



# Bookaar Solar Farm Landscape & Visual Impact Assessment

**FINAL**

## Landscape & Visual Impact Assessment

9<sup>th</sup> July 2018

**Tract**  
**Tract**  
**Landscape Architects**  
**Urban Designers**  
**Town Planners**

Tract Consultants Pty Ltd  
Landscape Architects, Urban Designers, Town Planners  
Level 6, 6 Riverside Quay, Southbank, Victoria, Australia 3006  
p. 03 9429 6133  
[melbourne@tract.net.au](mailto:melbourne@tract.net.au)  
Reference: 0318-0077  
Contact Mark Reilly / Ata Tara

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<i>Reviewed By</i>	<i>Mark Reilly</i>
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## Glossary of Technical Terms

<i>Analysis</i>	Process of breaking down landscape or visual attributes into component parts to understand how it is made or valued.
<i>Assessment</i>	General term for description, classification and analysis of landscape or visual attributes.
<i>Classification</i>	A process of sorting the landscape into different types using selected criteria, but without attaching relative values to the different kinds of landscape.
<i>Community</i>	A group with shared culture, traditions and activities based within a defined locality.
<i>Community values</i>	Commonly held perceptions and values that the community attach to environmental attributes or qualities.
<i>Cumulative effect</i>	Collective impact of past, present and foreseeable future effects and actions.
<i>Designated landscape</i>	A landscape area formally listed by government as a park, reserve or area with valuable natural or cultural attributes and specific management requirements.
<i>DTM / DEM</i>	Digital Terrain Model / Digital Elevation Model, a 3-dimensional model of the land surface (with or without trees and buildings) generated by computer from contour, survey or remote sensing data.
<i>Duration of effects</i>	Measure of both time and the reversibility of effects.
<i>Effect</i>	A consequence of change.
<i>Enhancement</i>	Landscape improvement through restoration, reconstruction or mitigating action.
<i>Field of View</i>	Field of View (FOV) is the extent of the observable landscape. Human FOV is defined as 124° horizontal - 55° vertical
<i>Glare</i>	Excessively bright light or high visual contrast that causes visual discomfort to viewers or interferes with the ability to see objects clearly.
<i>Glint</i>	Momentary flashes of light
<i>Impact</i>	A positive or negative change to the landscape or the visual environment.
<i>Indirect impact</i>	Secondary impacts on the environment that occur away from the development site, as a direct result of the new development.
<i>Intervisibility</i>	Situation where an area is subject to overlapping visibility from more than one visual receptor
<i>Landscape</i>	A distinctive physical area as perceived by people, whose character is the result of the action and interaction of natural and / or human factors. Human perception of the land conditioned by knowledge and identity with a place.
<i>Landscape assessment</i>	Deals with the potential effects on the quality of the landscape setting, considered as an environmental resource, independent of views of that landscape.
<i>Landscape character</i>	A distinct and recognisable pattern of landscape elements or characteristics that occur consistently in a particular type of landscape.
<i>Landscape Character Type (LCT)</i>	A broad categorisation of landscape character, generally based on a geographic basis using topography, land cover and land use
<i>Landscape quality</i>	A judgement about the relative physical condition of an area, related to its intactness, character and visual, functional and ecological condition.
<i>Landscape sensitivity</i>	The extent to which a landscape can change without unacceptable adverse effects on its landscape character.
<i>Landscape value</i>	The relative value or importance attached to a landscape, which expresses agreed community values because of its quality, scenic beauty, tranquillity, wildness, cultural associations, conservation or other special value.
<i>Magnitude of effect</i>	Combination of scale, extent and duration of an effect
<i>Mitigation</i>	Measures to avoid, reduce or compensate for adverse landscape and visual effects.
<i>Perception of landscape</i>	The psychology of seeing and potentially attaching value or meaning to a landscape

<b><i>Receptor</i></b>	A physical landscape resource, viewer or special element that will experience an effect as a result of change. A place, route, viewer group or interest group which may experience an effect.
<b><i>Scenic</i></b>	Attractive scenery, particularly combinations of landscape features and elements which appear 'composed' similar to landscape paintings.
<b><i>Scenic quality</i></b>	A relative judgement, based on common community perceptions, about the visual qualities associated with a landscape type or character area.
<b><i>Sense of place</i></b>	A relative judgement, based on common community perceptions, about the essential character and spirit of an area.
<b><i>Sensitivity</i></b>	The extent to which changes in landscape and visual resources can accept change without unacceptable, adverse effects on its character.
<b><i>Sensory characteristics</i></b>	Perceptual characteristics or capacities that underpin a person's ability to view, comprehend and respond to the landscape.
<b><i>Significance</i></b>	A relative measure of the importance of a landscape or visual change against a defined value system
<b><i>Viewshed</i></b>	A region visible to an observer, defined by reference to an actual view or area of theoretical visibility determined by a ZVI analysis.
<b><i>Visualisation</i></b>	A computer simulation, photomontage or technique to illustrate the appearance of a proposed development.
<b><i>Visual absorption capability</i></b>	The capacity of the landscape to absorb change (usually development-related), without significant detriment to its landscape values (character, scenic quality and integrity). VAC is a function of both slope and vegetation screening capacity.
<b><i>Visual amenity</i></b>	The value of a particular area or view in terms of what is seen.
<b><i>Visual assessment</i></b>	Deals with potential effects on the visual resources of the setting from changes in the composition and quality of views, people's response to likely changes and the overall effect on visual amenity.
<b><i>Visual sensitivity</i></b>	The extent to which a landscape can change without unacceptable adverse effects on its visual character or scenic quality.
<b><i>Zone of Visual Influence</i></b>	An area within which a proposed development may be visible and have an effect on visual amenity (ZVI).

## Agreed Terminology

Following terminology has been agreed with the project team and followed throughout this report.

<b><i>Proposal</i></b>	The proposed solar farm including solar arrays and electrical transmission infrastructure at Bookaar
<b><i>Property</i></b>	The entire landholding known as 520 Meningoort Road, Bookaar
<b><i>Site</i></b>	The part of the Property that encompasses the solar farm.
<b><i>Development Footprint</i></b>	The net developable area available for the proposal which excludes any areas of constraints.
<b><i>Study Area</i></b>	The study area extending up to 20km radius from the centre of the Site was defined for the desktop study



# Executive Summary

## Introduction & Method

The report provides a technical evaluation of the potential landscape and visual effects associated with the proposed solar farm including solar arrays and electrical transmission infrastructure, at Bookaar, in western Victoria, which is referred to in this report as 'the Proposal'.

The Proposal is located on approximately 605 hectares of rural land 12.5 km northwest of Camperdown Township. The designated area for the Proposal, herein referred to as the Site, is part of a broader site area which is referred to as the Property. The Property is the entire landholding known as 520 Meningoort Road, Bookaar.

This LVIA covers both 'landscape' and 'visual' assessment within the Study Area:

The **landscape assessment** deals with the potential effects on the character and quality of the landscape setting, considered as an environmental resource, independent of views of that landscape.

The **visual impact assessment** deals with potential effects on the visual resources of the setting from changes in the composition and quality of views, people's response to likely changes and the overall effect on visual amenity.

## Planning matters related to visual amenity

The planning review identified the following key considerations in relation to the visual amenity:

- Elevated Views: The level of visibility and obtrusiveness of the Proposal within the landscape, particularly from elevated views from public vantage points external to the Site, such as views from the Camperdown Botanic Gardens and nearby residential areas (7.5km from Site), Mt Leura (12km) and Mt Elephant (26km). Refer to Figure 12.
- Impact on the surrounding landscape – Potential impact on the immediate surrounding area including visual impact from the perimeter of the Site and adjacent properties.
- Appropriate siting of the panels and associated buildings in conjunction with vegetation screening should be considered as part of an appropriate response to the immediate context. Other potential impacts such as glint, light spill, and electromagnetic interference should also be addressed via various supporting technical assessments or by the planner in the planning report where impacts are considered minor.
- Heritage – Any potential impact on the heritage values of the Meningoort Homestead. The LVIA should be prepared in conjunction with a heritage consultant and a visual assessment undertaken as to how the appearance of the solar panels may impact on the appearance of the homestead and surrounds, as relevant to those features of the homestead that are listed as being of significance. The separation of the heritage overlay and the solar farm should be maximised.

## Baseline conditions findings

The baseline analysis indicates:

- The regional **volcanic plains landscape** is characterised by relatively flat to gently undulating terrain with intermittent volcanic cones and lake formations. On a comparative basis, the landscape of the Site represents an area of relatively **low scenic quality** given its flat terrain, simple, repetitive plantation forms and the presence of a major power line easement through the centre of the site.
- The Site has a **low landscape sensitivity** due to the modified nature of the agricultural landscape and low elevation.
- Long distance (6+ km), elevated views of the site incorporate a wider range of landscape features such as volcanic cones and lakes with higher scenic quality values, but at these distances the Site becomes a smaller part of a more **complex visual landscape** that is formed by patterns of grazing land, remnant vegetation and windrow plantations. In that context, the site is not seen as a separate or distinctive landscape area.
- The **long established cultural landscape** that has developed in the Study Area and its surroundings is primarily based on grasslands with a combination of windrow plantations (native and exotic) and scattered planting. Homesteads, driveways and concentrations of outbuildings are typically surrounded by gardens and / or shelter plantings that partly separate them from their visual surroundings.
- **Meningoort Homestead** is located on an adjoining site that has designated cultural heritage and landscape values. While the homestead and its gardens are not physically affected by the Proposal, the broader rural setting plays a supporting role in the visual character and scenic quality of the homestead setting and on that basis should be specifically considered within the design of the Proposal and any visual mitigation measures.
- The Site is considered to have a **moderate visual absorption capability** based on its low elevation, relatively flat landform and shelter planting patterns.
- The site has a relatively **low level of landscape sensitivity** given its existing land use characteristics and the protection and spatial separation given to environmental and cultural heritage features.
- The visibility of the Proposal is limited due to flat landscape and an abundance of scattered trees and windbreaks
- The pattern of viewing study indicates that the Site has a relatively **high visibility potential when no vegetation is present but a significantly lower visibility potential when vegetation is considered**, particularly from flat areas nearer to the site. **Elevated landform areas have a significantly higher view potential, but these locations are at significant distances from the site (6+ km)** and in this context, it is likely to be seen as a background element and a component part of a broader landscape mosaic.

## Impact assessment – key findings

- Based on the photomontage visualisation completed from the four nominated viewpoints, **the overall impact of the Proposal on visual values is considered low.**
- The overall impacts resulting from the Proposal on visual receptors are summarised in Table 8.

