Australian Renewable Energy Agency, accessed 2 November 2016 from http://arena.gov.au/resources/

NSW Department of Planning (2010). Discussion Paper On Planning For Renewable Energy Generation - Solar Energy, prepared April, 2010.

Mid-Western Regional Council, 2015, accessed 31 October 2016 from http://www.midwestern.nsw.gov.au/ .

OEH, 2014, Statement of Management Intent: Yarrobil National Park, Community Conservation Area Zone 1, accessed 15 November 2016 from http://www.environment.nsw.gov.au/resources/parkmanagement/SMI/20140261SMIYarrobilNP.pdf

Spaven Consulting (2011). Solar Photovoltaic Energy Facilities: Assessment of potential for impact on aviation. Report prepared January 2011, for RPS Planning and Development.

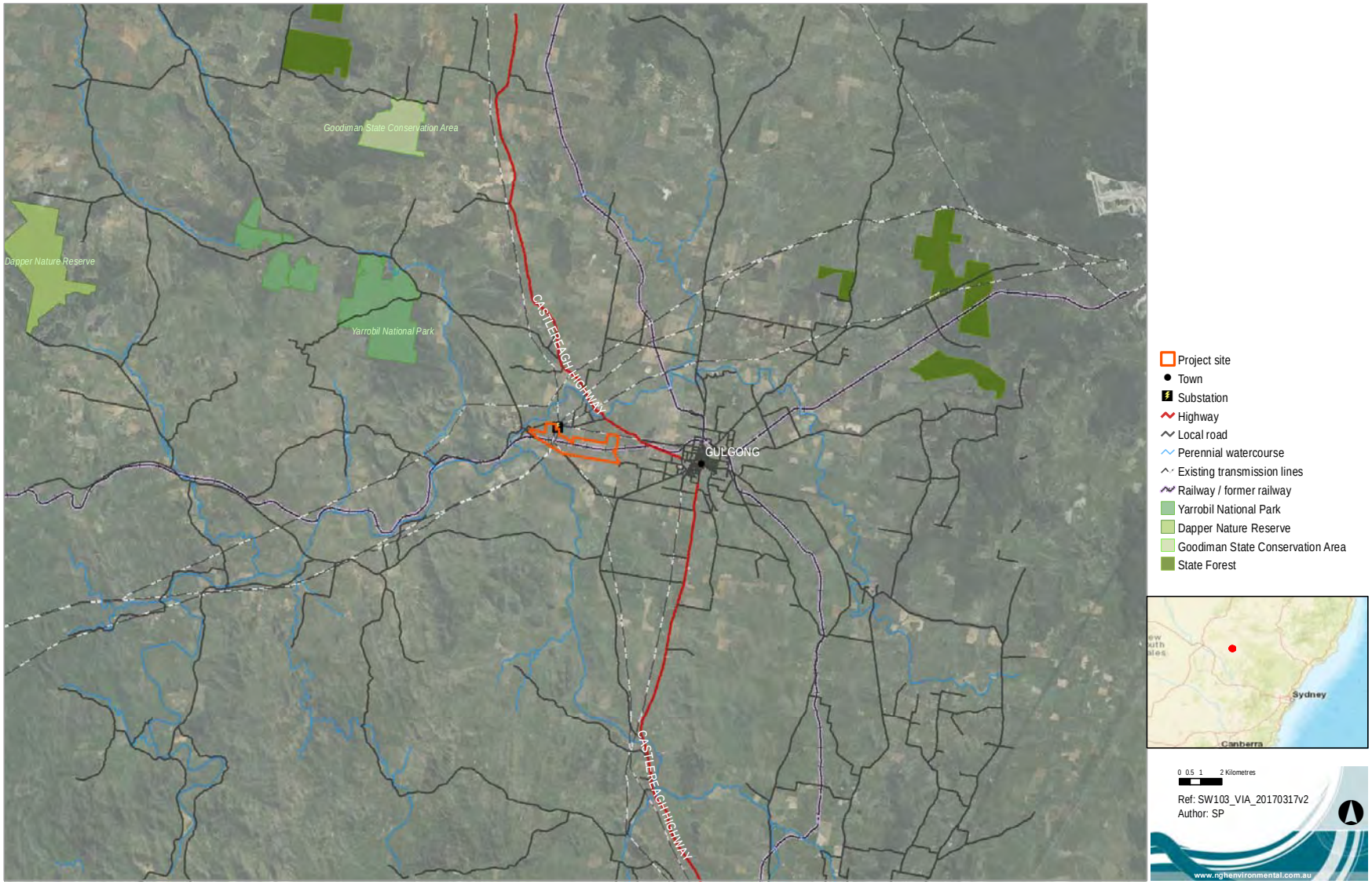
State of New South Wales (Service NSW), 2016, Gulgong Health Service, accessed 31 October 2016 from https://www.service.nsw.gov.au/nswgovdirectory/gulgong-health-service

