Narragamba Solar Project

Preliminary Visual Impact Assessment

moir
landscape architecture

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Preliminary Visual Impact Assessment

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1.0 Introduction

1.1 Introduction

ACEN Australia Pty. Ltd. (the Proponent) proposes to develop the Narragamba Solar Project and potential associated Battery Energy Storage System (BESS) to the northeast of Stubbo. Moir Landscape Architecture (Moir LA) has been commissioned by Ramboll Pty Ltd on behalf of the Proponent to prepare a Preliminary Visual Impact Assessment (PVIA) for the proposed Narragamba Solar Project. The purpose of this PVIA is to provide a preliminary assessment of the potential visual impacts associated with the Narragamba Solar Project which is referred to hereafter as 'the Project'.

The PVIA for the Project has been prepared in accordance with the following documents:

- *Large-Scale Solar Energy Guideline August 2022* (referred to hereafter as 'the Guideline) developed by the Department of Planning and Environment (DPE, 2022a)

- *Technical Supplement - Landscape and Visual Impact Assessment, Large-Scale Solar Energy Guideline August 2022* (referred to hereafter as 'the Technical Supplement') developed by the Department of Planning and Environment (DPE, 2022b)

- *State Significant Development Guidelines - Preparing a Scoping Report (Appendix A)* (referred to hereafter as 'the SSD Guidelines') developed by the Department of Planning and Environment (DPE, 2022)

This PVIA will form part of the Scoping Report seeking the Secretary's Environmental Assessment Requirements (SEARs) in order to prepare an Environmental Impact Statement (EIS).

1.2 Relevant Experience

The Technical Supplement states: "*The applicant is expected to engage relevant professionals (for example: landscape architects, architects, environmental planners, geographers, or other visual assessment specialists) with demonstrated experience and capabilities. Experts should follow the guidance in this document to perform an effective and consistent assessment for large-scale solar energy development."* (DPE, 2022b).

Moir LA is a professional design practice and consultancy specialising in the areas of Landscape Architecture, Landscape Planning and Landscape and Visual Impact. Our team has extensive experience in undertaking Landscape and Visual Impact Assessments for large-scale infrastructure and renewable energy projects. In the context of our experience and with guidance from the Guideline and the Technical Supplement, we have developed methodologies to ensure a comprehensive and qualitative assessment of the Project.

Recent experience includes the preparation of Landscape and Visual Impact Assessments (LVIA) for the following Solar Energy Projects:

- *Blind Creek Solar Farm LVIA (Bungendore, NSW)*
- *Glenellen Solar Farm LVIA (Glenellen, NSW)*
- *Oxley Solar Farm LVIA (Castledoyle, NSW)*
- *Stubbo Solar and Battery Project PVIA & LVIA (Stubbo, NSW)*
- *Tilbuster Solar Farm LVIA (Tamworth, NSW)*
- *Dunedoo Solar Farm LVIA (Dunedoo, NSW)*
- *Barneys Reef Wind Farm PVIA (Barneys Reef, NSW)*

1.3 Overview of Preliminary Visual Impact Assessment for Solar Farms

The Technical Supplement states: "*A preliminary visual assessment must be included in an applicant's scoping report as part of their request for the Secretary's environmental assessment requirements (SEARs).*" (DPE, 2022b). It also states that the visual assessment process is broken into two key stages:

- **Stage 1** - Preliminary Assessment
- **Stage 2** - Detailed Assessment

This PVIA forms part of *Stage 1 - Preliminary Assessment* and will be submitted to DPE together with the Scoping Report for the request for SEARs. This stage is used to identify viewpoints or receptor locations that would require detailed assessment in Stage 2 as a part of the EIS phase.

Stage 1 - Preliminary Assessment comprises of the application of the Preliminary Assessment Tools. The Preliminary Assessment Tools assist in the identification of viewpoint locations where a solar project may have impacts and which may warrant further consideration. This also provides the opportunity to identify potential impacts that may inform and refine the proposed development footprint layout. The tools assist in identifying locations and viewpoints that are likely to experience little to no impacts which is useful in early consultation and ensures that field work and assessments are targeted only in areas with potential visual impacts.

The Guideline states that effective and early stakeholder engagement is critical for large-scale solar energy projects (DPE, 2022a). Along with the application of Preliminary Assessment Tools in *Stage 1 - Preliminary Assessment*, the Guideline recommends proponents engage with the local community in the project's preliminary stages. Findings from preliminary stakeholder engagement helps to identify existing community values related to specific viewpoints or key landscape features, and assists in identifying opportunities and constraints related to the design, management, visual impact and mitigation measures.

2.0 Study Method

2.1 Study Method

The Guideline and Technical Supplement state that assessments for large-scale solar projects should include a landscape character assessment and visual impact assessment. It defines these two (2) components as the following:

- Landscape Character Assessment: *"This is the process for determining the overall impact of a project on an area's character and sense of place including what people think and feel about it and how society values it*." (DPE, 2022b).

- Visual Impact Assessment: *"This is the process for determining the day-to-day visual effects of a project on people's views (what people see at a place, when they are there) from the private and public domain."* (DPE, 2022b).

The following has been undertaken to develop the PVIA in accordance with the Guideline and the Technical Supplement:

Preliminary Landscape Character Assessment:

This PVIA includes a preliminary landscape character assessment in order to assist with the determination of preliminary landscape character zones and the level of detail that may be required to develop a baseline analysis in the EIS phase. The findings of this assessment will assist in understanding sensitivities associated with the existing landscape.

Preliminary Visual Impact Assessment:

Preliminary Assessment Tools have been applied to identify locations or viewpoints with potential views to the solar array. The results of the preliminary visual impact assessment identify viewpoint locations that require further detailed assessment. The findings of the preliminary assessment have been included in this PVIA and will form the basis for discussion with the community in the EIS phase of the Project.

Community Consultation:

Community consultation will be undertaken in subsequent phases of the Project. The results of the community consultation will be utilised to gain perspective on the landscape values held by the community to inform the LVIA.

2.2 Report Structure

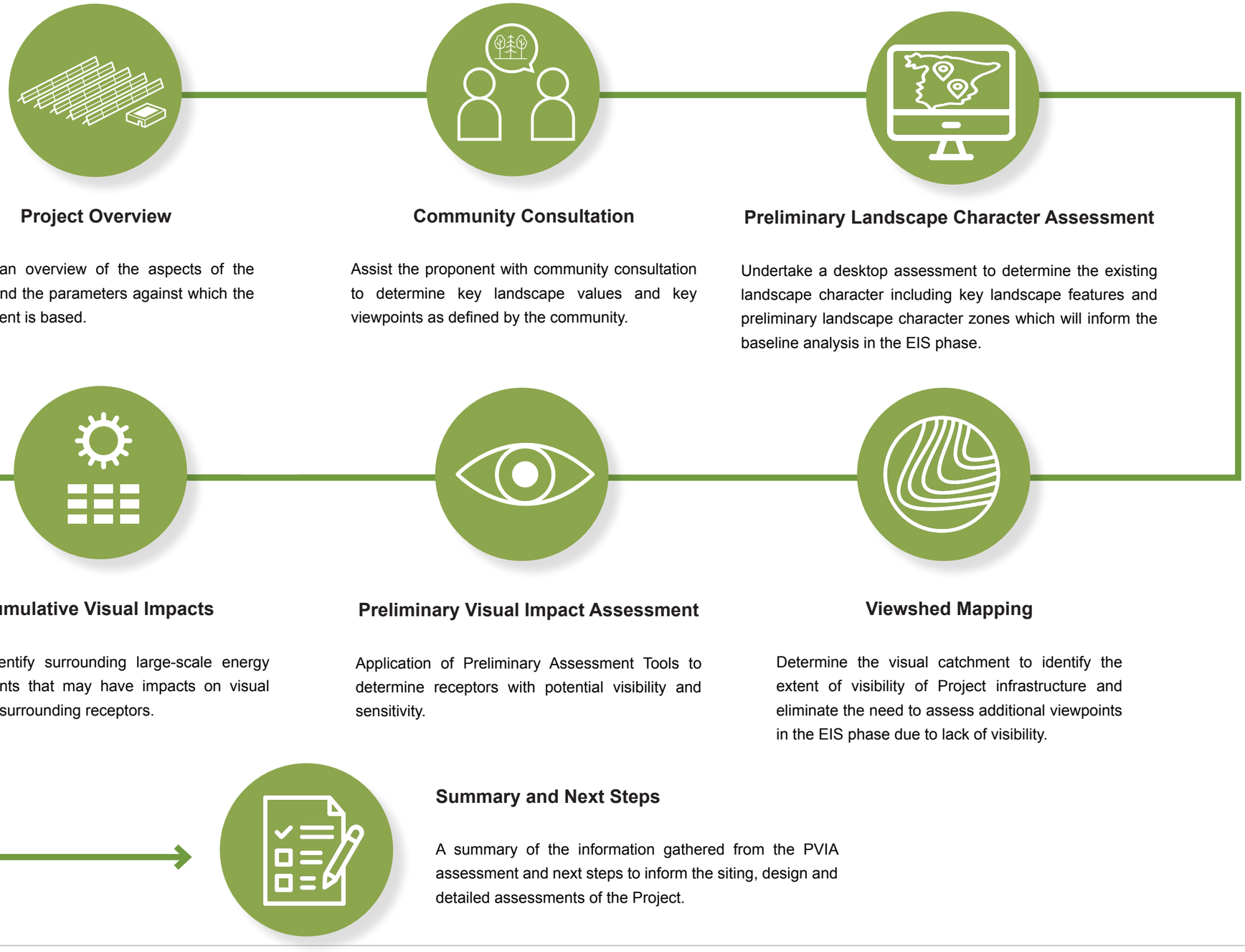
The following table provides an overview of the requirements of the Guideline and the Technical Supplement, and where these have been addressed in the PVIA:

Preliminary Visual Impact Assessment Report Structure:	
PVIA Report:	**Guideline and Technical Supplement Requirements:**
Refer to Section 3.0: Project Overview	*The assessment must include a full description of the proposed solar energy project design and use maps to show the location of the project in relation to viewpoints and surrounding landscapes identified for analysis.*
Refer to Section 4.0: Community Consultation	*The community should be engaged as early as possible to identify potential opportunities and constraints associated with the proposed development. The applicant should identify the elements of the project and the environmental assessment that can be influenced or shaped by the community.*
Refer to Section 5.0: Preliminary Landscape Character Assessment	*The applicant is encouraged to consult with the department in scoping its project to determine the level of detail that may be required in the landscape character assessment.*
Section 6.0: Preliminary Visual Impact Assessment and Viewshed Mapping	*A preliminary visual assessment must be included in an applicant's scoping report as part of their request for the Secretary's environmental assessment requirements (SEARs). The applicant can use viewshed mapping to further eliminate the need to assess viewpoints that fall below the lines in the Preliminary Assessment Tool if the analysis shows there is intervening terrain that would block line of sight to a particular viewpoint. The applicant should also consider undertaking a reverse viewshed analysis.*
Section 7.0: Cumulative Visual Impacts	*The baseline analysis should identify and describe (...) the location of any existing operational or approved large-scale energy developments within a regional and local context, including projects which may have the potential to create direct or indirect cumulative impacts with the project.*
Section 8.0: Summary and Next Steps	

Table 1 Overview of Report Structure

2.3 Steps Undertaken for PVIA

The following process has been undertaken to develop this PVIA:



3.0 Project Overview

3.1 The Project

The Project includes the construction, operation and decommissioning of a 320 megawatt (MW) solar project that would power approximately 160,400 homes. The Project also comprises associated infrastructure such as a potential BESS and substation. **Figure 1** shows the proposed extent of the Project which is referred to as the 'Project Area' in this report.