**Table 8 – Summary of Impacts on Visual Receptors**

Viewpoint Location	Receptor Group	Viewer Sensitivity	Magnitude of Change Considering Glint & Glare	Visual Impact without Planting buffer	Visual Impact with Planting buffer (20m wide/ 4m high)
VP01 Darlington Road	A	Low	Low	Low	Nil
VP02 Princes Hwy	A	Moderate	No change	No impacts	Nil
VP03 Meningoort Homestead	B	High	Low	Moderate	Low & reducing over time
VP04 Camperdown Botanic Garden	C	High	Low	Low	Low

- The proposed **20m wide planting buffer will be effective** in eliminating views to the site from low elevation viewpoints over time and minimising the impacts from elevated viewpoints.
- Sensitive parts of the Property, including parts of Mount Meningoort are excluded from the Development Footprint, including the identified constraint area such as the wetlands, drainage lines (vegetation habitat protection areas) and Meningoort Road (crossing the northern part of the Development Footprint).
- The existing vegetation buffer on the perimeter of the Development Footprint is integrated within the proposed 20m wide buffer planting. The existing powerline which crosses the Development Footprint eliminates the need for a new transmission line and minimises the visual impacts associated with the Proposal. Ancillary facilities including battery, substation and telecommunication tower are located near the existing powerline and in already disturbed areas. The Proposal does not include any significant landform changes and will be limited to minimal excavations associated with the track and building construction. **The overall impacts on landscape are considered low.**
- Distant elevated viewpoints are likely to retain views of the Proposal, but at the distances involved, any land use changes within the site are likely to be seen as a part of the larger regional landscape mosaic and not as a significant adverse impact on the landscape character or scenic qualities of the location.
- With effective mitigation measures the Proposal is considered to have a low landscape impact and an overall low visual impact on the setting, including the Meningoort Homestead where planting works and existing landscape features will effectively screen any land use changes over time.
- Based on conducted assessment, the **Proposal would not represent an unacceptable impact on the regional or local landscape.**

# 1 Introduction

This Landscape and Visual Impact Assessment (LVIA) report has been prepared by Tract Consultants Pty Ltd for Bookaar Renewables Pty Ltd.

The report provides a technical evaluation of the potential landscape and visual effects associated with the proposed solar farm including solar arrays and electrical transmission infrastructure at Bookaar, in western Victoria, which is referred to in this report as 'the Proposal'.

The LVIA was required as part of the development application and is one of a suite of environmental assessments that form part of the assessment of environmental impacts for the project.

## 1.1 Site context

The Proposal is located on approximately 605 hectares of rural land 10 km northwest of Camperdown Township. The designated area for the Proposal, herein referred to as the 'Site', is part of a broader area which is referred to as the 'Property'. The Property is the entire landholding known as 520 Meningoort Road, Bookaar. Refer to **Figure 1**. The Development Footprint refers to the net developable area available for the proposal which excludes any areas of constraints. The Property is accessible from the Darlington-Camperdown Road via Meningoort Road. Refer to **Figure 2**.

Surrounding land uses are predominantly agricultural with scattered rural residential properties. The landscape character of the setting generally appears as a relatively flat volcanic plains landscape with scattered trees and windrow plantations, and some low volcanic cone landforms.

The Site is currently operating as grazing land. It is mainly flat with ground levels increasing near the Meningoort Homestead in its north-western corner. Meningoort Homestead is a heritage listed place that is sited on the south-east slope of Mount Meningoort outside the Site, directly facing Mount Leura.

The Site is an irregularly shaped block around 7km in length from north to south, and ranging in width from around 480m to around 2.8km. The average width of the site is 1.2km.

For the purpose of this LVIA, a Study Area extending up to 20km radius from the centre of the Site was defined for the desktop study. Field investigations expanded up to 28km distance from the Site in order to address potential elevated viewpoints.

## 1.2 Assessment objectives

The primary objective of this LVIA is to determine the potential visual effects of the Proposal on landscape and scenic quality values, and on people living and working in, or travelling through the landscape within and surrounding the Site.

This LVIA is also undertaken to:

- Describe and analyse existing landscape and visual attributes and their likely sensitivity to change;
- Identify potential landscape and visual receptors and their sensitivity to change;
- Determine the extent and nature of the potential visual effects and significance of the Proposal on surrounding areas; and
- Identify measures to mitigate and minimise any potential landscape and visual impacts.

This report includes:

- Study methodology and methods;
- Planning policy context;

- Description of the Proposal;
- Baseline values assessment;
- Landscape and visual impact assessment;
- Potential impact mitigation measures;
- Overall evaluation of the Proposal in terms of landscape and visual effects; and
- Key findings and conclusion.



Figure 1 Site Context (Source: Tract Planning Report)



Figure 2 Aerial Plan (Source: Tract Planning Report)

## 2 Description of development proposal

### 2.1 Development description

The following description of the Proposal is based on information supplied by Bookaar Renewables Pty Ltd February 2017 (Refer Appendix C).

The Proposal involves the installation of Photovoltaic (PV) panels with a combined generation capacity of approximately 200 MW. The Proposal includes the following elements:

- Solar arrays: approximately 700,000 solar panels supported by a mounting system on piles, driven into the ground. The panel surface colour will be dark blue (refer Figure 4). The colour of any other supporting elements such as structural supports, structures and fencing will nominally be chosen to provide minimum colour contrast to their surroundings and reflectivity;
- The panels will be installed on either a north to south orientated single axis tracking system that tilts the panels from east to west throughout the day (Figures 3 & 5), or a fixed tilt system. For the purposes of this report a tracking system has been assumed as it presents a worst case height of 4m, compared with a fixed system that would be approximately 3.5m high;
- Approximately 60 central inverters located throughout the site;
- Cabling and electrical connections;
- Onsite access tracks (gravel);
- A single substation structure of approximately 8m height, connecting the solar array to the national electricity grid;
- Support buildings located alongside the substation including communications equipment and, if required for grid connection, an open lattice tower structure (20m);
- Chain mesh perimeter fence (security fence up to approximately 2.5 m high with colour to be determined);
- Native planting buffers (Vegetation Screen) (Figure 5). Screening plantations will be a combination of existing tree plantations and new 20m wide plantations comprising a combination of local Ecological Vegetation Class (EVC) species (trees and shrubs), and native species that are common within the region;
- Lighting will be on-demand only with minimal security lightning that is restricted to being located 4m high. Any lights that are not motion activated will be downwards facing with shielded lighting sources; and
- Staffing at the site for solar farm management and possible agricultural activities (grazing) will be minimal, and is likely to involve eight to twelve regular staff. There will be day to day vehicle movements associated with the site operations but these will be minimal and generally consistent with existing farm activities.

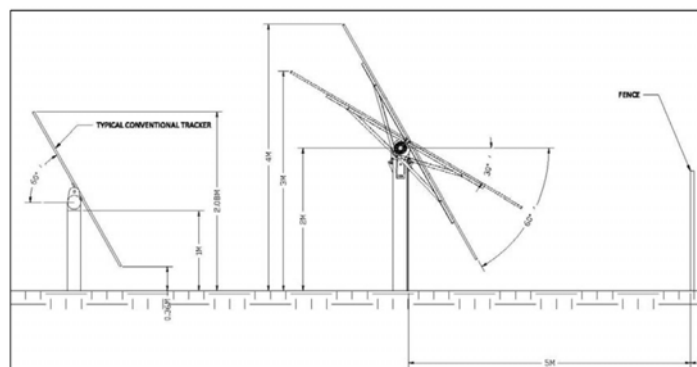


Figure 3 Panel Tracking Systems

### MAXPOWER PANELS

MaxPower is Canadian Solar's series of robust solar panels with 72 solar cells. These panels have high system energy yield at low irradiance and low NOCT. Our stringent quality control system put our panels in the top ranking of California Energy Commission's PVUSA Testing, leaving 12,471 other P-type silicon panels behind. Our enhanced frames ensure the robustness of our panels for up to 5400 Pa load.

<b>Power:</b>	310/340 W
<b>Size:</b>	982 * 1954 * 35 mm
<b>Weight:</b>	22 kg

**PRODUCT FEATURES**

- High performance and energy yield
- High module quality
- Robust module construction
- Suitable for harsh environments

**DOWNLOADS**

- MaxPower CS6U-P\_High Efficiency
- MaxPower CS6U-P
- Installation Manual

**CERTIFICATES**

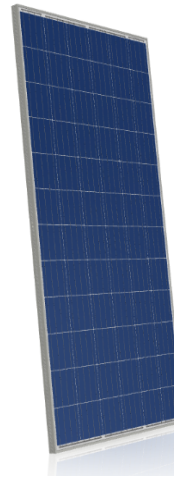


Figure 4 Typical Solar Panel (Refer Appendix C)

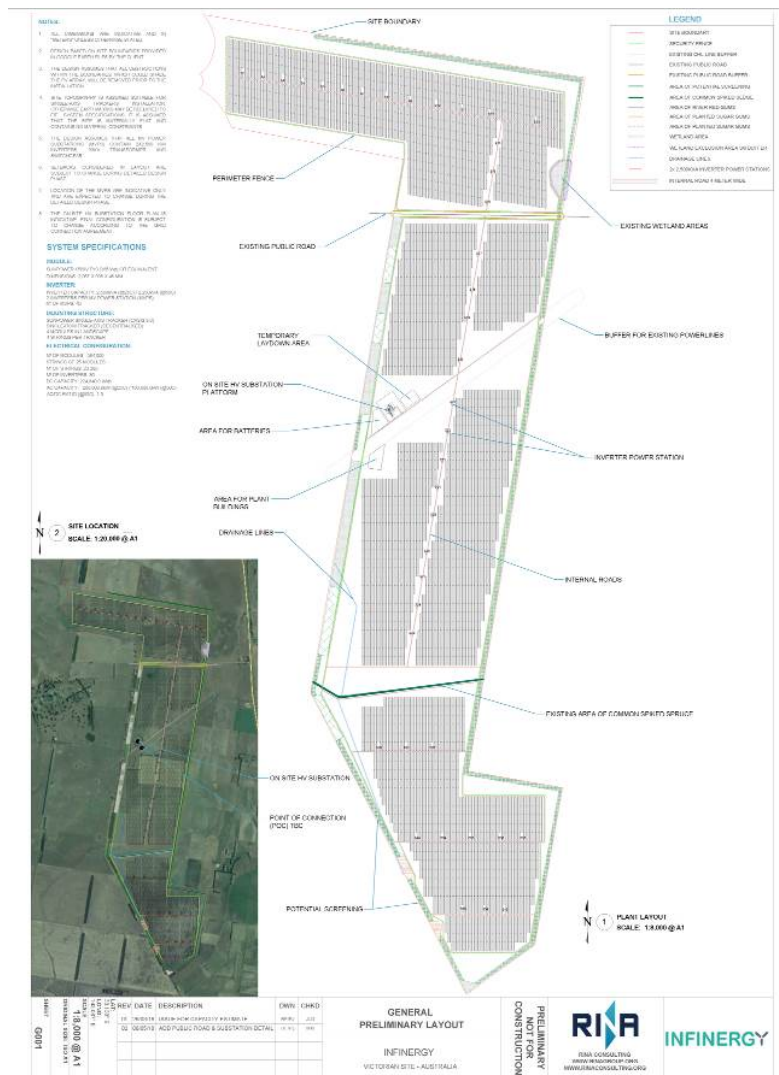


Figure 5 Proposal Layout (Refer to Appendix C)



## 2.2 Construction phase activities

In addition to the key components outlined in 2.1, there will be a temporary construction compound required to facilitate the construction and decommissioning phases of the Proposal. The construction compound will include:

- Temporary construction offices;
- Car and bus parking areas;
- A staff amenity block (including portable toilets, showers and a kitchen) designed to accommodate peak staff numbers during the construction period; and
- Laydown areas.