APPENDIX A LOCATION AND PROPOSED INFRASTRUCTURE LAYOUT

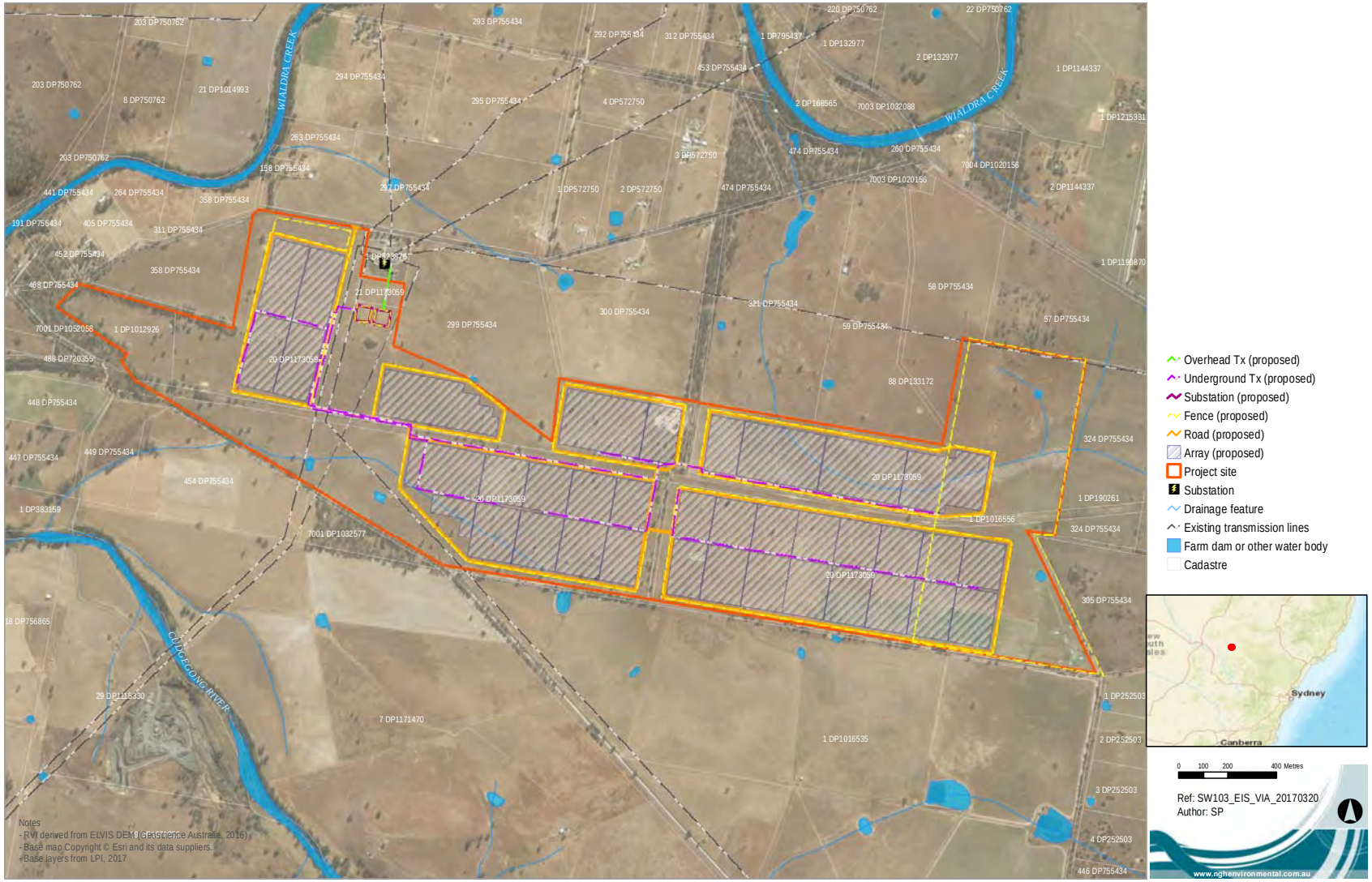
A1 Regional location of proposed solar farm site