The Project Area is approximately 856 hectares (ha). It is located 4 kilometres (km) west of Bungaba, 11 km north of Stubbo and 25 km southeast of Dunedoo in the Mid-Western Regional Local Government Area (LGA). **Figure 1** shows the existing site context. The final layout and capacity of the Project will be investigated during the preparation of the EIS and will be selected on the basis of environmental constraints identification, outcomes of stakeholder engagement, engineering assessments and the final design of project infrastructure.

The Project would supply electricity to the National Energy Market (NEM) via the Merotherie Energy Hub which is proposed by Energy Corporation of NSW (EnergyCo) on behalf of the Network Operator. The transmission infrastructure (330 kV) to connect the Project to the Merotherie Energy Hub would form part of the Central West Orana - Renewable Energy Zone (CWO-REZ) transmission project.

The Project will comprise of approximately 832,000 photovoltaic panels spread across the area identified as the Development Footprint shown in **Figure 2**. Module spacing is between five (5) and twelve metres (m) apart aligned in a north-south direction. The estimated total height of the PV modules will be up to 5 m above ground level in a 2P configuration or a maximum of 2.5 m above ground level in a 1P configuration. The lower edge of each PV module in the maximum tilt position will be 0.3 m above ground level.

This visual impact assessment has been prepared utilising the worst case scenario, that is, the maximum tilt position of 5 m. It is noted, however that it is unlikely the position of the solar panels will reach the maximum vertical position, and will adjust throughout the day. The solar arrays will be mounted to steel structures and utilise single axis tracking systems.

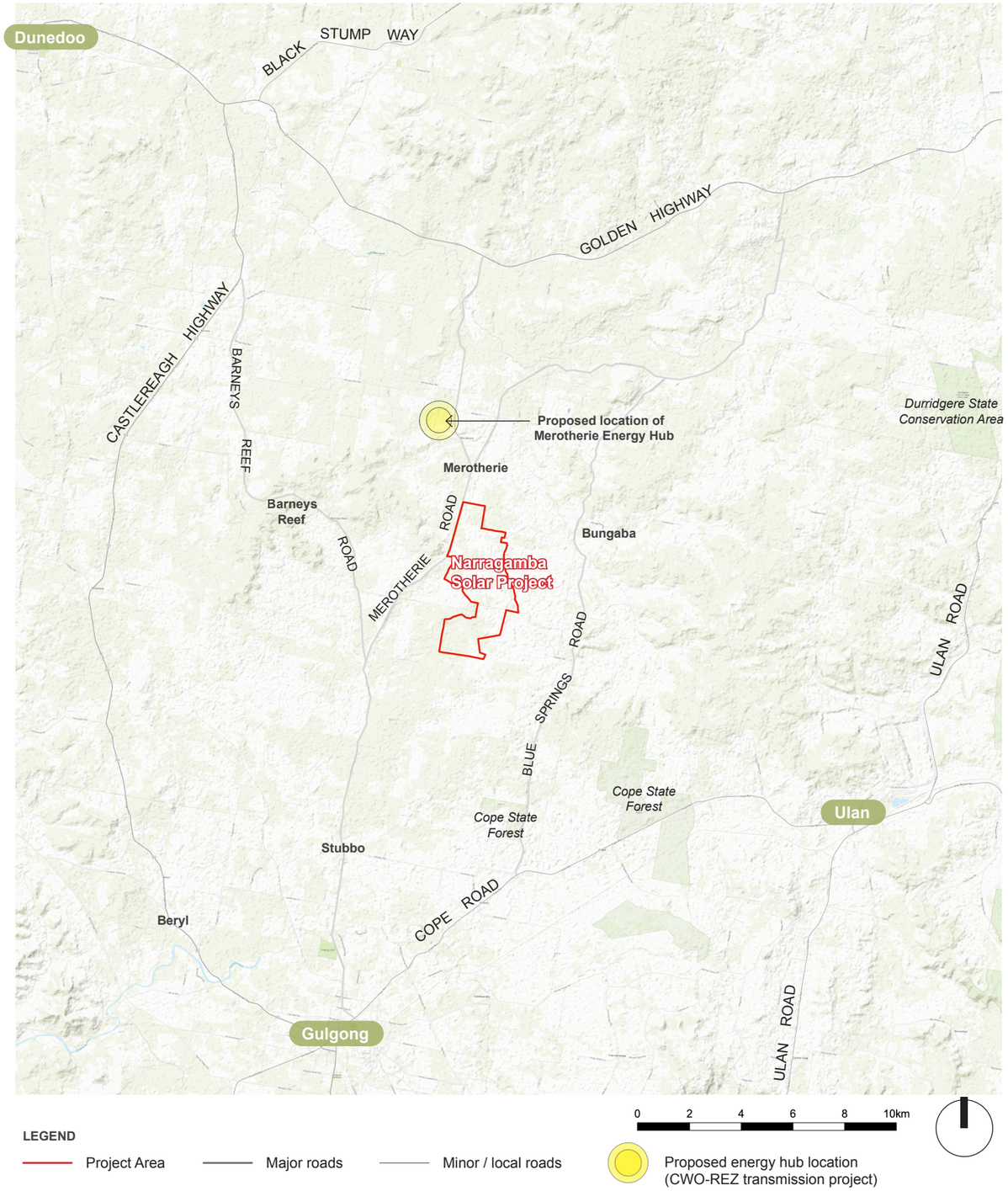


Figure 1 Site Context (Map Source: ESRI Imagery 2023)

3.2 Key Project Components

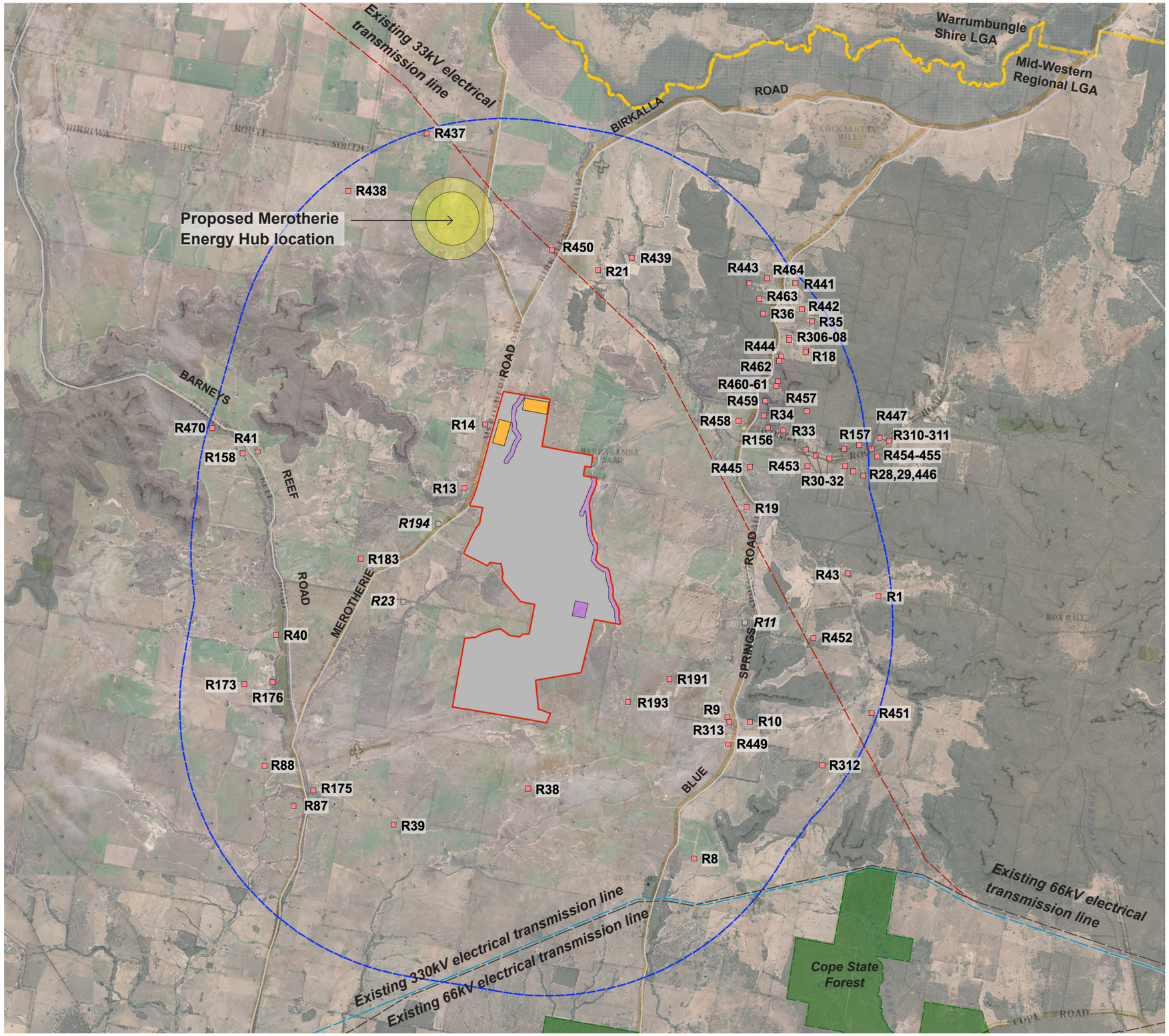
It is anticipated that the physical layout and design of the Project will comprise the following key infrastructure elements:

- Approximately 832,000 photo voltaic modules (solar panels) using a single axis tracking system
- Electrical infrastructure including:
  - approximately 55 power conversion units (PCUs) which include inverters for converting direct current (DC) power to alternating current (AC)
  - on-site substation containing main transformers and associated switchgear
  - overhead and underground electrical reticulation connecting the solar project elements
  - connection from the on-site substation to the Merotherie Energy Hub proposed by EnergyCo. The transmission infrastructure (330 kV) to connect the project to the Merotherie Energy Hub would form part of the CWO-REZ transmission project.
  - potential battery energy storage system (BESS), which may be distributed amongst the solar array area (if DC coupled) or co-located in an area near the substation (if AC coupled). This would be confirmed in the EIS.
- Other permanent on-site ancillary infrastructure including:
  - operational and maintenance facility
  - a temperature-controlled spare parts storage facility
  - supervisory control and data acquisition (SCADA) facilities for remote monitoring of the solar project
  - a workshop and associated infrastructure
  - access roads, both to the project and internal access roads
  - car parking area
  - security fencing and landscaping
- Temporary construction ancillary infrastructure including:
  - construction compounds
  - a concrete batching plant
  - laydown areas
  - parking areas
  - access tracks and associated infrastructure, including gates and fencing
  - potential construction workforce accommodation.

The Project Area will be accessed from Merotherie Road via the Golden Highway and it is likely that access will be available from the north-west corner of the Project Area. It is anticipated that the operational lifespan of the Project would be approximately 25 years and at the end of its operational life, the Project will be decommissioned and the site rehabilitated in consultation with the landholders. Ongoing refinement of the proposed layout and technology will continue throughout the EIS process as a response to engineering design refinements, landholder negotiations and outcomes of environmental and social assessments, to minimise potential impacts where possible.

For the purposes of this report, ‘associated residences’ are defined as residences where the property owners within or near the Project Area have entered into access licence and option agreements (landholder agreements) with the Proponent. ‘Non-associated residences’ are defined as residences near the Project Area that have not been the subject of an access licence and option agreement (landholder agreement) with the Proponent.