Construction phase activities will include:

- 182 daily movements of staff vehicles, construction vehicles and material transport vehicles, during the peak of construction activities, on Princes Highway and Darlington-Camperdown Road via Meningoort Road (refer to the main planning report for detail on traffic numbers);
- On-site construction activities.

## 2.3 Operational phase activities

Day to day activities will typically include:

- Staffing of the Proposal for management and agricultural activities (grazing) will be minimal and is likely to involve approximately eight to 12 regular staff;
- There will be day to day vehicle movements associated with the site operations but these will be minimal and generally consistent with existing farm activity levels;
- Routine and irregular maintenance activities that may involve equipment servicing or replacement; and
- Farm management activities including the movement of stock, slashing for fire management, fencing repairs and the like.

## 2.4 Decommissioning phase activities

Decommissioning phase activities are likely to match construction phase activities in terms of:

- Movement of equipment and vehicles; and
- The use of temporary facilities.

## 2.5 Site rehabilitation phase

It is intended that the Development Footprint be retained as a large rural allotment and that it will be rehabilitated and returned to agricultural production (grazing or related agricultural uses) following the completion of solar farm activities.

The only above ground remaining features following the decommissioning and rehabilitation phase will be:

- Existing electrical transmission lines and towers (existing site feature);
- Gravel access tracks (if required by the farmer);
- Site landform;
- Farm related fencing; and
- Buffer plantations.

## 2.6 Lighting

Lighting will be on-demand only with minimal security lighting that is at an elevation of 4m high. Any lights that are not motion activated will be downwards facing and have shielded lighting sources with minimal light spill. There are no regular night operations within the site. The level and pattern of lighting is expected to be consistent with a farm and seen in that context from surrounding areas.

## 2.7 Surface water and groundwater

The Proposal does not require extensive ground level changes or underground works. Existing low lying areas and surface drainage patterns will be maintained. On the basis of current information, there is no indication that surface drainage or groundwater changes will occur, or lead to unpredictable or adverse effects on the existing site landscape or the surrounding area.

## 2.8 Buffer planting

Native planting buffers for visual screening purposes (refer **Figure 5**) will be developed in combination with existing plantations. Screening plantations will be a combination of existing tree plantations and new 20m wide plantations comprising a combination of local EVC species (trees and shrubs), and native species that are common within the region.

## 2.9 Hours of operation

The electricity generating hours of the Proposal will be daylight hours with work outside these hours only required for essential maintenance. The patterns of movement associated with the development are expected to be similar to a farming operation and represent a minimal change from existing conditions.

## 2.10 Project timeline

The Proposal will have a lifetime of 30 years as indicated in **Table 1** below. It is estimated that the Proposal would take approximately 12 months to construct, and would be operational for approximately 28 years. Following the operational period, all above ground infrastructure would be removed from site which would take approximately 6 months.

**Table 1:** Indicative timeframe for project phases

Phase	Indicative Start	Indicative Period
Construction	July 2019	12 months
Operation	July 2020	~ 28 years
Decommissioning	2048	~ 6 months

## 3 Study methodology

The following section describes the methodology and methods applied in this study to assess the landscape and visual impacts of the Proposal. This methodology is based on the assessment of multiple renewable energy and infrastructure projects undertaken by Tract Consultants.

### 3.1 Study methodology

#### Overall assessment methodology

The overall method applied to assess landscape and visual impacts of the existing landscape is based on principles outlined in *Guidelines for Landscape and Visual Impact Assessment (third edition)*, The Landscape Institute & Institute of Environmental Management & Assessment, Spon Press, April 2013, which represents a 'best practice' approach within the United Kingdom and has been extensively trialled since 1995 on a range of project types including extractive industry projects, wind farms, property and road infrastructure development.

#### Visualisation standard

In terms of visual representation of effects (photomontage images), the methodology is based on the principles outlined in the following publications which are cross referenced within the UK based LVIA guideline:

- *Photography & Photomontage in Landscape & Visual Impact Assessment, Advice Note 1/11*, Landscape Institute (UK) 2011: and
- *Visualisation Standards for Wind Energy Developments*, The Highland Council (Scotland), 2013.

#### Professional judgement in LVIA

Structured professional judgement (qualitative assessment) is an integral part of the LVIA process and has been used in conjunction with quantitative based assessment procedures in this project. Tract has used a team based approach to validate professional judgements, using our reviewer Dr Rodney Wulff, to provide an independent review of draft assessment findings.

### 3.2 Scope of assessment

This LVIA covers both 'landscape' and 'visual' assessment within the Study Area:

The **landscape assessment** deals with the potential effects on the character and quality of the landscape setting, considered as an environmental resource, independent of views of that landscape.

The **visual impact assessment** deals with potential effects on the visual resources of the setting from changes in the composition and quality of views, people's response to likely changes and the overall effect on visual amenity.

This study covers the following key elements:

- Description of the Proposal;
- Legislative and planning policy context;
- Baseline landscape values, visual values and intervisibility by field work, and desktop study supported by GIS modelling;
- Assessment of impacts on landscape and visual receptors supported by photomontage simulations and GIS modelling;

- Discussion of overall visual impacts; and
- Recommendations and conclusion.

The assessment does not consider:

- The effects of future land use changes such as new farming, rural residential development, road development or tourist activity that are not defined at this time but may occur within the areas adjoining the Study area.

The landscape and visual impact assessment process is outlined in **Figure 6**.

### **3.3 Community values**

No empirical research or targeted consultation relating to community values or perceptions of landscape and visual quality was undertaken as a part of this study.

A Council workshop and general community consultation session were carried out in April 2018. These sessions provided opportunities for Councillors and the community to comment on the overall development proposal and early analysis findings related to LVIA issues. While there was general interest in the appearance of the Proposal in the landscape, no specific concerns were raised regarding potential landscape or visual impacts or the effects on any specific receptor locations.

The LVIA technical process is based on a range of existing information sources, including the State and Local Planning Policy Framework and existing studies which make specific reference to landscape character values and visual quality of the area surrounding the Site. In this context, these information sources are considered to generally represent State Government, Council and broader community values relating to the landscape and visual resources of the region.

The LVIA uses a risk management approach to assess the nature, level, duration and significance of potential landscape and visual effects, and to identify the appropriate responses to reduce those impacts to the extent practicable.

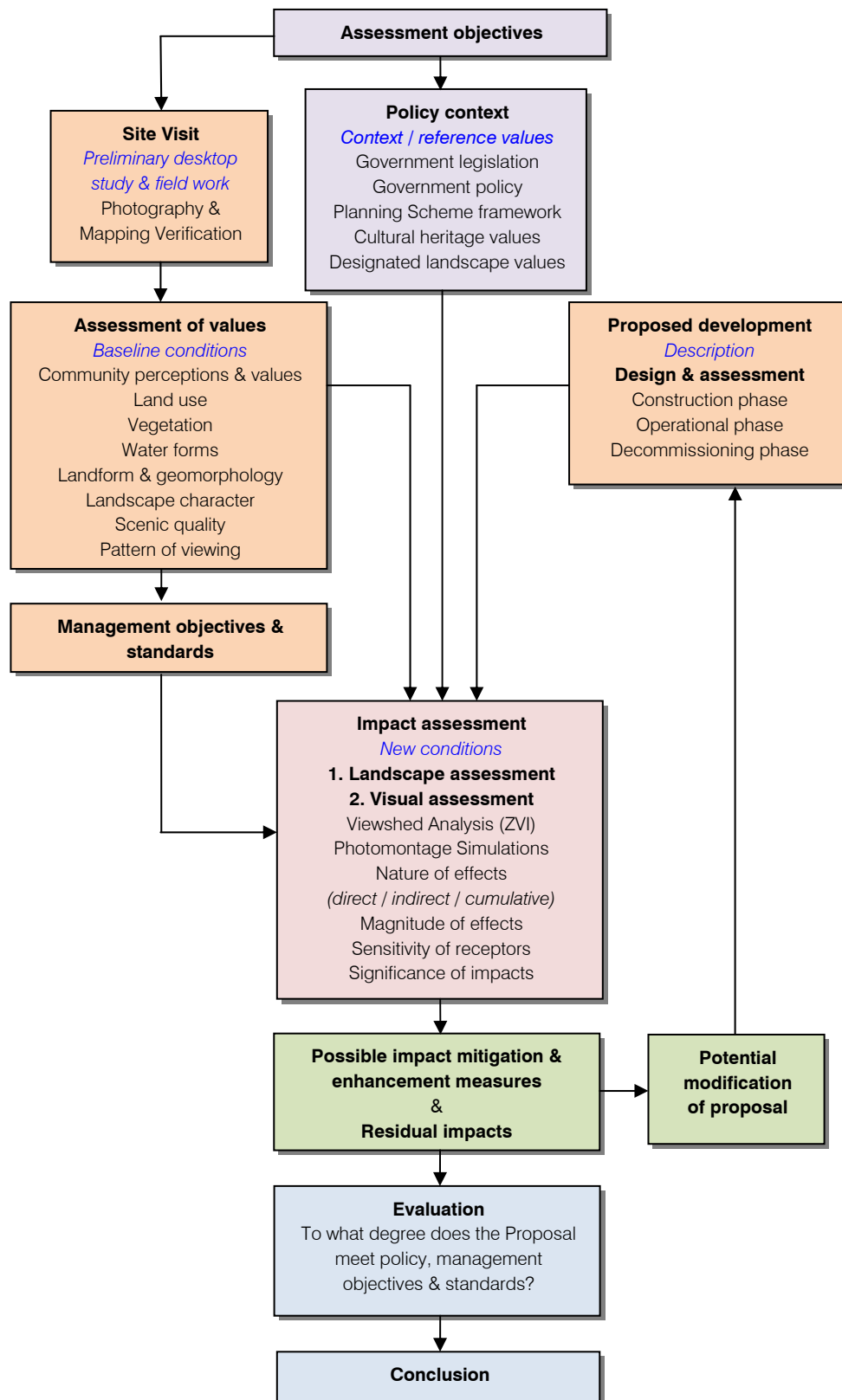


Figure 6 Landscape & Visual Impact Assessment process

### 3.4 Landscape assessment method

This LVIA considers both landscape character and scenic quality in the assessment of landscape values. Landscape character and values are assessed at two levels - status and classification.