A2 Proposed infrastructure

A.3 Location of representative viewpoints (and associated LCUs) foreground



A1 Regional location of proposed solar farm site



A2 Proposed infrastructure

APPENDIX B ZONE OF VISUAL INFLUENCE AND REPRESENTATIVE VIEW POINTS

B.1 ZVI foreground (1km) and midground (5km)

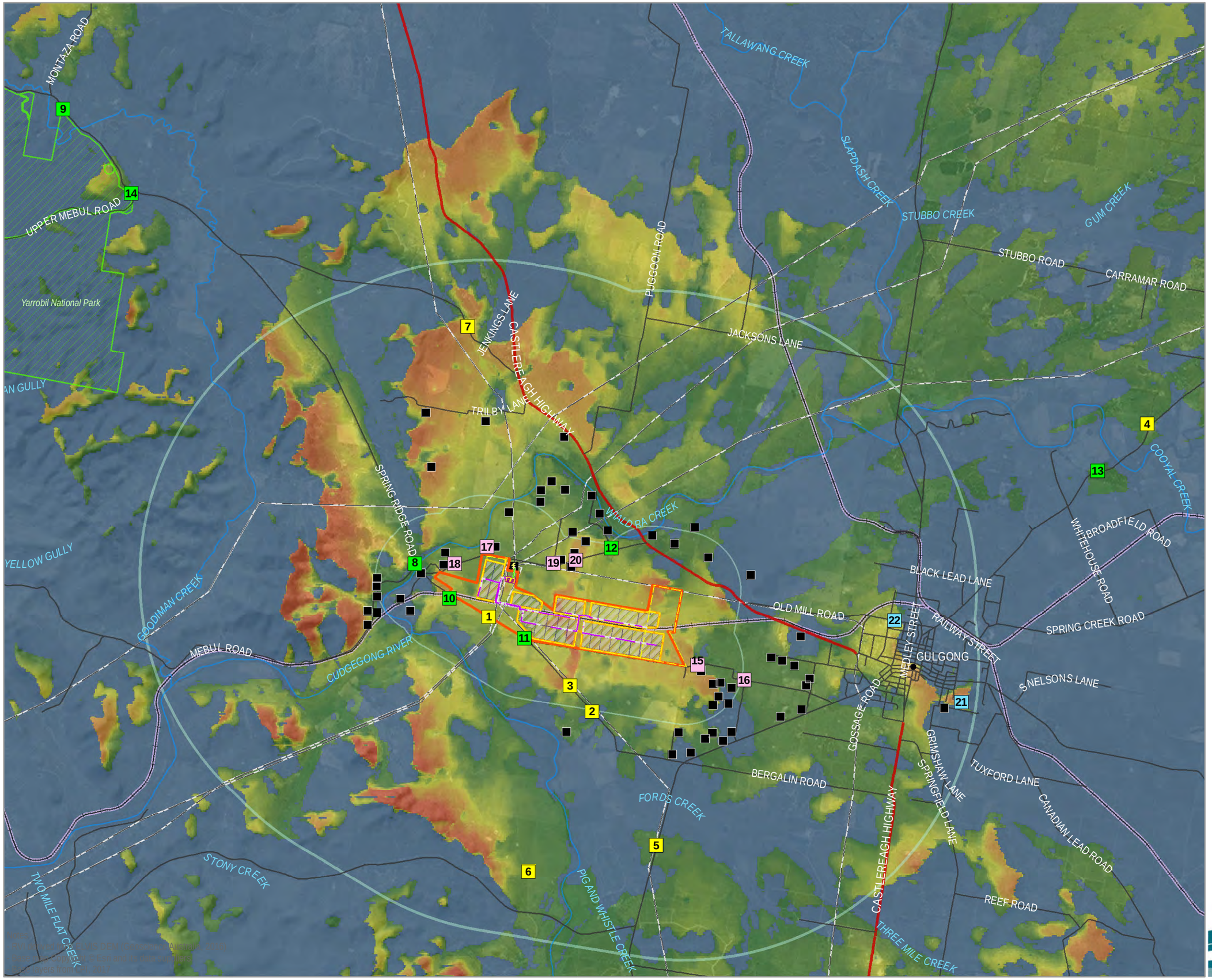
B.2 ZVI background (16km)

The ZVI (or viewshed) of the proposed solar farm was produced using topographic information.