In accordance with the Technical Supplement, this report identifies the ‘Study Area’ as the land encompassed within 5 km of the Project Area which is shown in **Figure 2.**



Preliminary Project Layout

Narragamba Solar Project

LEGEND

- Project Area
- Development Footprint
- Non-Associated Residences
- Associated Residences
- Potential options for BESS and substation
- Restricted development area
- 5 km from the nearest Solar Array Panel (Study Area)
- Existing 33 kV electrical transmission line
- Existing 66 kV electrical transmission line
- Existing 330 kV electrical transmission line
- Main Road
- Local Road
- Creeks and Gully Channels
- LGA boundary
- State Forest
- Proposed Merotherie Energy Hub location (CWO-REZ transmission project)
- Ridgelines

0 1 2 3 4km

Figure 2 Preliminary Project Layout (Map Source: ESRI Imagery 2023; Six Maps, Apr 2011)

4.0 Community Consultation

4.1 Preliminary Stakeholder Engagement and Consultation

The purpose of community consultation is to understand the current community perceptions in relation to the existing landscape features, scenic quality and to identify key public viewpoints. Community engagement will continue during the EIS phase of the Project and provide the community with opportunities to provide input into the LVIA. The intent is to:

- Undertake early and proactive community engagement with nearby residents and the wider community to identify and address any concerns.
- Ensure the layout of the Project will minimise potential visual impacts and reflect community feedback.
- Ensure mitigation measures proposed for the project are in consultation with the relevant landowners.

4.2 Results of Preliminary Stakeholder Engagement and Consultation

Community consultation has helped establish an understanding of stakeholder needs and potential issues. Consultation began in November 2021 with the associated landowners and in January 2023 with the neighbouring non-associated properties. Ongoing community consultation has been undertaken by the Proponent through face to face meetings, emails, phone calls, letter box drops and newspaper advertisements.

A community information session that was organised at the Gulgong Memorial Hall on 20th April 2023 to provide the general community an opportunity to provide feedback on the Project. A website has been established to provide updates on the Project to the community.

Feedback through early consultation has been limited and identified that the neighbouring landowners would prefer to see vegetation screening along Merotherie Road in order to reduce the potential visual impacts along the route. No other concerns were identified for potential visual impacts.

Additional consultation and further detailed assessment of viewpoints along Merotherie Road will be undertaken during the EIS phase. On-site and off-site visual landscape mitigation strategies will be developed in response to the potential visual impact assessment to ensure that the Project is integrated into the existing landscape.

5.0 Preliminary Landscape Character Assessment

5.1 Existing Visual and Landscape Character

The Technical Supplement states: *'the study area for the landscape character assessment should generally be approx. 5 km from the proposed development'* (DPE, 2022b)

For the purposes of this assessment, the 'Study Area' is defined as the land encompassed within 5 km of the Project Area as shown in **Figure 2 and 3.** The Study Area forms the basis for this Landscape Character Assessment.

The Project is proposed on the eastern side of Merotherie Road and approximately 11 km north of Stubbo within the Mid-Western Regional LGA. Merotherie Road is a local road that continues north to provide access to the Golden Highway. Blue Springs Road is a low use road located to the east of the Project and runs north to also connect with the Golden Highway. Birkalla Road is a low use road located to the north of the site that eventually meets with Blue Springs Road.

The surrounding land parcels are typically modified land that support agricultural production and cropping. The topography is generally flat to the north and gently undulates toward the southern extents of the Project Area. Isolated knobs or low, vegetated hills are visible to the west and east of the Project.

The Study Area includes a number of ephemeral and permanent creeks and waterways that eventually drain into the Talbragar River located approximately 6 km to the north of the Project Area at its closest point. Two (2) small ephemeral creeklines run through the Project Area and feed into the Narragamba Swamp which is located to the north-east of the Project Area. These areas have been classified as restricted development areas for the purposes of the Project (see **Figure 2**).

Cockabutta Creek and Blue Springs Creek are located to the north and east of the Project Area and generally flow north-south. Merotherie Creek is located to the south-west of the Project and joins Slapdash Creek to the south. Vegetation generally follows the creeklines and waterway areas and is a key landscape feature when travelling through the Study Area.

Roadside vegetation is prominent along the northern stretches of Merotherie Road where it intersects with Birkalla Road. Vegetation along the stretch of Merotherie Road that is adjacent to the Project Area is intermittent and patchy. Wind break vegetation is visible in some areas surrounding residences.

5.2 Existing Landscape Character Zones

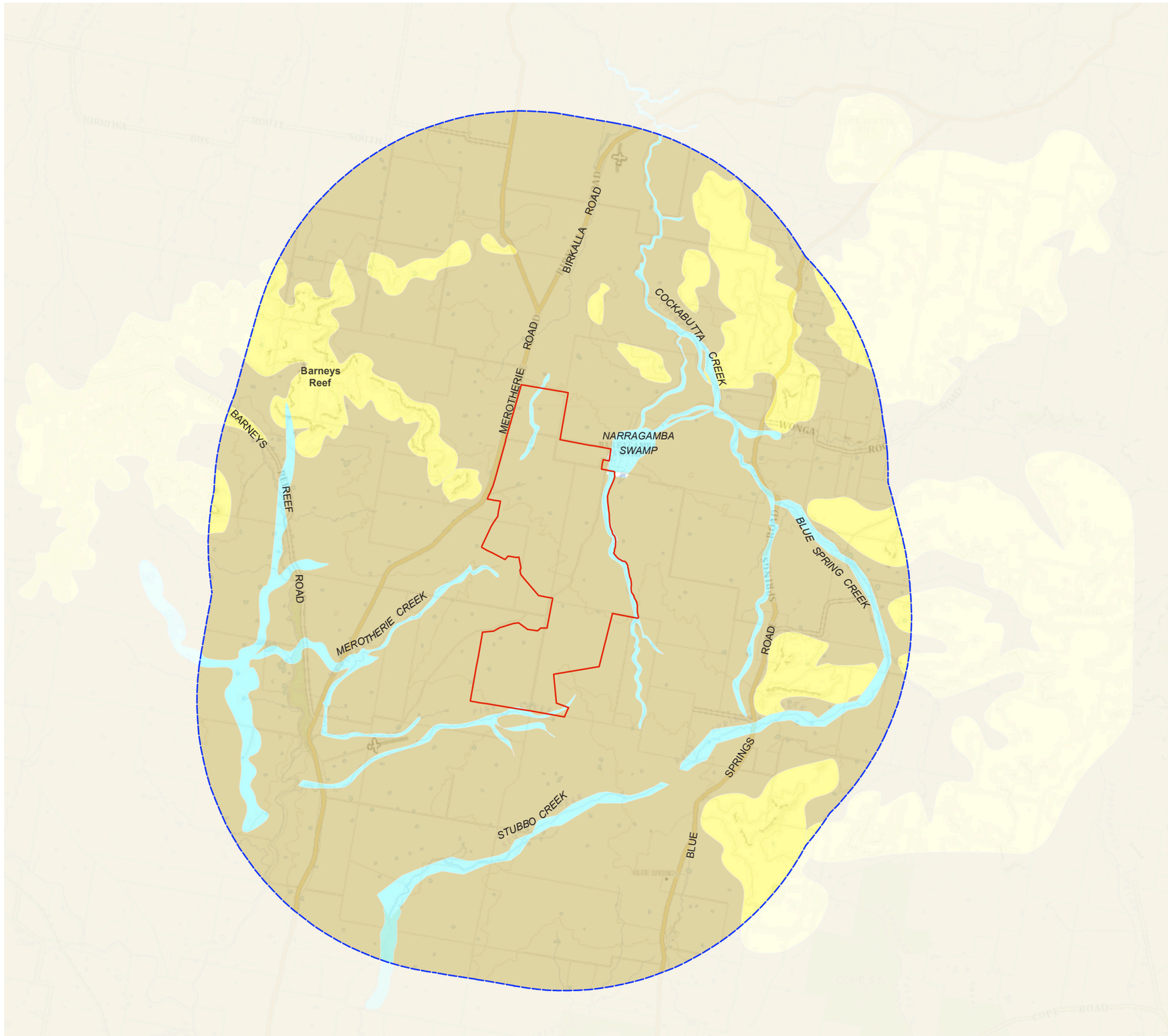
The Technical Supplement states: '*If the landscape includes distinct areas that have different qualities, the study area should be broken down into different character zones. Landscape character zones (LCZs) should divide the landscape based on common distinguishing visual characteristics. These patterns are formed by combinations of vegetation, water bodies, landforms and land use, from which key landscape features can also be identified.'*

A preliminary desktop assessment indicates that typical existing LCZ's identified within the Study Area form a precursory baseline for character assessment which will be assessed in detail in the EIS.

Figure 3 indicates the preliminary LCZ's identified through a desktop assessment. A summary of the preliminary LCZ's identified is provided in **Table 2** below.

Preliminary Landscape Character Zones	
Code	**Name**
LCZ01	**Agricultural Pastures**
LCZ02	**Creeks and Waterways**
LCZ03	**Hills and Knobs**

Table 2. Overview of Landscape Character Zones



Preliminary Landscape Character Zones

Narragamba Solar Project

LEGEND

- Project Area
- Main Road
- Local Road
- 5 km from the nearest Solar Array Panel (Study Area)
- LCZ01: Agricultural Lands
- LCZ02: Creeks and Waterways
- LCZ03: Hills and Knobs

0 1 2 3 4km

Figure 3 Landscape Character Zones (Map Source: Six Maps, Apr 2011)

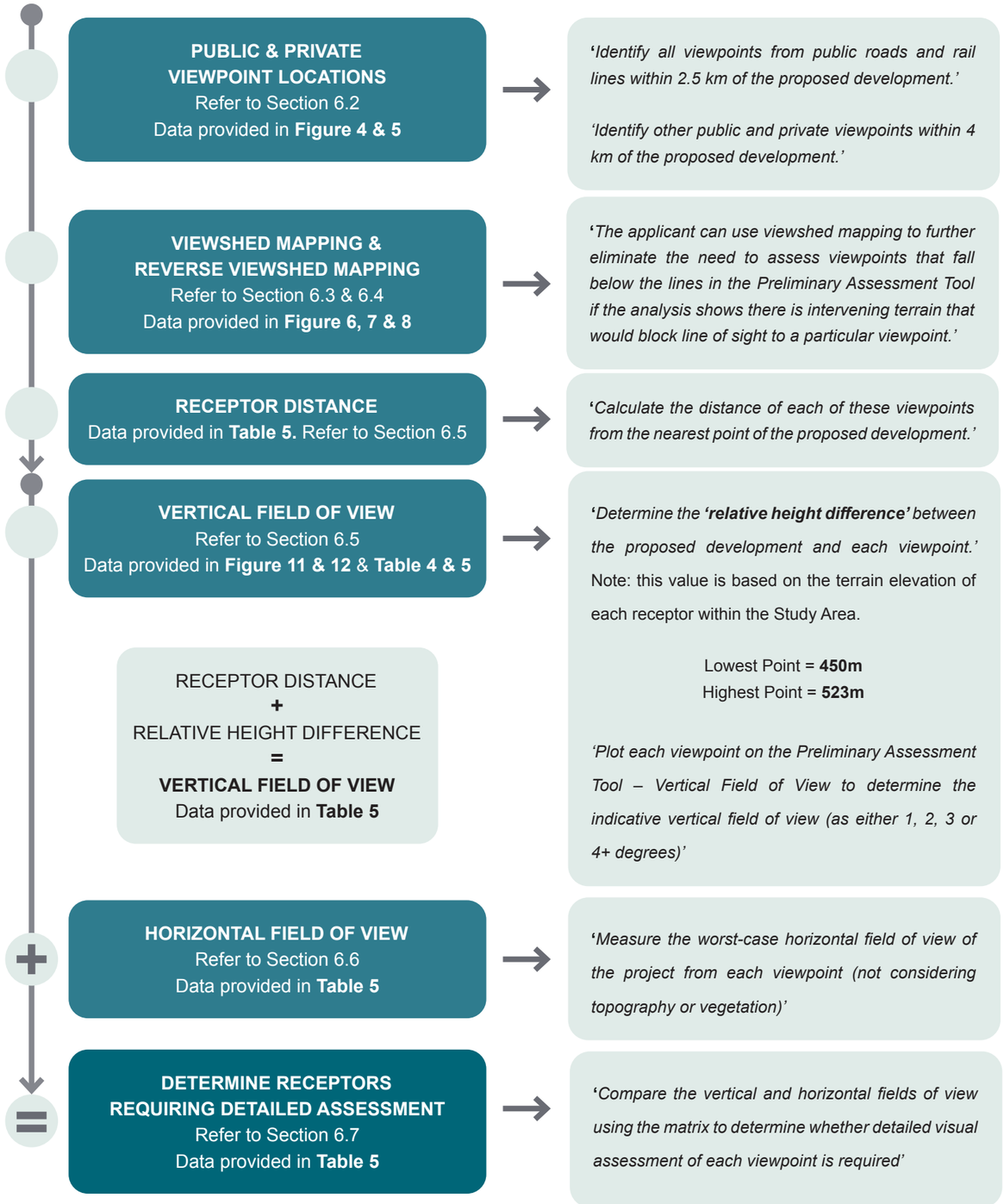
6.0 Preliminary Visual Impact Assessment