The **status** of the area as a recorded or listed landscape of National, State, Regional or Local importance on the basis of its formal natural, cultural heritage or scenic value. The landscape status is covered in Section 4-Policy Context.

The **classification** of representative landscape character types and related scenic qualities is derived through the definition of common distinguishing visual characteristics – landform, climate, vegetation, water-form and land use pattern. Under this system of classification, each landscape type establishes its own benchmarks for scenic quality. Assessment of landscape character is provided in Section 4-Baseline Assessment.

The Landscape Character Assessment guidance for England and Scotland (2002) provides a framework for assessing landscape character types and areas at various levels (national, regional and local).

This method has been used as a basis for regional and state landscape assessments in Victoria including South West Victoria Landscape Assessment Study (Planisphere, 2013) which considers landscape character, significance, community values, landscape change and protection of landscapes.

The landscape character of the subject site has been assessed by considering the regional Landscape Character Type classification provided in previous formal studies. The landscape assessment in this study evaluates these earlier findings along with other relevant influencing factors including visual absorption capability, landscape values and sensitivity. These baseline values are used as a basis for the assessment of landscape and scenic quality impacts associated with the Proposal.

### 3.5 Scenic quality assessment method

There are several approaches to studying scenic landscape quality which can be classified into two broad groups – the objective approach and subjectivist approach – which are based on a long-standing debate in the philosophy of aesthetics (Tveit et al., 2012)<sup>1</sup>.

In the objective approach, the visual quality is assessed by experts based on formal knowledge by assuming the beauty is 'in the object'. In the subjective approach, the visual landscape quality is considered a construct of the observer (in the eye of the beholder) derived from lay people's perceptions and preferences.

Daniel and Vining (1983)<sup>2</sup> have distinguished five models to studying landscape quality which are ranging between the objective and subjective paradigms including: ecological, formal aesthetic, psychophysical, psychological and phenomenological models. Based on their detailed review of these models, they concluded that a careful combination of the psychophysical and psychological approaches would provide the basis for a reliable, valid and useful method for landscape-quality assessment (Daniel and Vining, 1983).

In absence of such a scenic quality assessment based on psychophysical and psychological models in Victoria, a previous study of Victorian landscapes, *Landscape character types of Victoria: with frames of reference for scenic quality assessment* (Leonard, 1984)<sup>3</sup>, has been used as a basis for assessment of the scenic quality of the Site within the Study Area and wider regional context. This study, which is based on the formal aesthetic model, characterises landscape in terms of formal properties of landscape based on expert evaluations. The descriptions are based on the variety of

<sup>1</sup> Tveit, M.S., Sang, A.O., Hagerhall, C.M. 2012, 'Scenic beauty: visual landscape assessment and human landscape perception' in Linda Steg, Agnes E. van den Berg, Judith I.M. De Groot [eds], 'Environmental Psychology: An Introduction', John Wiley & Sons, London.

<sup>2</sup> Daniel, T., Vining J., 1983, Methodological Issues in the Assessment of Landscape Quality, in Irwin Altman, Joachim F. Wohlwill [eds], Behaviour and the Natural Environment, Vol 6, the University of Michigan.

<sup>3</sup> Leonard, M., Hammond, R. & Forests Commission, Victoria, 1984. Landscape character types of Victoria : with frames of reference for scenic quality assessment, [Melbourne]: Forests Commission Victoria.

landform, vegetation covers and watercourses. A descriptive criterion for scenic values for landscape character type is developed which describes the relative range of scenic quality (high, moderate and low) within each broad landscape character type.

Based on Visual Resource Management assumptions applied in this study (Leonard, 1984, p. 60), scenic quality increases with:

- Greater degrees of uniqueness in rock outcropping, water, sub-alpine heathlands and other natural features;
- Greater degrees of naturalness and lesser degrees of man-made alterations;
- Greater degrees of vegetative diversity and general landscape variety;
- Greater degrees of vegetative diversity and green crop patchwork effected in agricultural landscapes; and
- Greater degrees of vegetative mixture and edge diversity in coniferous plantations.

A mapping of scenic quality and frames of reference for each character type and subtype is provided in this study. The high scenic quality classification is assigned where one or more of these elements (Landform, Vegetation or Water form) are assessed as high.

### 3.6 Impact assessment definitions

Impact assessment has been based on the criteria of sensitivity of receptors including landscape and its users (viewers), duration of impacts, nature and magnitude of impacts, and significance of impacts.

#### 3.6.1 Impact duration

The *duration* of impacts is defined as:

<b>Short term</b>	Project construction and establishment phase (<3 years)
<b>Medium term</b>	Early project operational phase (3 – 10 years)
<b>Long term</b>	Within projected operational phase (10 – 25 years)
<b>Permanent</b>	Beyond projected operational phase (25 years +)
<b>Reversible</b>	Physical potential for full rehabilitation to original baseline condition within feasible cost parameters and land use objectives (To be specified within the Decommissioning Management Plan)
<b>Irreversible</b>	Permanent physical change to the baseline condition Beyond feasible cost parameters and land use objectives (Specified for retention in the Decommissioning Management Plan)

### 3.6.2 Significance

The significance of impacts will be determined by a combination of sensitivity of the receptor (whether it is landscape or a viewer) and the magnitude of the predicted changes.

The scales shown in **Table 2**, define the levels of significance of impacts expressed as three levels (represented by shading). Impact ratings are made against the Baseline Conditions.

The descriptive meanings of high, moderate and low significance are explained in Table 3.

Significance ratings reflect an assessment of the overall importance of the predicted impact and also indicate mitigation priorities.

A number of ‘moderate’ rating factors may collectively represent a relatively ‘high’ degree of change to a receptor (cumulative impact) and therefore mitigation measures may need to be considered for more than ‘high significance’ rated impacts.

**Table 2:** Impact significance matrix – the nature & magnitude of impacts

<b>MAGNITUDE OF CHANGE</b>	<b>high</b>	moderate	high	high
	<b>moderate</b>	moderate	moderate	high
	<b>low</b>	low	moderate	moderate
	<b>negligible</b>	low	low	low
		<b>low</b>	<b>moderate</b>	<b>high</b>
	<b>RECEPTOR SENSITIVITY (Landscape / Viewers)</b>			



### 3.6.3 Nature and significance of impacts

This table defines the likely effects of the changes resulting from each level of predicted impact identified in Table 2.

**Table 3: Nature and magnitude of impacts – definition**

<b>Impact Significance Levels</b>	<b>Definition Visual Impacts on Landscape</b>	<b>Definition Visual impacts on Receptors</b>
Major adverse <b>HIGH (6)</b>	Total or substantial alteration to key features of the baseline conditions.  Effects are at considerable variance with the landform, scale and pattern of the landscape and cannot be substantially mitigated.  Would cause a high quality or designated landscape to be substantially changed and its quality and values diminished.	Total or substantial alteration to key features of the baseline conditions.  The Proposal forms a significant and dominant part of a view of high scenic quality. Other scenic elements become subordinate and diminished in value.  The valued scenic character of the site is markedly changed.  Sensitive visual receptors are adversely affected by the change.
Moderate adverse <b>MODERATE (5)</b>	Would be noticeably out of scale with the landscape and clearly at variance with key landscape attributes identified within the baseline conditions.  Will leave an adverse impact on a landscape of recognised quality.	The Proposal forms a clearly visible and recognisable new element within the overall scene that is readily noticed by the receptor.  The scenic character and quality of the site is diminished.
Minor adverse <b>LOW (4)</b>	Will have an apparent but not obvious or dominant effect on an area of recognised landscape character or its key attributes.	The Proposal constitutes a discernible but minor component of the wider view.  Awareness of the element will have a negative but not a marked effect on overall scenic quality.
Neutral <b>NEGLIGIBLE (3)</b>	Only a very slight change to baseline conditions and maintains existing landscape character and quality.  New features complement the scale, landform and pattern of the site landscape and its broader setting.	No part of the Proposal or associated activity is visually discernible.  The activity or feature is visible but has an insignificant effect on the perceived values or scenic quality of the setting.
Minor beneficial <b>NEGLIGIBLE (2)</b>	Likely to enable the restoration of valued landscape characteristics or features lost or diminished through existing land use activities.  Potential to contribute to the development of a new and higher quality landscape character.	The Proposal fits comfortably within the existing visual landscape.  The Proposal helps to articulate existing visual character and amenity values.  Potential for the Proposal to contribute to the development of a new and higher value visual character.
Moderate / Major beneficial <b>NEGLIGIBLE (1)</b>	Fits comfortably within the existing landscape character and clearly contributes to the development of higher landscape values.  Results in a significant improvement to the quality of the landscape through the rehabilitation of damaged areas or the removal of features or activities that have a negative impact on landscape values.  Results in a distinctive landscape feature that has the potential to add new values to the landscape without diminishing existing valued landscape characteristics.	Fits comfortably within the existing landscape character and clearly contributes to the development of higher landscape values.  Results in a significant improvement to the visual quality of the landscape through the rehabilitation of damaged areas or the removal of features or activities that have a negative impact on scenic values.  Results in a distinctive landscape feature that has the potential to add new visual or tourism values to the landscape without diminishing existing valued visual characteristics.

### 3.6.4 Common human perceptions & values

This table defines common human perceptions and values that typically influence personal judgements of landscape and visual change. These factors provide a measurable and logical basis to quantify the proposed change.

<b>Visibility</b>	The magnitude of visual impact is at least partly determined by the nature of that view and whether it is moving or static.
<b>Field of view</b>	<p><b>Horizontal line of sight:</b> The normal binocular field of vision (horizontal line of sight / width of view) is considered to be 124 degrees. Within the binocular field of vision the viewer has depth perception. Either side of the binocular field is a monocular field of 42 degrees for each eye (peripheral vision) which provides the viewer with awareness of movement speed and locational cues.</p> <p>Within the binocular field is a central foveal field (zone of visual acuity) of 2.5 degrees where viewed objects are sharply fixed and in detailed focus.</p> <p><b>Vertical line of sight:</b> the normal vertical field of view is considered to be 120 degrees with the limit of colour discrimination at 55 degrees.</p> <p><b>Method of Perception:</b> These fields of vision indicate a field of view and visual 'recognition' but in isolation, are not meaningful measures of scenic perception. The process of recognising and observing an object or scene (Dynamic Visual Acuity) is complex and involves constant scanning of the seen area, recognition and refocussing within the field of view; a process that is modified (narrowed and simplified) by viewer movement, the speed of movement of the viewer and secondary activities such as driving, but enhanced by colour contrasts, illumination, proximity, size, shape, symbol recognition based on expectation and other factors.</p> <p><b>Occupied view area:</b> The nature and magnitude of the visual impact is likely to have a proportional relationship to the percentage of the available view taken up by development infrastructure, new activities or landscape interventions. Objects may be visible, but not dominant, particularly when they occur within landscapes that have been modified by human activity and where the context and complexity of the natural landscape has been significantly altered.</p> <p>A spread of built elements or landscape changes across a wide view or several viewable areas is likely to result in a perception of greater overall visual impact than a similar number of built elements within a more confined viewable area.</p> <p>Horizontal field of view – as a general guide only, a visual element of less than 5° of a field of view may be considered insignificant, depending on the nature of background visual contrasts and the movement of the viewer.</p> <p>Vertical field of view – as a general guide only, less than 0.5° of a field of view may be considered insignificant, depending on the nature of background visual contrasts and the movement of the viewer.</p>
<b>Speed of movement</b>	As the speed of movement increases, viewer concentration on a fixed area increases and peripheral vision diminishes, effectively shrinking the visual field. Foreground detail also begins to fade.
<b>Relative elevation</b>	Objects viewed against a skyline silhouette or at the edge of a break in slope are likely to have a greater visual impact than objects or changes viewed from a location where features are viewed against a land backdrop. Colour contrasts may modify this outcome.
<b>Size, colour and form</b>	The greater proportion of a view occupied by new features or activities the greater the impact. Contrasting colours and forms increase the relative impact of change.
<b>Illumination</b>	Luminance contrast increases the visual definition of the shape, size and location of objects and potentially changes the context in which objects are re viewed. Lighting colour and movement increase the potential level of contrast.
<b>Activity</b>	Movement of objects, including vehicles and light reflection changing with movement will increase impact.