A height of 3m was used to model onsite infrastructure. This is a realistic approximation of the height of panels and PV containers, which may actually be 2.3m and 3.4m, respectively. Topography was based on a 25m resolution Digital Elevation Model (DEM) derived from 25m contours. The ZVI does not take into account screening such as vegetation or infrastructure and on this basis is considered a 'worst case' model.

Representative viewpoints assessed in this report are also shown for the study area on the ZVI maps.

B.3 Location of panoramic photos, shown in Section 5.2.



Landscape Character Unit (LCU)
- Residence
- Agricultural
- Remnant
- Rural residential
- Urban
- Overhead Tx (proposed)
- Underground Tx (proposed)
- Substation (proposed)
- Fence (proposed)
- Road (proposed)
- Array (proposed)
- Project site
- Substation
- Highway
- Local road
- Perennial watercourse
- Existing transmission lines
- Railway / former railway
- National Park / Reserve
- Foreground (1km)
- Midground (5km)

Relative Visibility Index

Not visible	16	32	48
Low visibility	17	33	49
2	18	34	50
3	19	35	51
4	20	36	52
5	21	37	53
6	22	38	54
7	23	39	55
8	24	40	56
9	25	41	57
10	26	42	58
11	27	43	59
12	28	44	60
13	29	45	61
14	30	46	62
15	31	47	63