6.1 Preliminary Visual Impact Assessment

The Technical Supplement states: "*A preliminary visual assessment must be included in an applicant's scoping report as part of their request for the Secretary's environmental assessment requirements (SEARs)"* (DPE, 2022b). Further, it states: *'To use the preliminary assessment tools; identify all viewpoints from public roads and rail lines within 2.5 km of the proposed development; identify other public and private viewpoints within 4 km of the proposed development.'* (DPE, 2022b)

The preliminary assessment tools must be used to identify viewpoints that require detailed assessment in the EIS. The tools can be used to eliminate the need to assess viewpoints that are likely to experience very low impacts. This is assessed using the vertical and horizontal field of view that a development is likely to occupy when viewed from each viewpoint and is influenced by distance, height elevation changes, and width of a project (DPE, 2022). The flowchart provides an overview of the requirements of the Preliminary Assessment (in accordance with the Section 3.1.1 of the Technical Supplement) and the relevant sections of the report where these have been addressed.

38 residences were identified within 4 km of the Project. Of these, three (3) residences were identified as being associated with the Project and 35 were identified as non-associated with the Project.



6.2 Viewpoint Selection and Preliminary Assessment Tool

Assessment Parameters:

The Technical Supplement states: "*The calculations can be based on either the project area, or the development footprint depending on the level of information available at the time. A more refined approach that uses the development footprint, may result in less viewpoints requiring assessment.*" (DPE, 2022b).

As stated in the Technical Supplement, the landscape character of the surrounding area has been assessed to an extent of 5 km from the Project Area. Additionally, all other private receptors have been assessed within 4 km of the Project. All public road receptors have been assessed within 2.5 km of the Project.

With the exception of assessing the Landscape Character, all other assessments have been undertaken within an extent of 4 km (for all Private Receptors) from the Project Area and 2.5 km (for all Road and Rail Receptors) from the Project Area. All the above distances are in accordance with the Technical Supplement (DPE 2022, p. 12).

The following provides an overview of the viewpoint selection process. Selected viewpoints have been illustrated in **Figure 4**. Further refinement of the viewpoints will be undertaken in the preparation of the LVIA.

Public Roads and Rail Lines:

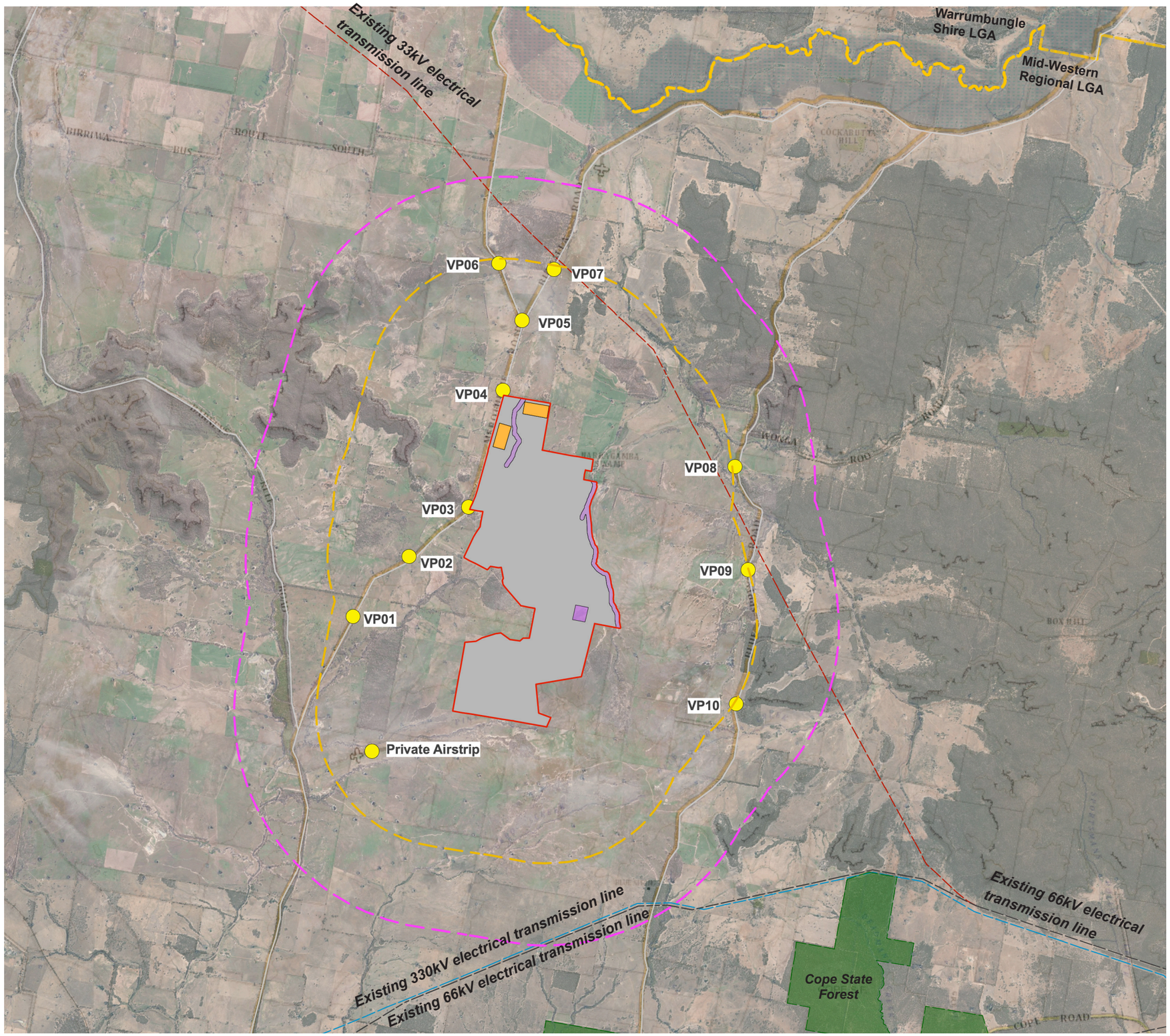
In accordance with the Technical Supplement, all viewpoints from public roads and rail lines within 2.5km of the Project must be assessed. A total of 11 public viewpoints have been selected to represent roads within 2.5 km of the Project Area.

Other public and private viewpoints:

In accordance with the Technical Supplement, other public and private viewpoints within 4 km of the Project Area must be identified and assessed. 38 residences were identified within 4 km of the Project. Of these, three (3) residences were identified as being associated with the Project and 35 were identified as non-associated with the Project. It should be noted that dwellings located on the northeastern side of the Project Area are surrounded by dense vegetation.

Additional viewpoints:

The Technical Supplement states: "*Additional viewpoints should be considered if ancillary infrastructure, such as substations, have the potential to cause impacts beyond the distances prescribed in the tool.*" (DPE, 2022b). It should be noted that the viewpoints selected for assessment also consider the proposed BESS and substation location options however it is noted that this will be assessed once ancillary infrastructure layout has been confirmed.



Public Viewpoint Locations

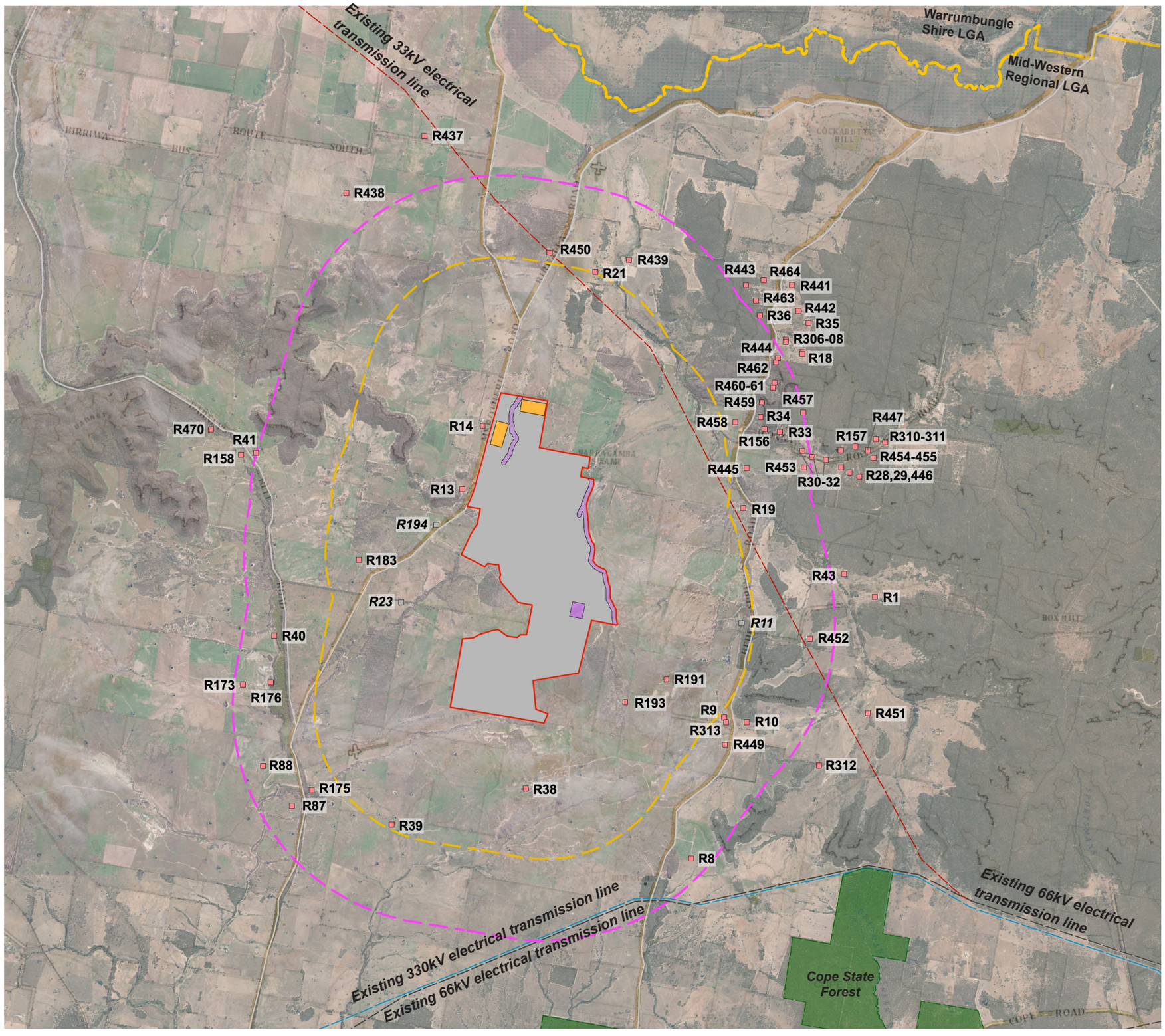
Narragamba Solar Project

LEGEND

- Project Area
- Development Footprint
- Potential area of BESS and substation
- Restricted development area
- 2.5 km from the nearest Solar Array Panel
- 4 km from the nearest Solar Array Panel
- Existing 33 kV electrical transmission line
- Existing 66 kV electrical transmission line
- Existing 330 kV electrical transmission line
- Main Road
- Local Road
- Creeks and Gully Channels
- LGA boundary
- State Forest
- Ridgelines
- VP01 Public Road Viewpoint Locations