<b>Complexity</b>	Changes to a visually complex field of view with elements of varying scales and form are likely to result in lower impacts than changes to a relatively uniform field of view.
<b>Context</b>	The extent to which the Proposal is in character with the land use and landscape character of the site will affect the perceived level of impact.
<b>Weather conditions</b>	The overall clarity of the view, the angle of the sun and the degree to which skyline silhouettes are masked by clouds etc will affect visibility.
<b>Change</b>	The degree of change in the view and the process of change will affect the degree of impact on the viewer.  Other potential aspects of change include scale, proportion, size, height, massing, colour, texture, finish, permanence.
<b>Familiarity</b>	Changes to a familiar visual setting or where the viewer interacts with the setting is likely to have a relatively greater impact on the viewer than changes to a setting that is rarely seen or poorly understood.
<b>Cultural context</b>	Changes to a visual setting with significant cultural value or purpose is likely to have a relatively greater impact on the viewer than what may be considered a 'generic' landscape setting with no specific value.
<b>Individual context</b>	The perception of a visual impact or visual improvement within a landscape is likely to differ between communities, cultural groups and among individuals. Personal context and values strongly influence the manner in which visual effects are valued.
<b>Distance</b>	The greater the viewing distance, the less detail is observable and the more difficult it is to distinguish between the site or object and its background, diminishing the impact. Distance based effects are also influenced by atmospheric conditions.  Distance is an important factor in assessing the magnitude of change and overall impacts.

### 3.6.5 Landscape sensitivity

Landscape character and scenic quality assessment is used as a basis to assess the landscape's sensitivity to change, which is used further to assess the visual impacts resulting from proposed development within the landscape. Visual sensitivity refers to the extent to which a landscape can change without unacceptable adverse effects on its visual character and quality. Landscape sensitivity levels are described in **Table 4**.

**Table 4 - Landscape Sensitivity**

<b>Sensitivity Level</b>	<b>Definition</b>
<b>HIGH</b>	Key characteristics of the landscape are highly vulnerable to the type of change being assessed, with such change likely to result in a significant change in valued character.
<b>MODERATE</b>	Some of the key characteristics of the landscape may be vulnerable to the type of change being assessed. Although the landscape may have some ability to absorb change, some alteration in character may result. Considerable care may be needed in locating and designing change within the landscape.
<b>LOW</b>	Key characteristics of the landscape are less likely to be adversely affected by the proposed change. Change can potentially be more easily accommodated without significantly altering character and there may be opportunities to positively create new character. Sensitive design is still needed to accommodate change.

### 3.6.6 Receptor Sensitivity

To determine visual receptor sensitivity, consideration is given to those receptors that have the potential to view the proposed change. For the purposes of the impact assessment viewer sensitivity is defined as a combination of the following factors:

- Interest in the visual environment, viewer distance and the available angle of view (field of view);
- Place attachments and functional relationships with the place;
- Familiarity with the place and expectations;
- The surrounding level of use (number of visual receptors/users);
- The nature of the visual receptors and their familiarity with the place (receiving location and / or viewer type); and
- The distance of the receptor from the potential impact.

Visual receptor sensitivity is a measure of the direct or indirect effects that development based changes may have on a view or scenic resource, which could include physical elements, visual character and cultural values. **Table 5** defines different levels of receptor sensitivity. **Table 6** defines distance related factors that relate to the magnitude of the impact.

**Table 5 – Visual receptor sensitivity**

<b>Sensitivity Level</b>	<b>Definition</b>
<b>HIGH</b>	<ul style="list-style-type: none"> <li>▪ Designated state level parks and scenic reserves, major recreation trails, formal scenic view locations &amp; lookouts</li> <li>▪ Major tourist roads established scenic routes</li> <li>▪ Commercial facilities (i.e. wineries) or sites based specifically around scenic values</li> <li>▪ Public spaces within town centres</li> <li>▪ Non rural residential properties</li> </ul>
<b>MODERATE</b>	<ul style="list-style-type: none"> <li>▪ Large volume regional link roads (Princes Hwy, Hamilton Hwy &amp; Darlington Rd)</li> <li>▪ Secondary tourist roads and recreational driving routes</li> <li>▪ Major landscape dependant outdoor recreation facilities &amp; settings</li> <li>▪ Rural residential properties</li> <li>▪ Schools, hospitals and residential care facilities</li> </ul>
<b>LOW</b>	<ul style="list-style-type: none"> <li>▪ Local rural roads</li> <li>▪ Farming properties</li> <li>▪ Industrial land uses</li> <li>▪ Local sports facilities</li> <li>▪ Forest areas and other relatively inaccessible location</li> </ul>

**Table 6 - Distance factors**

<b>Distance Levels</b>	<b>Definition</b>
<b>Foreground (&lt; 1km)</b>	<ul style="list-style-type: none"> <li>▪ Obvious or dominant visual change to the landscape and landform characteristics including Colour contrast and textural details are clearly perceived.</li> <li>▪ Views are more likely to be broken by foreground features.</li> <li>▪ Landform characteristics and the relationship between landscape features are clearly discernible.</li> </ul>
<b>Middle ground (1 – 3 km)</b>	<ul style="list-style-type: none"> <li>▪ Obvious or dominant visual change to the landscape and landform characteristics.</li> <li>▪ Views are more likely to be broken by foreground features.</li> <li>▪ Landform characteristics and the relationship between landscape features are clearly discernible.</li> </ul>
<b>Background (3 – 5 km)</b>	<ul style="list-style-type: none"> <li>▪ Likely minimal visual recognition of strong colour and light contrasts and large scale vegetation clearance only.</li> <li>▪ Minimal recognition of form and detail and no appreciation of vehicle movement.</li> <li>▪ Distance zone where different landscape elements are visually apparent.</li> </ul>
<b>Distant views (5 km +)</b>	<ul style="list-style-type: none"> <li>▪ Textures are no longer visible. Only landform features such as ridges, valleys, skyline and ridgelines are visible.</li> <li>▪ Likely minimal visual recognition of strong colour and light contrasts and large scale vegetation clearance only.</li> <li>▪ Minimal recognition of form and detail and no appreciation of vehicle movement.</li> <li>▪ Depending on the scale of the development, the visual scale of the change may be barely discernible and appear as a relatively minor visual element within a larger landscape complex.</li> </ul>

### 3.7 GIS and computer based modelling procedures

#### 3.7.1 Visibility analysis

Visibility analysis through Zone of Visual Influence (ZVI) modelling of the Proposal and surrounding terrain was used to produce a plan model identifying potential visual receptors and areas that may be subject to views of the Proposal.

ZVI modelling produces mapping data indicating all places with a line of sight to the modelling points within the Proposal. Modelling points are chosen to best represent the layout and height of the Proposal.

High definition elevation data (LAS format) was provided by Infinergy Australia Pty Ltd for the Property area. Additional elevation data (5m contours) was sourced from DELWP for a larger extent up to 20km radius from the centre of the Development Footprint. These two datasets were combined to a digital terrain model (DTM) in GIS for ZVI modelling. DTM only includes the landform.

Several ZVI maps have been produced for various project components during the baseline and impact assessment stages of the study. A screening buffer at 10m height was added manually to the DTM to analyse the potential effect of screening.

Both elevation models were used for visibility analysis to produce conservative maps of potential visual receptors and the most / least affected areas. The ZVI modelling results identified the major roads, residential areas and areas of high public usage most likely to have views to the Proposal. These locations were the focus of field assessments and reference photography.

The actual extent of visibility was verified by surveyed reference photographs (including highway views), taking note of screening vegetation and existing built form as well as local character and features.

In addition to ZVI, multiple viewsheds were modelled from nominated viewpoints to check the visibility from these locations. The visibility analysis conducted in the scoping stage of this study informed the siting and design of the Proposal.

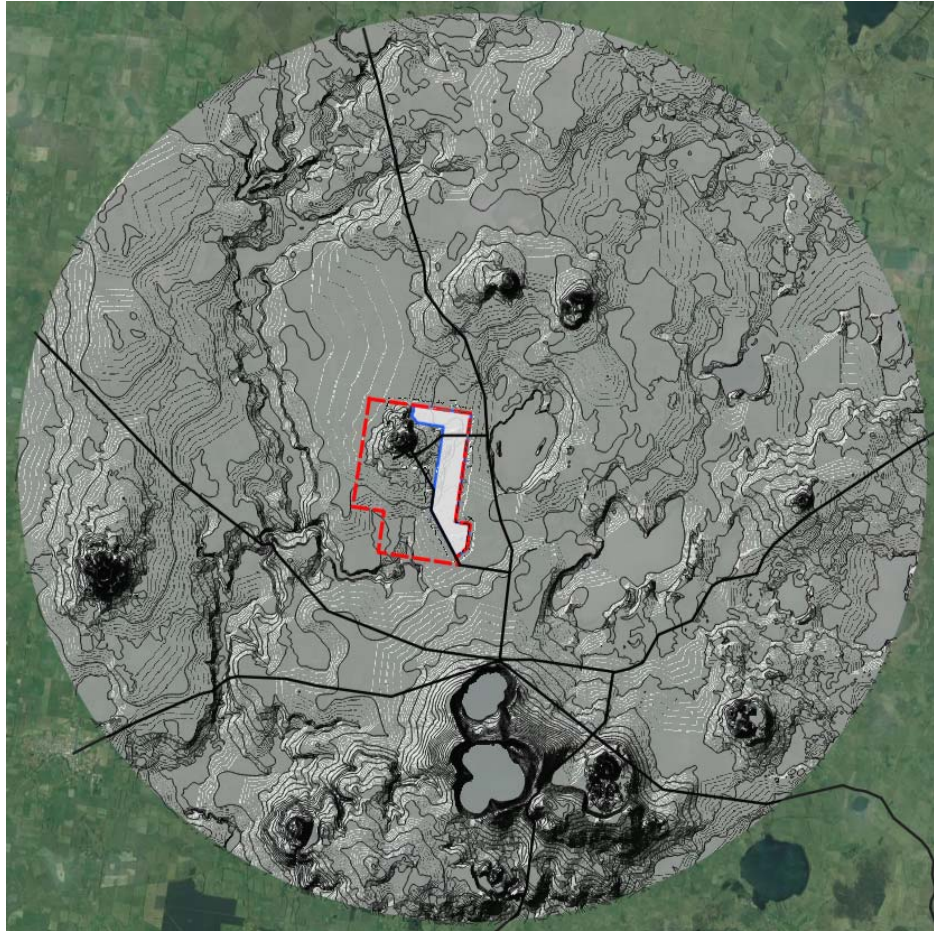


Figure 7 Digital Terrain Model (DTM) (landform only) to 20km radius

### 3.8 Photomontage simulations

The appearance of the Proposal is further assessed by photomontage simulations. These results are discussed in Section 5-Impact Assessment.