High visibility

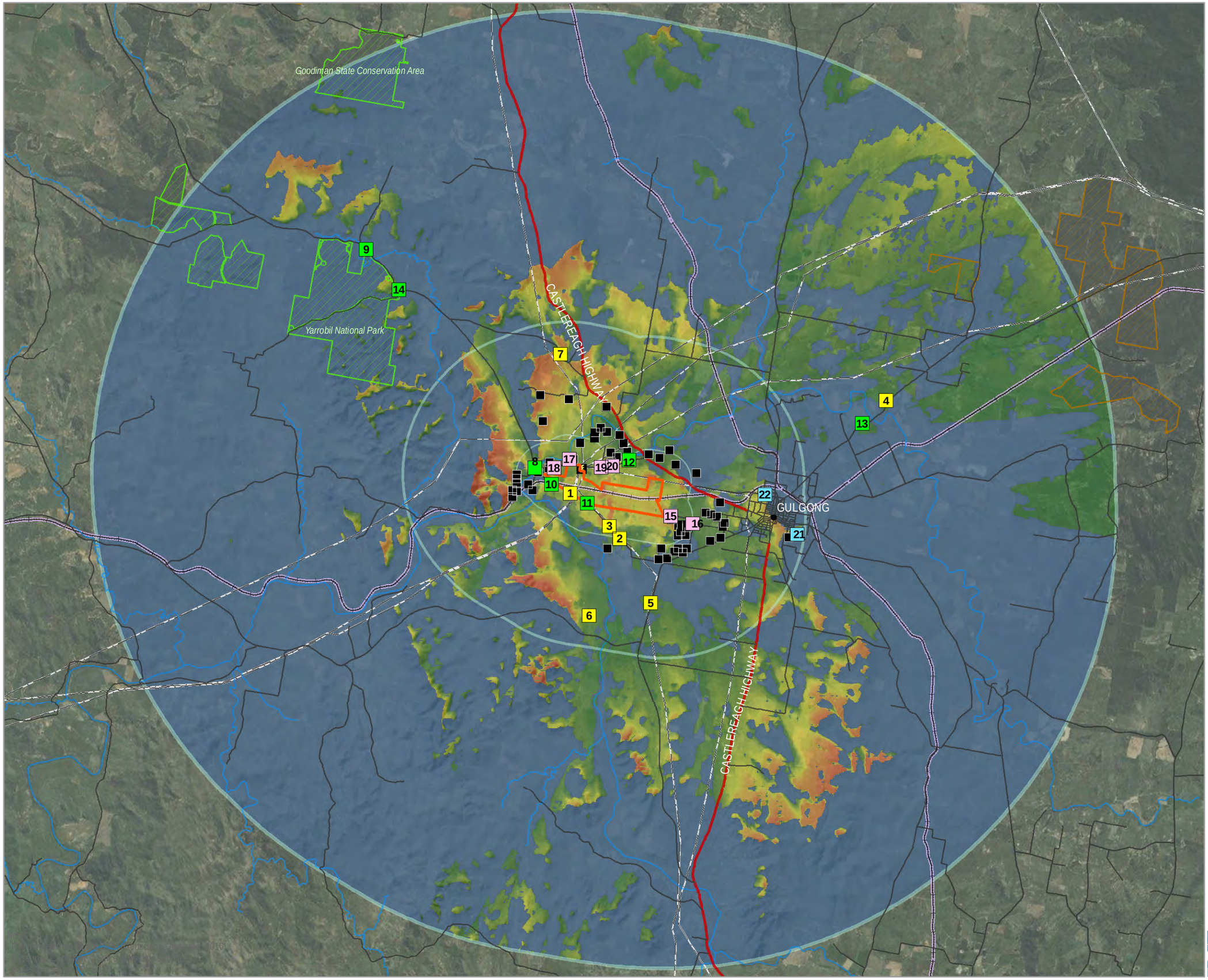
0 0.5 1 2 Kilometres

A3 @ 1:60000
Ref: SW103_VIA_20170320v2
Author: SP

ngh environmental

www.nghenvironmental.com.au

Notes:
RVI derived from 5m DEM (Geoscience Australia, 2010)
Base data ©NSW LPI Esri and its data suppliers
Wind farm layers from Oct 2017



Landscape Character Unit (LCU)

- Residence
- Agricultural
- Remnant
- Rural residential
- Urban
- Project site
- Substation
- Highway
- Local road
- Perennial watercourse
- Existing transmission lines
- Railway / former railway
- National Park / Reserve
- State Forest
- Foreground (1km)
- Midground (5km)
- Background (16km)

Relative Visibility Index

Not visible	16	32	48
Low visibility	17	33	49
2	18	34	50
3	19	35	51
4	20	36	52
5	21	37	53
6	22	38	54
7	23	39	55
8	24	40	56
9	25	41	57
10	26	42	58
11	27	43	59
12	28	44	60
13	29	45	61
14	30	46	62
15	31	47	63

High visibility

0 0.5 1 2 Kilometres

A3 @ 1:125000
Ref: SW103_VIA_20170320v2
Author: SP

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APPENDIX C COMMUNITY FEEDBACK FORM QUESTIONS

COMMUNITY FEEDBACK FORM: BERYL SOLAR FARM

Your feedback is important to develop a solar farm project that best suits the local area and community.

Your comments ensure local feedback is understood by the developers and assessment team.

Please send your feedback to (or seek further information directly, from):

Tom Best, First Solar Australia Pty Ltd
Level 3 16 Spring Street, Sydney, NSW 2000
berylsolarfarm@firstsolar.com

For further information about the project, please see the project website at berylsolarfarm.com.au

Your contact details: (this information will be treated as confidential)

Name: …… Address: …….. Ph: ……..

Circle which best describes how far you live from the proposed Beryl Solar Farm:

<1 km 1-2 km 2-5 km >5 kilometres Not a member of the local community

Tell us what you value about the local area:

What do you value most about the local area?

……
……
……
……

What views or landscape characteristics in the region and local area are important to you?

……
……
……
……

What do you like about solar farms?

……
……
……
……

Do you have any concerns about solar farms?

……
……
……
……

Do you have any specific concerns regarding the proposed solar farm at Beryl?

……
……
……
……

First Solar.