0 1 2 3 4km

Figure 4 Public Viewpoint Locations (Map Source: ESRI Imagery 2023; Six Maps, Apr 2011)



Private Viewpoint Locations

Narragamba Solar Project

LEGEND

- Project Area
- Development Footprint
- Non-Associated Residences
- Associated Residences
- Potential area of BESS and substation
- Restricted development area
- 2.5 km from the nearest Solar Array Panel
- 4 km from the nearest Solar Array Panel
- Existing 33 kV electrical transmission line
- Existing 66 kV electrical transmission line
- Existing 330 kV electrical transmission line
- Main Road
- Local Road
- Creeks and Gully Channels
- LGA boundary
- State Forest
- Ridgelines

0 1 2 3 4km

Figure 5 Private Viewpoint Locations (Map Source: ESRI Imagery 2023; Six Maps, Apr 2011)

6.3 Viewshed Mapping

A viewshed map identifies all areas from which a project may be viewed. Viewshed mapping can be achieved by using geographic information systems (GIS) that account for topography and line of sight between viewpoints and the project.

The purpose of the viewshed map is to further eliminate the need to assess viewpoints that fall below the lines in the Preliminary Assessment Tool if the analysis shows there is intervening terrain that would block line of sight to a particular viewpoint.

Viewshed mapping was undertaken for the Project to eliminate viewpoint locations that will not have a line of sight to the Project (refer to **Figure 6** and **7**). It is important to note that the viewshed map provides an assessment based on topography alone and does not take into account intervening elements such as vegetation and structures. The viewshed map, therefore, represents a theoretical worst case scenario.

Viewshed mapping has been undertaken based on a maximum panel height of 5 m.

Summary of Viewshed Map:

The following provides a summary of the viewshed map prepared for the Study Area:

- Due to the flat to gently undulating terrain within the Study Area and its surrounds, the viewshed map indicates that the Project may be visible, theoretically to varying degrees, in areas surrounding the Project.
- Views towards a larger proportion of the Project may theoretically be available to the immediate north, south, and north east of the Project as well as an area to the immediate west of the Project.
- The viewshed map indicates that areas to the east, north west and south west may experience views of between 1-25% of the Project.
- Approximately 28 non-associated residences surrounding the Project may have the potential to view the Project. The remaining seven (7) non-associated residences will not be able to view the Project.
- The northern stretch of Merotherie Road, where it intersects with Birkalla Road, and the central section of Merotherie Road that runs adjacent to the Project Area may have the potential to view the majority of the Project. Locations along the northern section of Blue Springs Road may also view the majority of the Project.
- Areas further to the west (near Barneys Reef Road and the southern sections of Blue Springs Road) are not likely to have any views due to topographical changes.

6.4 Reverse Viewshed Mapping

The Technical Supplement states: "*The applicant should also consider undertaking a reverse viewshed analysis. This can be a useful tool to refine the project design process to reduce any significant impacts. It can also be used to communicate the visibility of certain parts of the project and aid consultation with the community. This analysis should be used to highlight parts of the project that can be seen from the greatest number of viewpoints"* (DPE, 2022b).

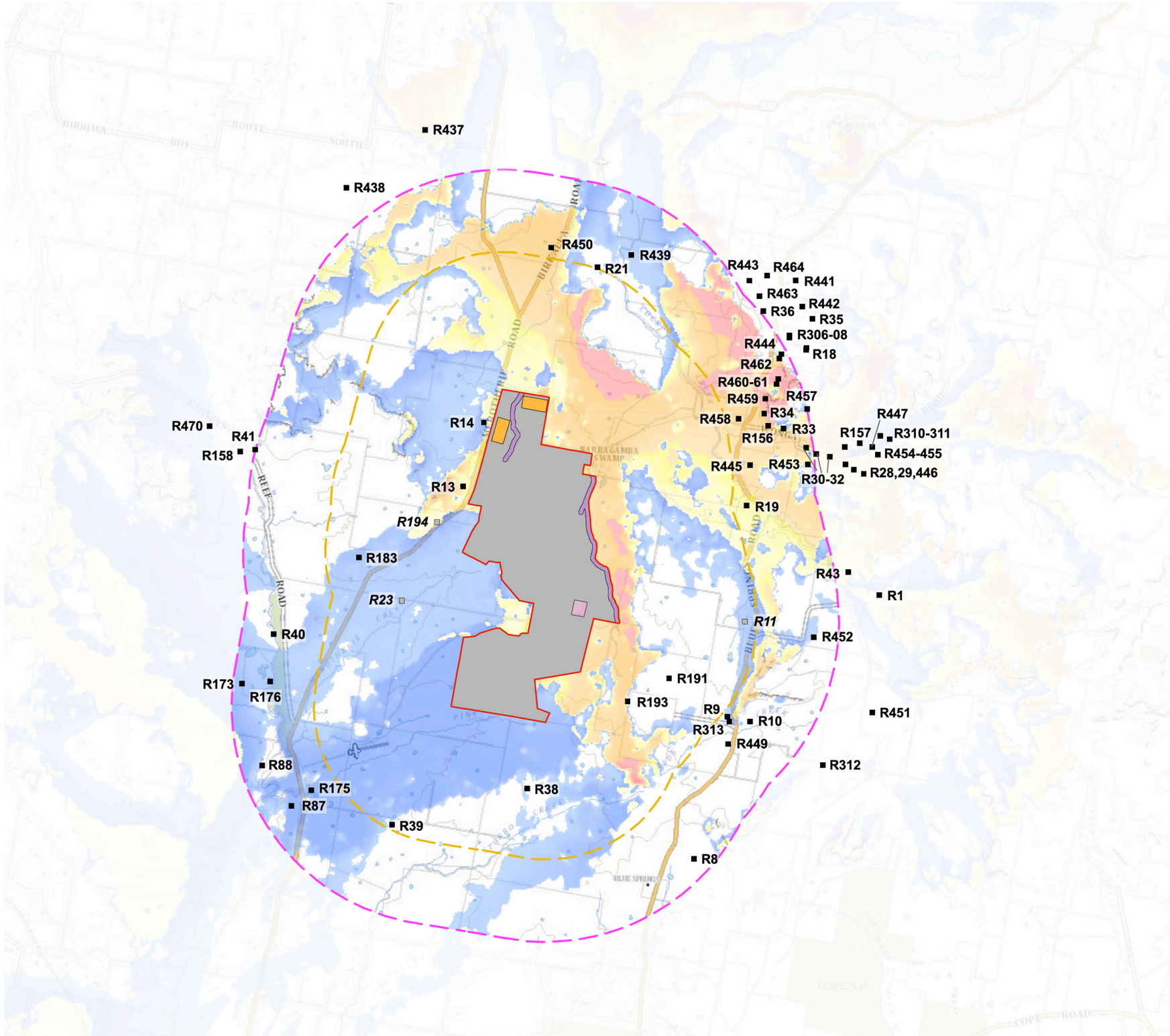
Figure 8 represents a reverse viewshed map that takes into account a total of 35 non-associated residences located within 4 km of the Project Area. This figure shows parts of the Project Area that are likely to be visible from these non-associated residences. This assessment also represents a bare ground scenario, i.e., a landscape without intervening elements such as vegetation and structures.

Summary of Reverse Viewshed Map:

The following provides a summary of the reverse viewshed map prepared for the Project Area:

- Theoretically, the majority of the Project Area may be visible from surrounding dwellings. The highest visibility may be towards the central area of the Project.
- Approximately eight (8) residences may theoretically view the southern/south eastern areas of the Project due to existing topographical conditions.

It is important to reiterate that the preliminary assessment is based on theoretical worst case scenario and does not consider the impact of vegetation or structures. Ground-truthing during field work will ascertain potential visibility by taking into account structures and vegetation.



Private Receptor Viewshed Map

Narragamba Solar Project

LEGEND

- Project Area
- Development Footprint
- Non-Associated Residences
- Associated Residences
- 2.5 km from the nearest Solar Array Panel
- 4 km from the nearest Solar Array Panel
- Main Road
- Local Road
- Creeks and Gully Channels
- Ridgelines
- Potential area of BESS and substation
- Restricted development area

Viewshed Map (Based on 5.0 m Panel Height)

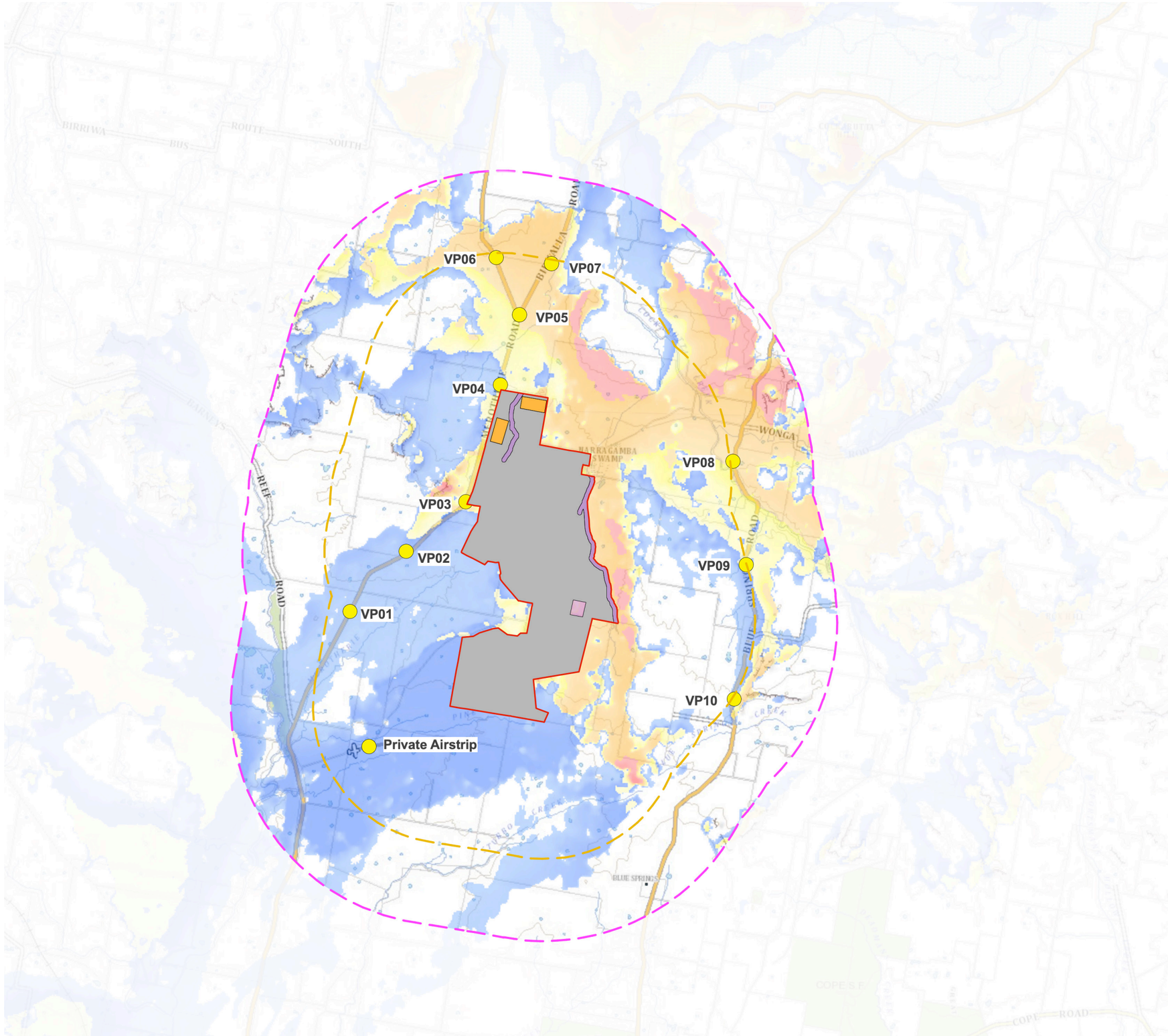
- No Visibility
- 1 - 25% Visibility
- 25 - 50% Visibility
- 50 - 75% Visibility
- 75 - 100% Visibility

NOTE

Viewshed Map is a preliminary assessment tool that represents a bare ground scenario - ie. a landscape without screening, structures or vegetation. As accurate information on the height and coverage of vegetation and buildings is unavailable, it is important to note the map is based solely on topographic information. Therefore this form of mapping should be acknowledged as representing the worst case scenario.