#### Additional reference material

- Landscape Institute (UK) Advice Note 01/09 [Use of photography and photomontage in landscape and visual assessment](#) (Feb 2009);
- Scottish Natural Heritage [Visual Representation of Windfarms: Good Practice Guidance](#) (Verified Photomontage); and
- Institute of Landscape Architects (NZ) Best Practice Guide - Landscape Assessment and Sustainable Management/Best Practice Guide - Visual Simulations (Nov 2010).

### Best-practice modelling process

As the first step in the process, several photo locations and control points were recorded during the site visit (**Figure 8**). Photos were taken with a DSLR Camera (Canon 5D) with a 50mm fixed lens focal length.

Conditions on the day of photography were clear and with good, long range visibility.

Survey equipment was used to establish the GPS location and elevation of the view point. This information was used in 3D software to match the virtual camera with the photos taken on site.

A 3D virtual model was developed in 3D software (3D Studio Max) including the 3D model of the Proposal (Appendix C). The photo point locations were added to this base to setup virtual cameras for camera matching. Once the views were matched, two output variations including wireframe or renders were produced to superimpose on existing condition photos.

As the last step, the outputs from 3D software (rendered or wireframe) were superimposed on the photos to create before and after conditions. Any mitigation measures considered in the design process (i.e. buffer planting) were added to the views to show their effects.



**Figure 8** Collection of GPS points on-site for photomontage modelling for the Proposal (27 March 2018)

### Background

The photographic and imaging techniques adopted for this study are intended to produce visual representations that:

- Are as geometrically and aesthetically accurate as possible to permit decision makers, after suitable field inspections, to make a reasonable, balanced judgement of the effects of a proposed change;
- Are based on a transparent, structured and replicable procedure, to allow others to confirm the accuracy of the information presented; and
- Are intended to present findings in a manner that is easily understood by non-technical people.

It is important to note that photographic images and simulations cannot provide the visual experience that a human observer would receive in the field. The detailed

technical assessments and professional judgements presented in this study have been made on the basis of site inspections, modelling and other information.

### 3.9 Selection of viewpoints

The potential viewpoints identified within this study and represented within the photo images meet the following criteria. The rationale for selection of viewpoints is explained in Section 5-Baseline Assessment.

Access to private properties, with the exception of the Meningoort Homestead during the LVIA process was unavailable. Representative views from publicly accessible locations have been selected to specifically consider:

- Specific view-points identified by Council; and
- Publically accessible receptor locations (key view points) that best represent areas of known sensitivity and other locations that have been identified through the ZVI modelling process as being the most likely areas of possible visual impact, the most representative visual impact locations and the likely 'worst case' visual impact scenarios.

The criteria and rationale for selection of viewpoints are further explained in Section 5.9.

### 3.10 Data limitations

Modelling and assessment outcomes are limited by the following:

#### Data accuracy

The terrain model is based on aerial survey sources and therefore has a limited level of accuracy (nominally within the range +/- 0.2m vertical). As a consequence, all information attached to the terrain model has a similar level of accuracy. It is considered that, given the scale of the Proposal, the size of the investigation area and the margins of accuracy applying to the modelling process, the modelling results are sufficiently accurate for the purposes of the LVIA.

Aerial photography has been used to provide general information about land use and landscape character. Aerial photography has not been used as a 3D modelling reference.

#### Modelling assumptions

Zone of Visual Influence (ZVI) modelling is based on a range of assumptions. The modelling assumes a 'worst case' scenario which is likely to exceed actual viewing conditions. The purpose of this modelling is to identify possible high sensitivity receptor locations that require further site specific investigation. The ZVI modelling does not include vegetation, buildings and other factors that affect view potential. On that basis, the ZVI modelling provides a general indication of viewing potential and the possible magnitude of visual effects. It does not represent actual views or levels of visual impact.

### 3.11 Study Team

**Mark Reilly:** B.Ed. (Env.Studies), M.L.Arch., AILA, RLA,

Principal Landscape Architect, Tract Consultants

- Methodology;
- Public Consultation; and
- Review of report findings.

**Ata Tara:** B.Arch., M.L.Arch., Ph.D., AILA RLA

Senior Landscape Architect, Tract Consultants

- Field assessment;



- Analysis & report preparation;
- GIS modelling-QGIS (Version 2.14.6);
- Photography & survey; and
- Landscape & Visual assessment & report writing.

### **Tristan County-Black**

#### **Modelling & imaging software**

- Photoshop (Version CS3);
- 3D Studio Max (Version Design 2010); and
- Illustrator (Version CS3).

#### **Printed image resolution**

- Printed image resolution to match photo resolution (10 megapixel).

## 4 Policy context

The purpose of this section is to outline the planning control framework and implications that relate specifically to landscape and visual values within the Study Area. In this context, planning controls are considered to be an expression of community values.

The Site is within the municipal area of the Corangamite Shire Council and therefore subject to the Corangamite Planning Scheme. The site is located within the Farming Zone (FZ).

Statutory provisions and policy documents with implications for landscape values are summarised below.

### 4.1 State and Local Planning Policy

#### Zoning

The Site as part of the Property is included within the Farming Zone which first and foremost seeks to protect existing productive agricultural land from inappropriate development and ensure its ongoing viability. The zone also seeks to ensure the use and development of land within the Farming Zone, which is based on comprehensive and sustainable land management practices and infrastructure provision.

The Site is subject to Schedule 1 of the Farming Zone, which sets out specific requirements relating to use and development of the land.

A renewable energy facility (other than wind energy facility) is a Section 2 use (permit required) subject to meeting the requirements of Clause 52.42. Application requirements are set out under Clause 52.42-2.

#### Clause 52.42-2

The purpose of this clause is to facilitate the establishment and expansion of renewable energy facilities, in appropriate locations, with minimal impact on the amenity of the area. This clause applies to land used and developed, or proposed to be used and developed for a renewable energy facility.

#### Clause 52.42

'Renewable Energy Facilities' is a key policy contained within all planning schemes across Victoria relating to the development of renewable energy facilities, other than wind and geothermal energy extraction. The purpose of the policy to facilitate renewable energy facilities in appropriate locations with potential impact on the amenity of the area minimised.

The policy stipulates application requirements and provides guidance on the key matters for consideration by the Responsible Authority in assessment of renewable energy facilities. These are:

- Effect on the surrounding area in terms of noise, glint, light spill, vibration, smell and electromagnetic interference;
- Impact of the Proposal on significant views, including visual corridors and sightlines.
- Impact of the Proposal on the natural environment and natural systems; and
- Whether the Proposal will require traffic management measures.

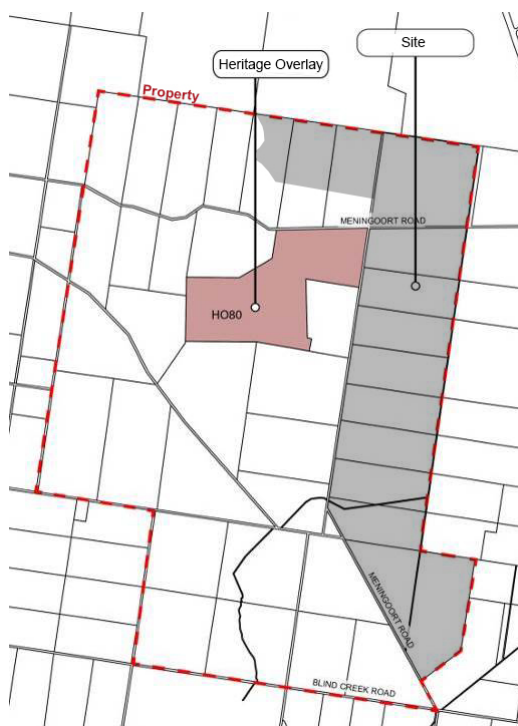
## 4.2 Overlays

The Property is subject to a number of planning Overlays:

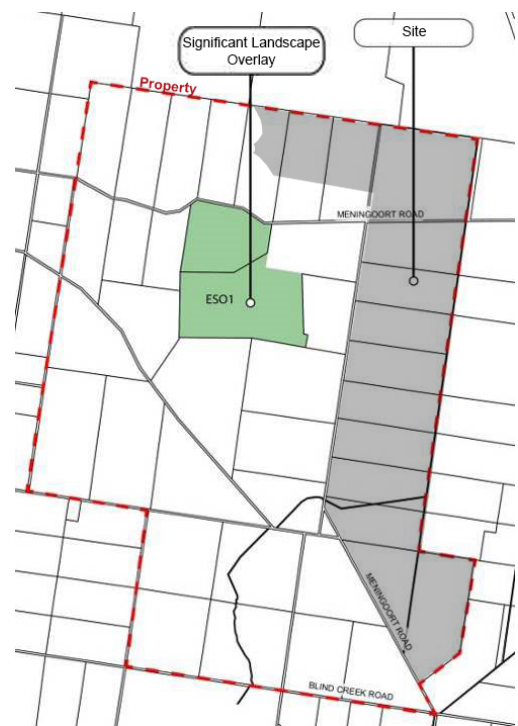
Heritage Overlay (HO) which relates to the heritage value attributed to Meningoort Homestead which is also included on the Victorian Heritage Register. The policy seeks to ensure that development does not adversely affect the significance of heritage places, including the potential to affect the appearance of the heritage listed area.

Significant Landscape Overlay (SLO) which seeks to identify, conserve and enhance the character of significant landscapes. Schedule 1 of the SLO applies and relates to the Volcanic Landscape Area which relates to the unique landscapes and features such as crater lakes and scoria cones.

These overlays only apply to a portion of the overall Property (refer to **Figures 9 & 10**) and are adjacent or near to the Site.