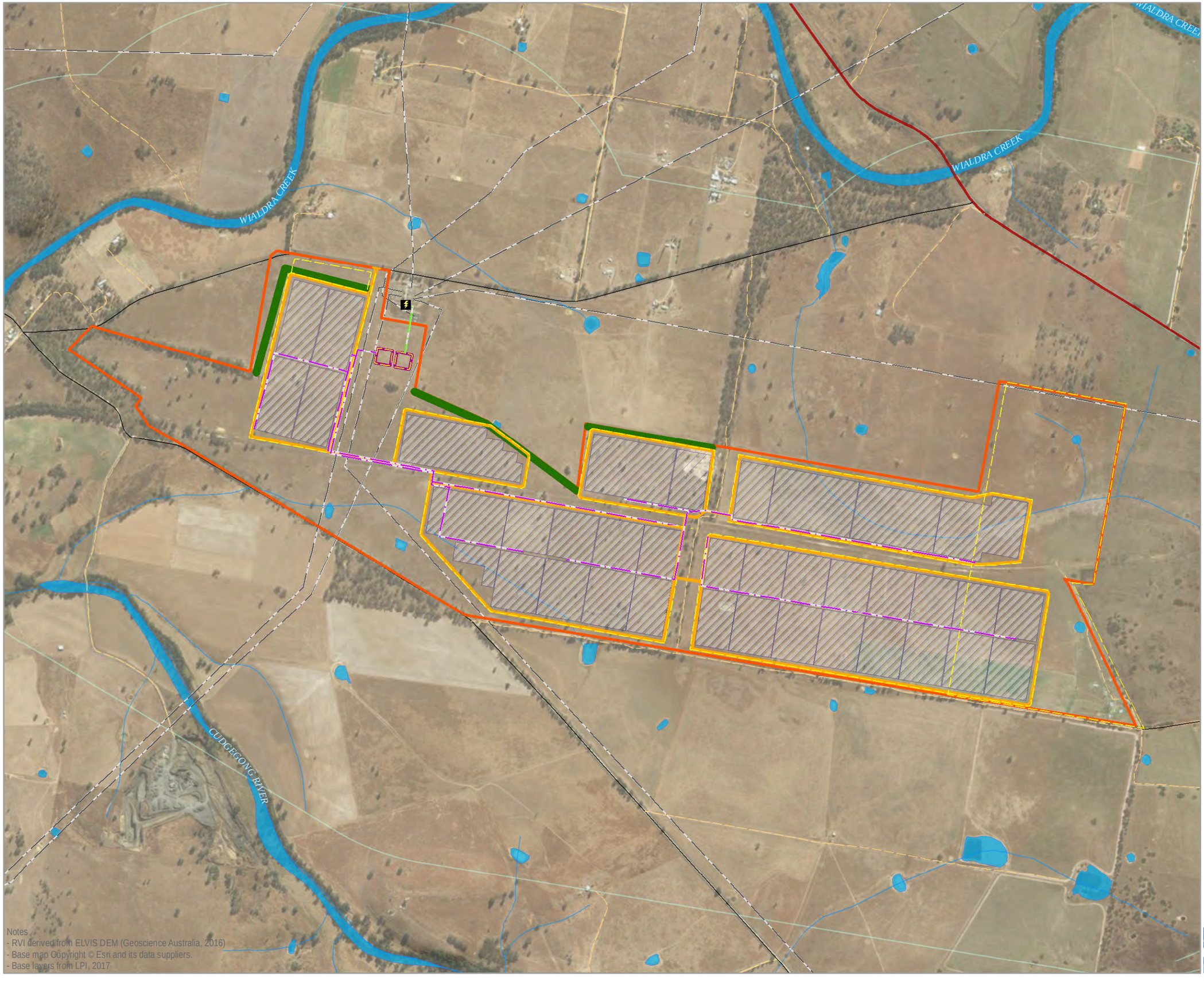
APPENDIX D PROPOSED ONSITE SCREENING

A vegetation buffer is part of the project description. A suggested location for the buffer is provided below, targeting specific sections of the project perimeter to minimise visual impacts. Screening effectiveness would also be audited post construction and augmented if required.

It is noted that:

- Onsite plantings would be 1-2 rows deep and be located on the outside of the security fence, where feasible, so that it breaks up views of the fencing as well as onsite infrastructure.
- The plant species to be used in the screen are recommended to be native, derived from the naturally occurring vegetation community in this area. Species selection could be undertaken in consultation with affected near neighbours and a botanist or landscape architect, taking into account the impact of shading on the array.
- Planting should be undertaken as soon as practical in the construction process, as it will take time for the plants to establish and become effective as a screen. Seasonal requirements for planting should also be considered.
- A post construction audit would be undertaken to assess the effectiveness of the screening layout with reference to the final constructed infrastructure and augment the former as required.
- The screen would be maintained for the operational life of the solar farm. Dead plants would be replaced. Pruning and weeding would be undertaken as required to maintain the screen's visual amenity and effectiveness in breaking up views.

The aim of plant screens is to break up the view and not eliminate it. Relatively sparse plantings, rather than a formal 'hedge' effect, is considered more appropriate to the existing environment.



Overhead Tx (proposed)
Underground Tx (proposed)
Substation (proposed)
Fence (proposed)
Road (proposed)
Array (proposed)
Screening (proposed)
Project site
Substation
Highway
Local road
Track
Drainage feature
Existing transmission lines
Farm dam or other water body
Foreground (1km)

0 0.125 0.25 0.5 km

A3 @ 1:14000
Ref: SW103_VIA_20170320v2
Author: SP

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Notes
- RVI derived from ELVIS DEM (Geoscience Australia, 2016)
- Base map Copyright © Esri and its data suppliers.
- Base layers from LPI, 2017