0 1 2 3 4km

Figure 6 Private Receptor Viewshed Map (Map Source: Six Maps, Apr 2011)



Public Receptor Viewshed Map

Narragamba Solar Project

LEGEND

- Project Area
- Development Footprint
- 2.5 km from the nearest Solar Array Panel
- 4 km from the nearest Solar Array Panel
- Main Road
- Local Road
- VP01 Public Road Viewpoint Locations
- Creeks and Gully Channels
- Ridgelines
- Potential area of BESS and substation
- Restricted development area

Viewshed Map (Based on 5.0 m Panel Height)

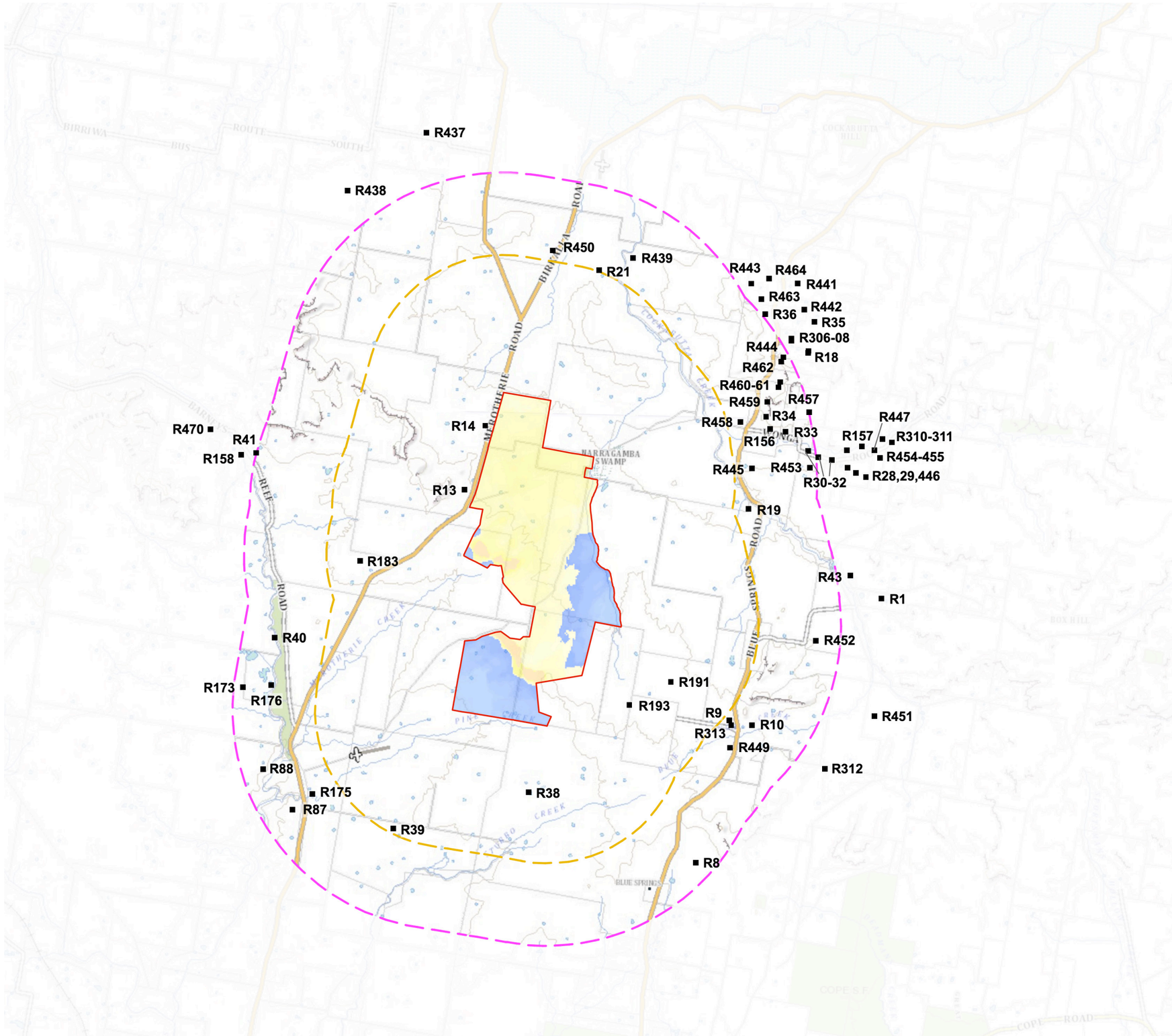
- No Visibility
- 1 - 25% Visibility
- 25 - 50% Visibility
- 50 - 75% Visibility
- 75 - 100% Visibility

NOTE

Viewshed Map is a preliminary assessment tool that represents a bare ground scenario - ie. a landscape without screening, structures or vegetation. As accurate information on the height and coverage of vegetation and buildings is unavailable, it is important to note the map is based solely on topographic information. Therefore this form of mapping should be acknowledged as representing the worst case scenario.

0 1 2 3 4km

Figure 7 Public Receptor Viewshed Map (Map Source: Six Maps, Apr 2011)



Reverse Viewshed Map

Narragamba Solar Project

LEGEND

- Project Area
- Non-Associated Residences
- 2.5 km from the nearest Solar Array Panel
- 4 km from the nearest Solar Array Panel
- Main Road
- Local Road
- Creeks and Gully Channels
- Ridgelines

Reverse Viewshed Map (Based on 5.0 m Panel Height)

- No Visibility
- 1 - 8 residences visible
- 9 - 18 residences visible
- 19 - 28 residences visible
- 29 - 38 residences visible

NOTE

Viewshed Map is a preliminary assessment tool that represents a bare ground scenario - ie. a landscape without screening, structures or vegetation. As accurate information on the height and coverage of vegetation and buildings is unavailable, it is important to note the map is based solely on topographic information. Therefore this form of mapping should be acknowledged as representing the worst case scenario.

0 1 2 3 4km

Figure 8 Reverse Viewshed Map (Map Source: Six Maps, Apr 2011)

6.5 Vertical Field of View Calculation

As stated in the Technical Supplement, **Figure 9** below illustrates the method of calculation for the relative height difference for each viewpoint location. Plotting viewpoints on **Figure 11** and **12** quantifies the vertical field of view combining the receptor distance and the relative height difference.

Project located above and below viewpoint (a - c)

Project located above viewpoint (a - b)

Project located below viewpoint (b - c)

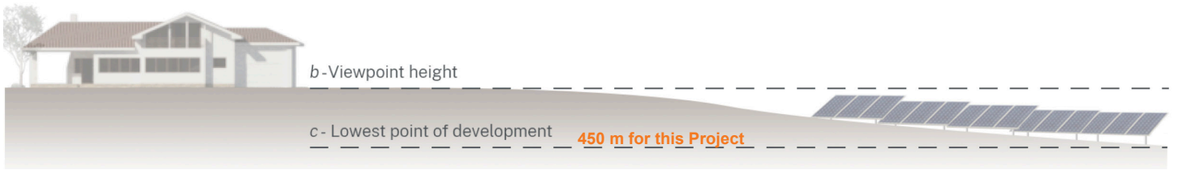


Figure 9 Relative Height Difference Calculation (Source: DPE, 2022b)

6.6 Horizontal Field of View Calculation

As stated in the Technical Supplement, **Figure 10** below illustrates the method of calculation for the horizontal field of view for each viewpoint location. The findings of these calculations can be found in **Table 4** and **Table 5**.

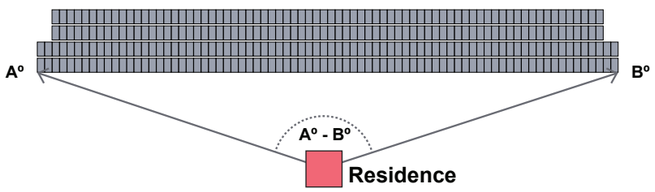


Figure 10 Horizontal Field of View (Source: Moir LA, 2023)

6.7 Assessment Requirements

Table 3 below demonstrates the vertical and horizontal field of views matrix as per the Guideline (DPE, 2022b). The matrix has been used to determine whether a detailed visual assessment for each viewpoint is required. The results of which can be found in **Table 4** and **Table 5.**

Horizontal field of view of project	1º vertical field of view	2º vertical field of view	3º vertical field of view	4º + vertical field of view
1 - 10º	No assessment required	No assessment required	No assessment required	No assessment required
11 - 20º	No assessment required	No assessment required	No assessment required	Assessment required
21 - 30º	No assessment required	No assessment required	Assessment required for all viewpoints except road / rail	Assessment required
31 - 40º	No assessment required	Assessment required for all viewpoints except road / rail	Assessment required for all viewpoints except road / rail	Assessment required
41 - 50º	No assessment required	Assessment required for all viewpoints except road / rail	Assessment required	Assessment required
51 - 60º	No assessment required	Assessment required for all viewpoints except road / rail	Assessment required	Assessment required
61 - 70º	No assessment required	Assessment required	Assessment required	Assessment required
71 - 130º	Assessment required for all viewpoints except road / rail	Assessment required	Assessment required	Assessment required
130º+	Assessment required	Assessment required	Assessment required	Assessment required

Table 3 Preliminary Visual Assessment Tool - Assessment Requirements (Source: Technical Supplement, DPE, 2022)