**Figure 9** – Extent of Heritage Overlay  
(Source: State Government of Victoria)



**Figure 10**– Extent of Significant Landscape Overlay (Source: State Government of Victoria)

Although not a planning overlay, the wider Property is identified as being within, or is affected by areas of cultural heritage sensitivity as defined within the Aboriginal Heritage Regulations 2007. Refer to **Figure 11**.

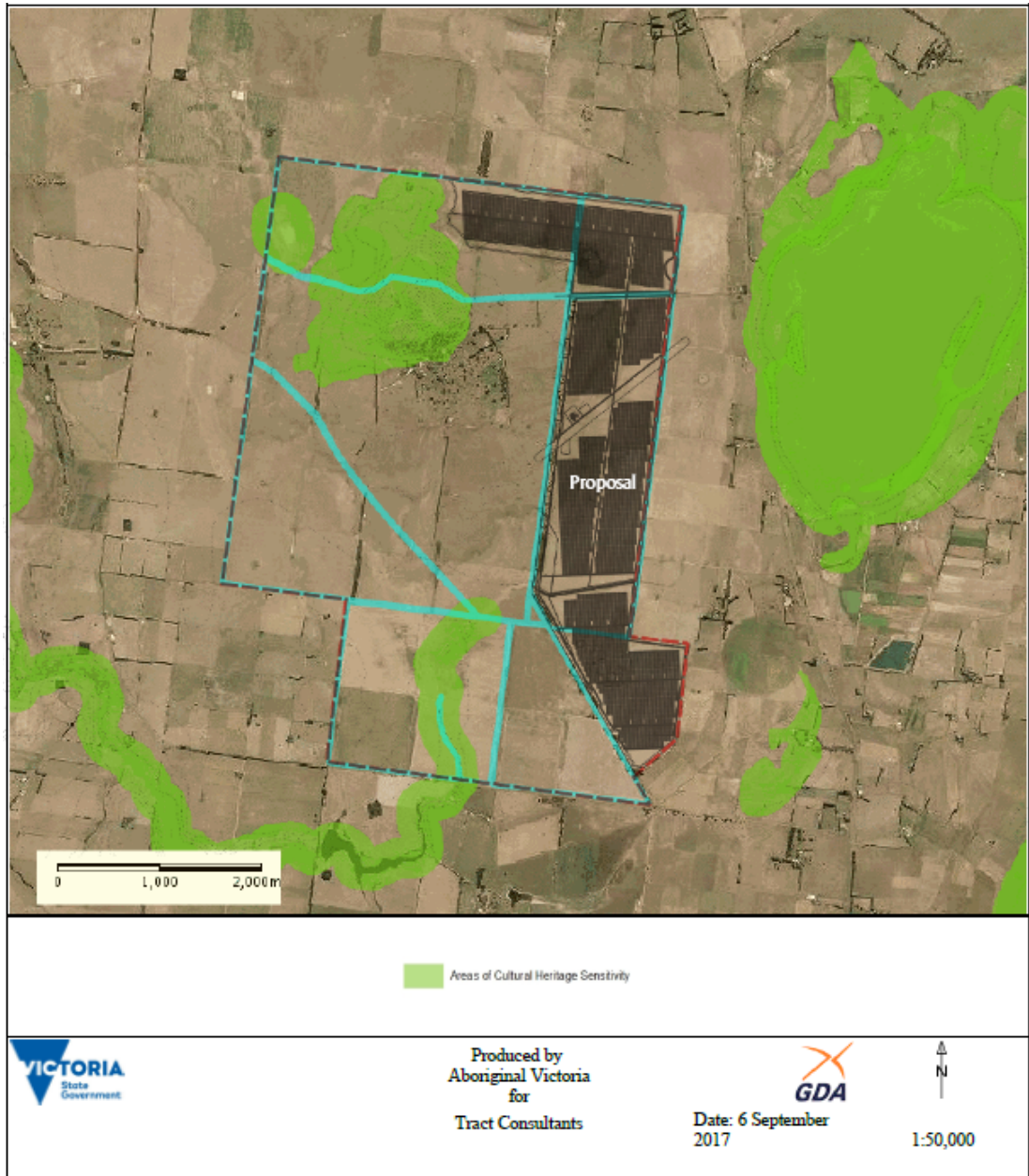


Figure 11 – Areas of Cultural Heritage Sensitivity (source: Victoria State Government)

### 4.3 Planning matters related to visual amenity

The planning review in Section 4.2 identified following key considerations in relation to the visual amenity:

- **Elevated Views:** The level of visibility and obtrusiveness of the Proposal within the landscape, particularly from elevated views from public vantage points external to the Site views from the Camperdown Botanic Gardens (7.5km from Site) and adjoining residential areas, Mt Leura (12km) and Mt Elephant (26km). Refer to **Figure 12**. This includes consideration of glint and the potential impact on the appearance of the scoria cone contained within the Site (subject to the SLO).
- **Impact on the surrounding landscape –** Potential impact on the immediate surrounding area including visual impact from the perimeter of the Site and adjacent properties.
- **Appropriate siting of the panels and associated buildings in conjunction with vegetation screening** should be considered as part of an appropriate response to the immediate context. Other potential impacts such as glint, light spill, and electromagnetic interference should also be addressed via various supporting technical assessments or by the planner in the planning report where impacts are considered minor.
- **Heritage –** Any potential impact on the heritage values of the Meningoort Homestead. The LVIA should be prepared in conjunction with a heritage consultant and a visual assessment undertaken as to how the appearance of the solar panels may impact on the appearance of the homestead and surrounds, as relevant to those features of the homestead that are listed as being of significance. The separation of the heritage overlay and the solar farm should be maximised.

These considerations have been taken into account in preparation of baseline study and visual impact assessment which are discussed in following the chapters.

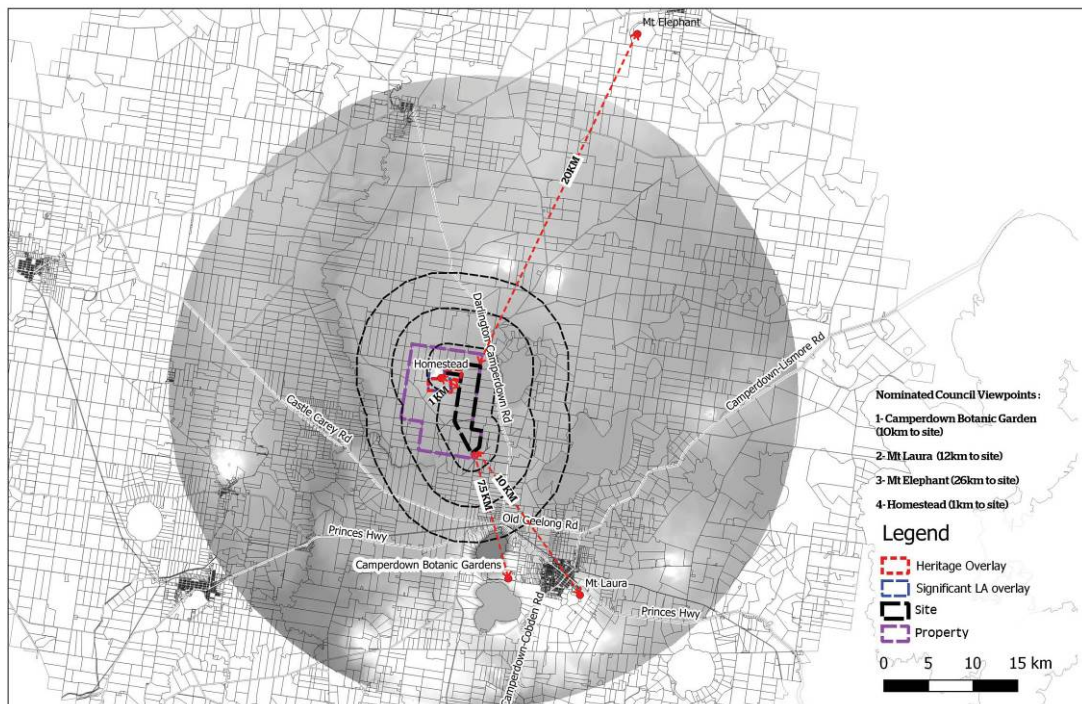


Figure 12– Council Nominated Viewpoints (refer Appendix A for A3 full-size figure)



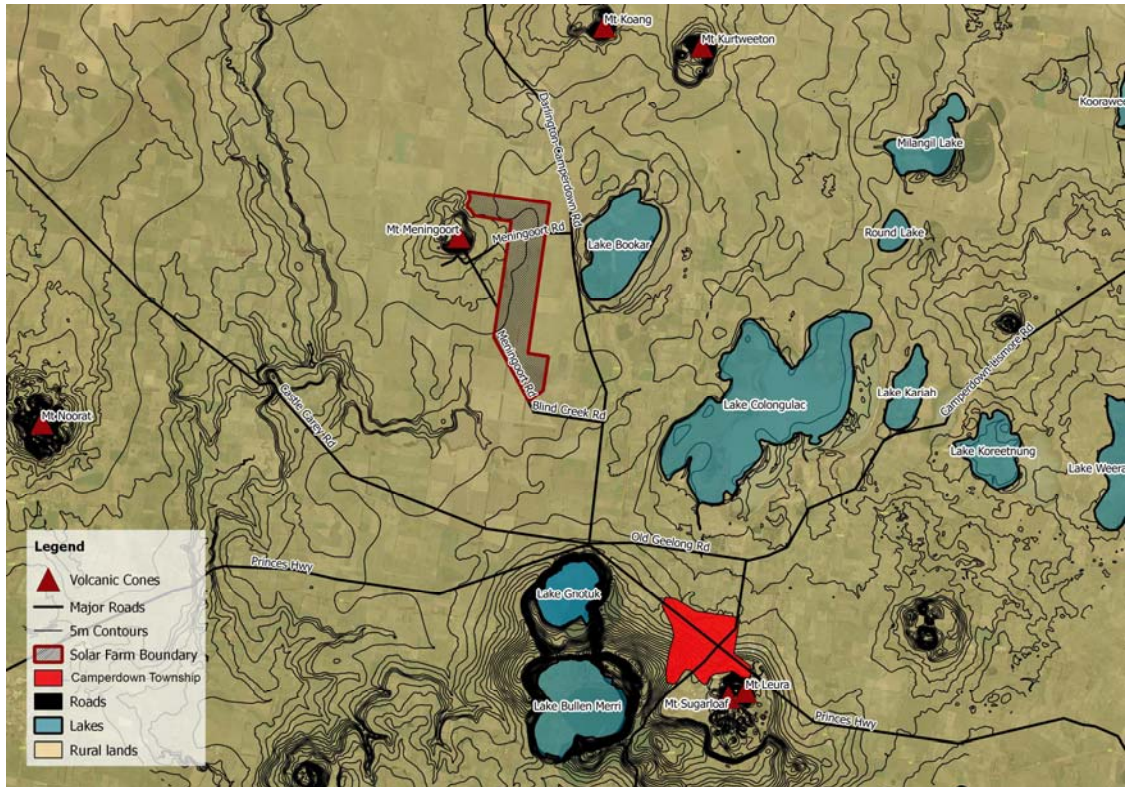


Figure 14 Landscape features in local area



A: Mt Elephant (view from Hamilton Hwy)



B: Scenic views from Camperdown Botanic Garden toward the Site



C: Volcanic flat plan with lakes, volcanic cones (Mt Kurweeton & Mt Elephant) and scattered trees (view from Mt Leura)

Figure 15 Landscape character images



**D:** Households with screening planting



**E:** Rural household with cypress windbreaks



**F:** Mt Meningoort as visible from Darlington Rd (Homestead is screened by the vegetation)



**G:** Rural activity inside the Site (view from Meningoort Rd)



**H:** Shallow lakes (Lake Booker) view from Darlington Rd opposite to the Site



**I:** Power lines and farm related structures (view from Darlington Rd towards the Site)



**J:** Wind breaks & mixed native buffer planting (view from Darlington Rd towards the Site)



## 5.2 Landscape condition

Landscape condition is a measure of the physical status and relative ecological condition of the site and factors which may influence landscape changes over time.