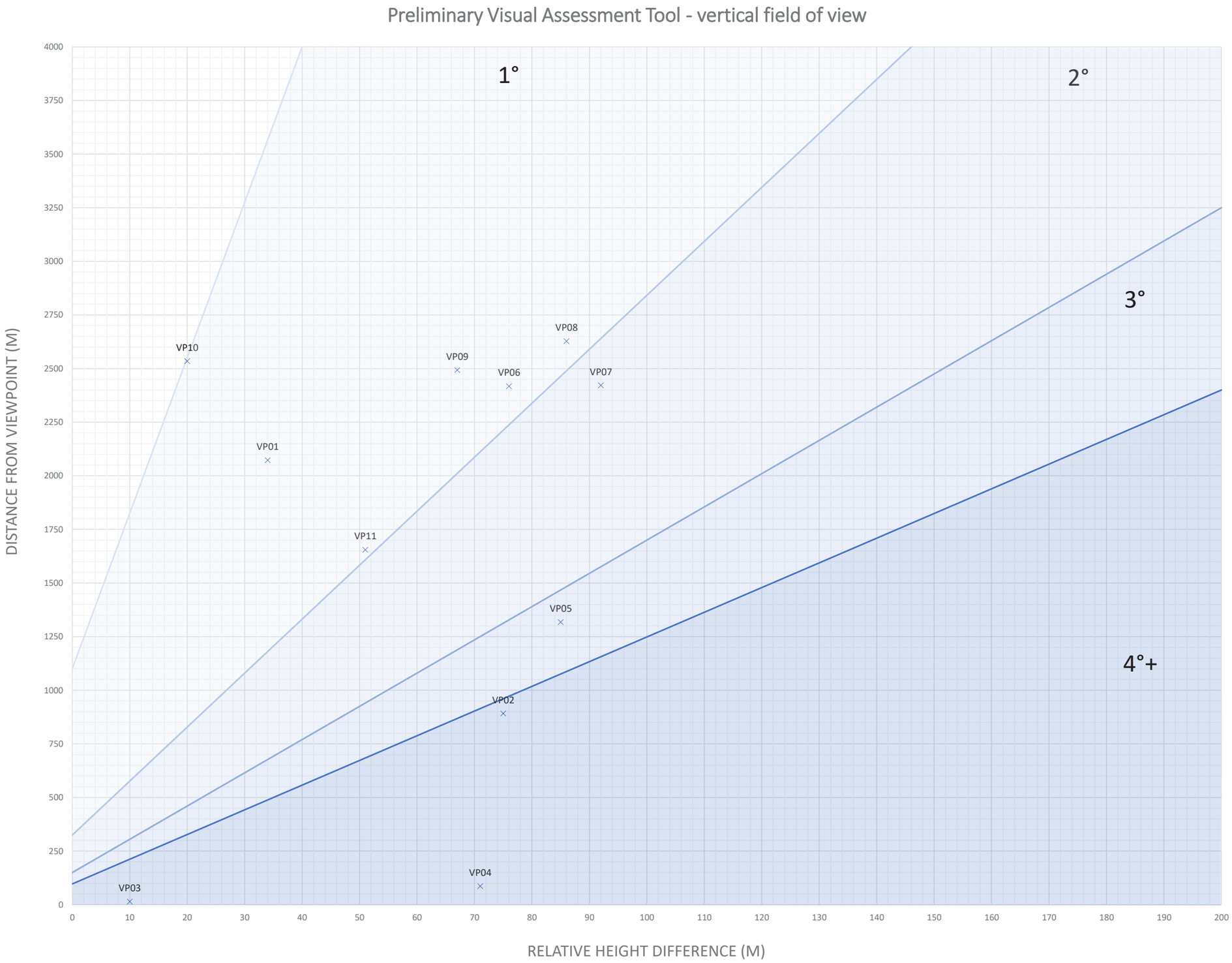


Figure 11 Preliminary Assessment Tool public viewpoint locations – vertical field of view (Source: DPE, 2022b)

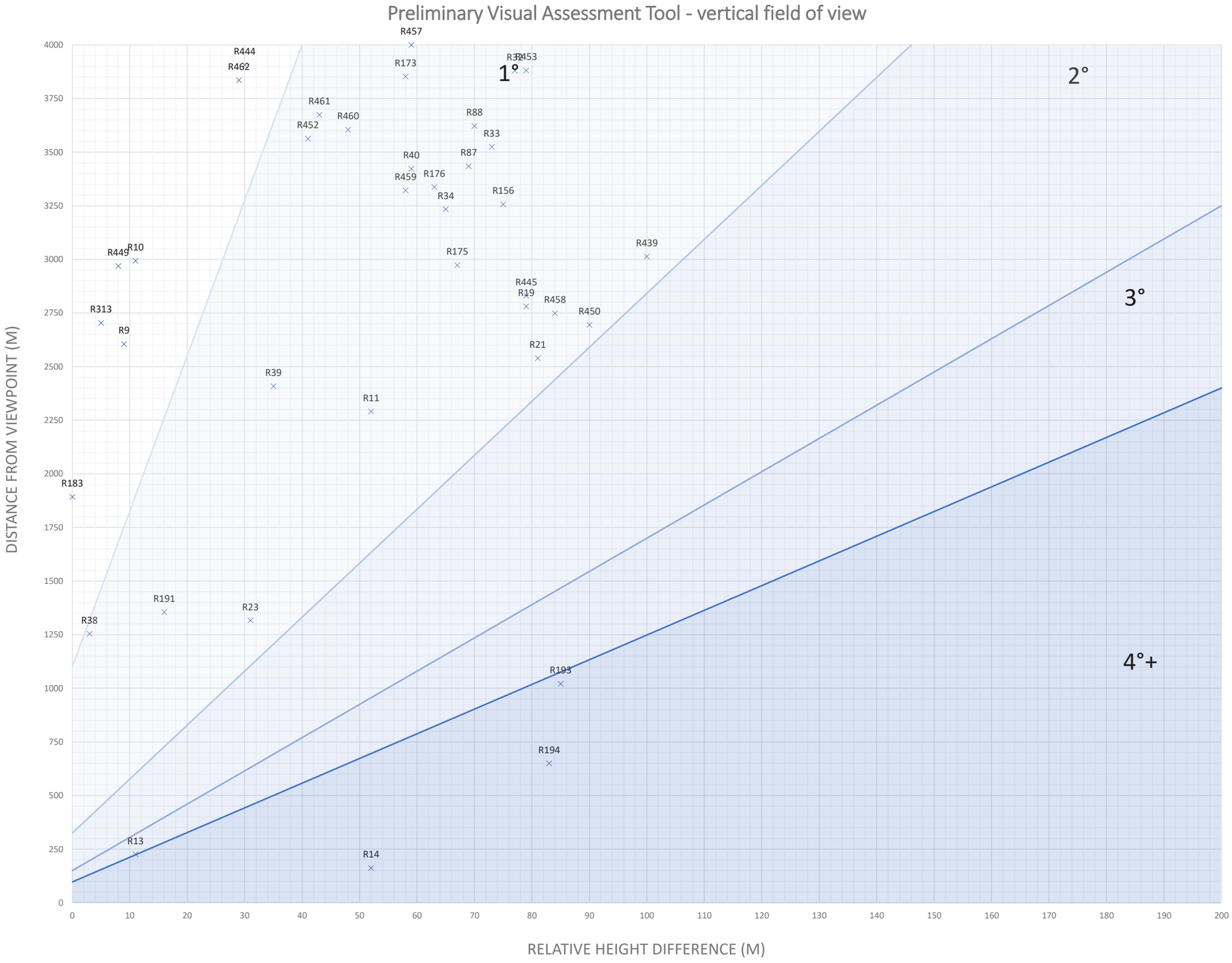


Figure 12 Preliminary Assessment Tool Residences – vertical field of view (Source: DPE, 2022b)

6.8 Results of Preliminary Assessment Tool

The preliminary assessment tool identifies viewpoints (public and private) within 4 km of the Project Area. Application of the preliminary assessment tool identified that of the 38 residences assessed within 4 km of the Project Area, six (6) residences will require further detailed assessment. Of these, five (5) residences are identified as non-associated residences and one (1) residence is currently identified as associated residence (R194).

Additionally, 11 public receptors were identified of which four (4) would require further detailed assessment in the LVIA. **Tables 4 and 5** provide a summary of these results.

Public Viewpoints:								
Receptor ID:	**Distance to nearest: panel (m):**	**Elevation of receptor (m):**	**Relative Height Difference (m):**	**Vertical field of view:**	**Horizontal extent of view:**	**Horizontal field of view:**	**Visible based on viewshed mapping:**	**Detailed Assessment Required?:**
VP01	2073	489	34	**1º**	133º - 33º	**100º**	YES	**NO**
VP02	890	525	75	**4º**	165º - 27º	**138º**	YES	**YES**
VP03	15	513	10	**4º**	183º - 16º	**167º**	YES	**YES**
VP04	87	452	71	**4º**	195º - 106º	**89º**	YES	**YES**
VP05	1318	439	85	**3º**	195º - 151º	**44º**	YES	**YES**
VP06	2418	447	76	**1º**	185º - 154º	**31º**	YES	**NO**
VP07	2422	432	92	**2º**	200º - 167º	**33º**	YES	**NO**
VP08	2628	438	86	**1º**	287º - 215º	**72º**	YES	**NO**
VP09	2493	457	67	**1º**	309º - 231º	**78º**	YES	**NO**
VP10	2535	504	20	**1º**	328º - 262º	**66º**	YES	**NO**
VP11 Private Airstrip	1655	472	51	**1º**	80º - 19º	**61º**	YES	**NO**

Table 4 Results of Preliminary Viewpoint Assessment (public viewpoint locations)

Residential Viewpoints:										
Receptor ID:	**Distance to nearest: panel (m):**	**Elevation of receptor (m):**	**Relative Height Difference (m):**	**Vertical field of view:**	**Horizontal extent of view:**			**Horizontal field of view:**	**Visible based on viewshed mapping:**	**Detailed Assessment Required?:**
R9	2605	514	9	**0º**	331º	-	267º	**64º**	YES	**NO**
R10	2994	512	11	**0º**	328º	-	269º	**59º**	NO	**NO**
R11 (Associated)	2291	471	52	**1º**	318º	-	242º	**76º**	YES	**NO** *(identified as associated residence)*
R13	226	512	11	**3º**	182º	-	21º	**161º**	YES	**YES**
R14	162	471	52	**4º**	189º	-	29º	**160º**	YES	**YES**
R19	2781	445	79	**2º**	297º	-	222º	**75º**	YES	**YES**
R21	2538	442	81	**1º**	216º	-	175º	**41º**	NO	**NO**
R23 (Associated)	1317	492	31	**1º**	153º	-	24º	**129º**	YES	**NO** *(identified as associated residence)*
R32	3880	446	77	**1º**	280º	-	222º	**58º**	YES	**NO**
R33	3525	451	73	**1º**	277º	-	218º	**59º**	YES	**NO**
R34	3234	459	65	**1º**	274º	-	213º	**61º**	YES	**NO**
R38	1254	520	3	**0º**	316º	-	28º	**288º**	NO	**NO**
R39	2409	488	35	**1º**	55º	-	12º	**43º**	NO	**NO**
R40	3422	464	59	**1º**	111º	-	42º	**69º**	NO	**NO**
R156	3257	448	75	**1º**	276º	-	215º	**61º**	YES	**NO**
R183	1893	523	0	**0º**	147º	-	39º	**108º**	YES	**NO**
R191	1355	508	16	**1º**	340º	-	250º	**90º**	NO	**YES**

Table 5 Results of Preliminary Viewpoint Assessment (residences)

Residential Viewpoints:										
Receptor ID:	**Distance to nearest: panel (m):**	**Elevation of receptor (m):**	**Relative Height Difference (m):**	**Vertical field of view:**	**Horizontal extent of view:**			**Horizontal field of view:**	**Visible based on viewshed mapping:**	**Detailed Assessment Required?:**
R193	1021	535	85	**3º**	352º	-	255º	**97º**	YES	**YES**
R194 (Associated)	650	533	83	**4º**	174º	-	25º	**149º**	YES	**YES** *(if identified as a non-associated residence in the EIS phase. No if associated residence)*
R313	2704	518	5	**0º**	331º	-	268º	**63º**	YES	**NO**
R439	3014	424	100	**1º**	222º	-	181º	**41º**	YES	**NO**
R444	3906	493	30	**0º**	261º	-	205º	**56º**	NO	**NO**
R445	2831	444	79	**1º**	277º	-	227º	**50º**	YES	**NO**
R449	2969	515	8	**0º**	336º	-	276º	**60º**	NO	**NO**
R450	2695	433	90	**1º**	198º	-	162º	**36º**	YES	**NO**
R452	3563	483	41	**1º**	311º	-	254º	**57º**	NO	**NO**
R453	3881	444	79	**1º**	283º	-	222º	**61º**	NO	**NO**
R457	4000	464	59	**1º**	272º	-	219º	**53º**	YES	**NO**
R458	2749	439	84	**1º**	276º	-	209º	**67º**	YES	**NO**
R459	3322	466	58	**1º**	271º	-	212º	**59º**	YES	**NO**
R460	3605	476	48	**1º**	267º	-	212º	**55º**	YES	**NO**
R461	3674	480	43	**1º**	266º	-	212º	**54º**	YES	**NO**
R462	3836	494	29	**0º**	262º	-	210º	**52º**	YES	**NO**
R87	3435	454	69	**1º**	70º	-	26º	**44º**	YES	**NO**
R88	3622	453	70	**1º**	80º	-	31º	**49º**	YES	**NO**
R173	3853	465	58	**1º**	96º	-	40º	**50º**	YES	**NO**
R175	2973	456	67	**1º**	72º	-	24º	**48º**	YES	**NO**
R176	3337	460	63	**1º**	97º	-	37º	**40º**	YES	**NO**

Table 5 Results of Preliminary Viewpoint Assessment (residences - Continued)

7.0 Cumulative Visual Impacts

7.1 Overview of Potential Cumulative Impacts

The Project is located within the Central West Orana - Renewable Energy Zone region. The existing landscape character allows optimum harvest of renewable energy and as such, over time this region has been utilised for the development of renewable energy projects. **Figure 13** shows four (4) renewable energy projects that are currently proposed and under construction within the 10 km of the Project.

7.2 Nearby Large-Scale Renewable Energy Projects

Name of Project	*Distance to Project Area*	*Current Status*
Stubbo Solar and Battery project	Adjacent (shared boundary)	Construction
Barneys Reef Wind Farm	Adjacent (shared boundary to the west and north)	SEARs issued (September 2021)
Birriwa Solar and Battery project	Approx. 4 km north-west	Response to Submissions Phase
Tallwang Solar Farm	Approx. 10 km south-west	Response to Submissions Phase

Table 6 Nearby Renewable Energy Projects (based on information available on *NSW Major Projects website*)

Stubbo Solar and Battery project (SSB) is an approved solar project located to the immediate south of the Project. DPE granted consent for the construction, development and operation of a 400 MW solar farm, potential 200 MW-hour (MWh) BESS and associated infrastructure in June 2021 (UPC Renewables Pty Ltd, 2021 and DPE, 2023). There may be opportunities to view SSB and the Project simultaneously from areas to the west and east of the Project. Cumulative impacts of the SSB and the Project will be assessed in detail during the EIS Phase.

Barneys Reef Wind Farm (BRWF) is a proposed wind farm located to the immediate west of the Project. BRWF's preliminary layout includes construction, development and operation of a wind farm to generate up to 441 MW, a BESS and associated infrastructure (Umwelt Pty Ltd, 2021). SEARs were issued for this project in September 2021 and the EIS is currently being prepared (DPE, 2023). There are likely to be opportunities to view BRWF and the Project simultaneously. The cumulative impacts of BRWF and the Project will be assessed in detail during the EIS Phase.

Birriwa Solar and Battery project (BSP) is a proposed solar project located approximately 4 km north-west of the Project. BSP's preliminary layout includes construction, development and operation of a solar farm to generate up to 600 MW, potential 1200 MWh BESS and associated infrastructure (ACEN Australia Pty Ltd, 2022). This project is currently in the Response to Submissions phase (DPE, 2023). There is likely to be limited opportunity to view BSP and the Project simultaneously due to the distance and scale of the Projects.

Tallawang Solar Farm (TSF) is a proposed solar farm located approximately 10 km south-west of the Project. TSF's proposed layout includes construction, development and operation of a solar farm to generate up to 500 MW, 200/400 MW-hour (MWh) BESS and associated infrastructure (Umwelt Pty Ltd, 2022). This project is currently in the Response to Submissions phase (DPE, 2023). It is likely that TSF and the Project will not be visible simultaneously due to the distance and scale of the Projects.

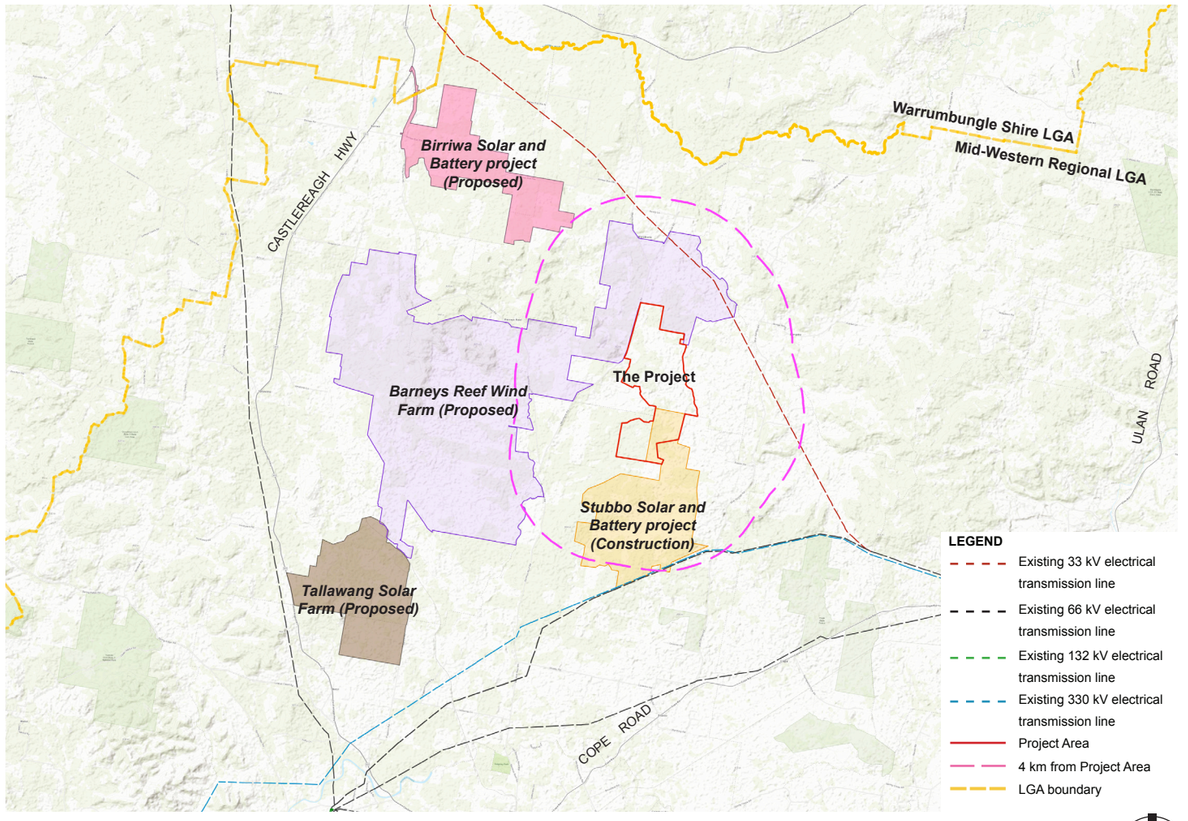


Figure 13 Nearby Large-Scale Renewable Projects (Map Source: ESRI Imagery 2023; Info source: Major Projects 2023)

7.3 Cumulative Impact on Broader Landscape Character

Re-occurrence of renewable energy projects has the potential to alter the perception of the overall landscape character irrespective of being viewed in a single viewshed. It is important to determine whether the effect of major infrastructure projects within the region would combine to become the dominant visual element, altering the perception of the general landscape character.

With respect to the Project, it is unlikely that TSF would be visible from the Project Area because of the distance between the Projects. There may be limited opportunities to view the Project in combination with BSP. There is likely to be opportunities to view the Project in combination with BRWF and SSB due to proximity.

Further assessment of the cumulative visual impact will be detailed in the EIS, along with potential mitigation and management measures that can be employed to reduce impacts.

8.0 Summary & Next Steps

8.1 Summary of Findings

A preliminary desktop assessment identified three (3) existing LCZ's within the Study Area. This will form a precursory baseline for character assessment to be assessed in detail in the EIS phase.

The preliminary visual assessment considered 2.5 km and 4 km buffers from the Project Area in order to identify preliminary visual impacts in accordance with the Guideline and the Technical Supplement. A total of 11 public viewpoints were selected to represent roads within 2.5 km of the Project Area. 38 residences, including 35 non-associated residences and three (3) associated residences were identified within 4 km of the Project.

In accordance with the Guideline and Technical Supplement, a preliminary viewshed map was prepared for the Project. This demonstrated that due to the flat to gently undulating terrain within the Study Area and its surrounds the Project may theoretically be visible, to varying degrees, in areas surrounding the Project. Generally, views towards a larger proportion of the Project may be available to the immediate north, south, and north east of the Project as well as an area to the immediate west of the Project. Areas to the east, north west and south west may have the potential to experience views of between 1-25% of the Project.

A preliminary reverse viewshed map was undertaken for the region located within 4 km of the Project Area. This found that the majority of the Project Area may have the potential to be visible from surrounding dwellings. The central area of the Project may have the highest visibility to the surrounding dwellings.

Application of Preliminary Assessment Tools indicated that six (6) residences within 4 km would require detailed assessment in the EIS phase. Of these, five (5) have been identified as non-associated residences and one (1) residence is currently associated with the Project. Additionally, four (4) public viewpoints would require detailed assessment in the EIS phase. A preliminary desktop analysis identified that intervening vegetation surrounding nearby residences, especially around dwellings located to the northeast of the Project Area and along public roads may assist in limiting the potential views of the Project. Further detailed assessment and ground-truthing will be undertaken in the EIS phase of the Project to confirm potential visual impacts from identified residences and viewpoint locations, where a detailed summary of the potential visual impacts will be provided as apart of the LVIA.

Further assessment of the cumulative visual impact from nearby large-scale developments will be detailed in the EIS, along with potential mitigation and management measures to reduce potential impacts.

8.2 Next Steps

An LVIA will be prepared in accordance with the Guideline and the Technical Supplement. During the preparation of the LVIA, detailed site investigations will be undertaken from areas identified in the preliminary assessment as having potential visibility towards the Project. This process will be undertaken using the procedures outlined in the following Guidelines:

- Large-Scale Solar Energy Guideline (DPE, 2022)
- Technical Supplement Landscape and Visual Impact Assessment - Large-Scale Solar Energy Guideline (DPE, 2022)
- Environmental Planning and Assessment Regulation (NSW Government, 2023)
- Mid-Western Regional Local Environmental Plan (LEP) 2012 (Mid-Western Regional Council, 2012)
- State Environmental Planning Policy (Transport and Infrastructure) 2021 (NSW Government, 2023)

The LVIA will include the development of a landscape character study that will be used as a baseline to assess the impact of the Project on the identified character areas and key landscape features.

The LVIA will also include an assessment of the landscape and visual impacts resulting from all associated infrastructure and ancillary structures. Specialised modelling tools, visualisations (including photomontages), public viewpoint analysis and dwelling assessments will be developed to illustrate potential visual impacts of the Project from key viewpoints identified through this report. Site inspections will be undertaken from key viewpoints identified as requiring further assessment in this PVIA.

A Glint and Glare Assessment using industry standard methodology will be undertaken and assessed.

Community consultation will be ongoing to develop an understanding of the community's landscape values.

The cumulative impacts of surrounding renewable energy projects will be assessed in the LVIA in order to identify impacts on the broader landscape character of the region.

On-site and off-site visual landscape mitigation strategies will be developed in response to the assessment and community consultation. The purpose of the mitigation strategies will be to ensure the Project is integrated into the existing landscape.

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