The Site as part of the broader rural landscape consists of cleared land for farming and grazing activities. The landscape surrounding the Site is a mosaic of agricultural properties with native and cypress wind breaks arranged in a mainly north – south orientation to match the land subdivision pattern and provide protection from the prevailing westerly winds. Some scattered trees are present in grazing areas and along roadsides with the overall effect of creating a visual mosaic of tree lines and grassland.

Farming homesteads with outbuildings are typically heavily planted for shade and wind protection. Darlington Road has scattered native tree planting. High tension power lines visible in the distance are an atypical visual element within what is otherwise a traditional and long established western district agricultural landscape.

The Site is predominantly considered as Plains Grasslands and Chenopod in the biodiversity mapping. The eastern side of subject land is considered as seasonal wetlands close to Lake Bookaar based on the Victorian bioregional mapping. However, according to a finer scale assessment in the ecology report, the extent of wetlands is limited to small section in the northern side of the Site which is excluded from the Development Footprint. Limited vegetation buffers exist along the access road (Meningoort Rd) to the Meningoort Homestead. Meningoort homestead is located on the lower woodland hill slopes of Mount Meningoort.



Figure 16 Landscape Condition

The Site is relatively flat with a gentle slope from the south (RL 138.8) to the north (RL142m). Vegetation buffer heights range between 5m to 10m as visible along the boundary line. The condition of the agricultural land is good and similar to surrounding agricultural land however, it does not hold any biodiversity values as concluded in the main planning report.

## 5.3 Landscape status

The Development Footprint is a farming land under the local and state planning schemes and is not subject to any special overlay controls, however a portion of the adjoining site, including Mount Meningoort and the Meningoort Homestead (refer Section 4) is subject to Significant Landscape Overlay (SLO) and Heritage Overlay (HO) controls. On that basis, the adjoining agricultural landscape is likely to be considered as a contributing / supporting element to the overlay area.

## The Meningoort Homestead

The Meningoort Homestead is a cultural site and heritage listed place. It is considered to have architectural, historical and horticultural significance to the State of Victoria.

The **Victorian Heritage Database Report** (edited extract) provides the following description of the site landscape:

### *Statement of Significance*

*The approach to the house and its setting are spectacular. The homestead is sited on the south-east slope of Mount Meningoort, directly facing Mount Leura. It has an unusual axial approach along a long avenue of Redgums to a circular driveway surrounded by a high hedge in front of the house, and two flights of stone steps lead from this up to the house.*

*The homestead garden is shaped by hedging and low plantings, with large mature species in extensive park-like surrounds. Aspects of the original landscape plan have survived, including the terracing and a number of mature species, including pines and conifers.*

### *Why is it significant in terms of cultural heritage?*

*The remnant homestead garden, and the broader landscaped grounds, is of horticultural and aesthetic significance for its park-like and picturesque setting, which was characteristic of pastoral homesteads in Victoria.*

*The bold landscaping treatment at Meningoort reflects the visual importance given to the siting of the homestead in the early pastoral period, and the place of the homestead in the natural landscape. Meningoort is also significant for its garden elements, including the terrace and collection of mature species that includes conifers and an Oak tree (*Quercus* sp.). The property's aesthetic significance is enhanced by the fact that it was painted by Eugene von Guerard in 1861, one of the many pastoral landscapes von Guerard painted in western Victoria in the 1850s and 1860s.*

On the basis of these descriptions, the building and the associated picturesque garden are part of a pastoral setting and the visual connection between the homestead and its pastoral surroundings is likely to be considered as a contributing factor to the wider interpretation of its cultural heritage value.

## 5.4 Scenic quality of the Site

The overall scenic quality of the Site has been assessed against the study Landscape Character Types of Victoria (Leonard and Hammond 1984). The Site falls in the “Western Plains” Landscape Character Type (LCT) located in south-western Victoria. This LCT stretches from the South Australian border to Port Philip Bay. This study defines three levels of scenic quality of Western Plains including following attributes (See **Figure 17**):

### *High Scenic Quality:*

- Features as volcanic cones, volcanic craters, craggy peaks and sharply serrated ridges rising starkly from the plains;
- Isolated peaks or ranges with distinctive form and colour contrast that become focal points;
- Distinctive gorges with near vertical walls and/or unusual configuration and colour;
- Major rock outcropping;
- Strong defined patterns resulting from eucalyptus forest, scattered conifers, riparian vegetation, barren rock or stony-rises and naturally appearing openings;

- Distinctive stands of vegetation which may create unusual forms, colours or textures in comparison; and
- Lakes, rivers, streams, swamps and reservoirs of a permanent or almost permanent nature.

***Moderate Scenic Quality:***

- Rounded hills, ridges and smaller volcanic cones which are not visually dominant but are surrounded by similar landforms;
- Moderately deep gorges with moderately sloped walls;
- Minor rock outcroppings;
- Predominately open forest with some natural openings and riparian vegetation in patterns that offer some visual diversity;
- Vegetation stands that exhibit the range of size, form, colour, texture and spacing found commonly in the surrounding landscape; and
- Intermittent streams, lakes, rivers, swamps and reservoirs.

***Low Scenic Quality:***

- Large expanses of indistinctly dissected or unbroken landforms that provide little illusion of spatial definition or landmarks with which to orient;
- Extensive areas of similar vegetation, such as grassland, which very limited variation in colour and texture; and
- Water forms absent.

Within this landscape character type, the Site is considered to represent a landscape area of **low scenic quality**, however the site will be visible from some elevated viewpoints as a background element (6km+) within a larger landscape context which includes some volcanic cone and lake features which represent a moderate scenic quality rating. On that basis a **Low-Moderate** scenic quality rating will apply to the Site.

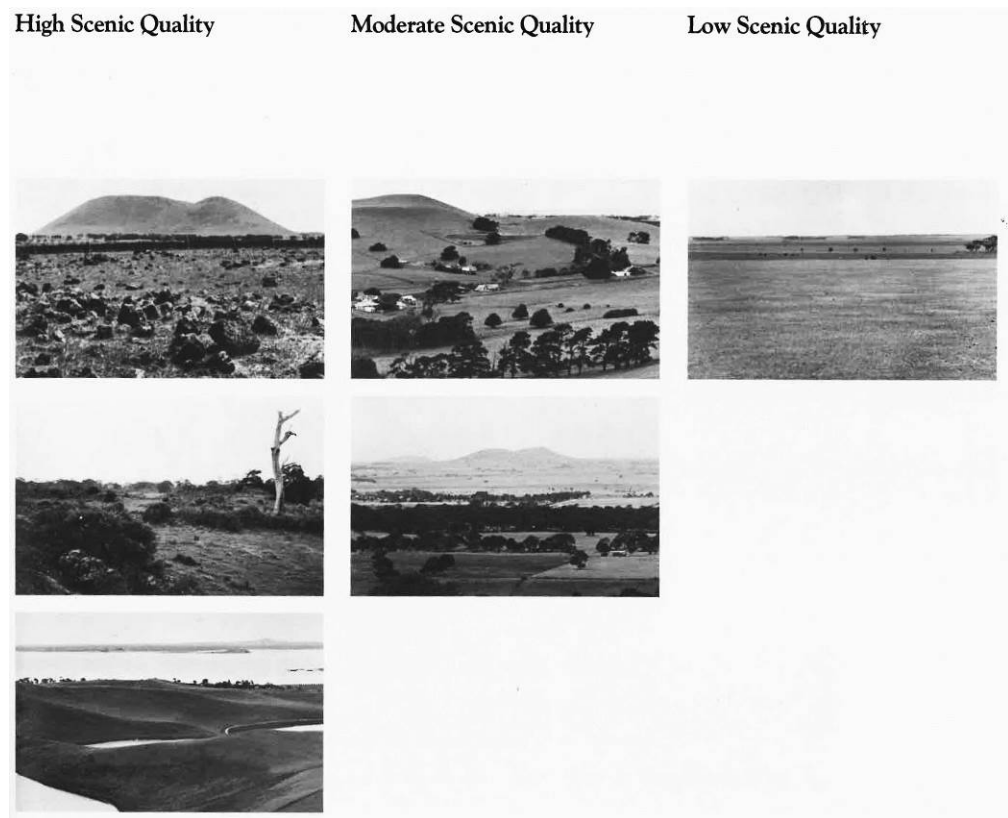


Figure 17 Scenic Quality Classifications of Western Plains (Source: Leonard and Hammond, 1984 p. 69)

## 5.5 Landscape value

Landscape value is a measure of the likely importance of the landscape to the community.

The Site is an area of low scenic quality and no designated value and is unlikely to represent a landscape of special value to the community, however it forms a part of the Meningoort Homestead setting and a part of the panel infrastructure is likely to be visible from the homestead.

On that basis, it is likely that the part of the site with a direct visual connection to the homestead would attract a relatively higher value.

## 5.6 Visual absorption capability

Visual absorbency is a measure of the area's ability to accommodate changes while maintaining existing landscape character and without a significant reduction in landscape and visual quality or amenity.

The major factors are likely to influence the visual absorption capability within the existing setting are as follows:

- The elevation of the landform;
- Landform and its ability to visually conceal development changes at the view source or at the location of the development change;
- Vegetation patterns, height and location that have the capacity to visually conceal development at the view source or destination; and
- The orientation and location of public roads, recreation trails and potential viewing points.

The Site has a **moderate** visual absorption capability based on the following:

- The land is relatively flat and easily screened from low level viewing points such as surrounding roads and rural properties by vegetation, including windrow plantations. Close views are all at low levels;
- The scale and pattern of paddock layouts leads to visual breaks through windrow plantations and other farm or residential planting patterns. This creates shorter and more complex views that more easily absorb landscape change;
- Elevated viewpoints are at long distances from the Site (6km+), which means that the site when viewed forms part of a larger landscape mosaic created by plantations and scattered planting forms. There are no skyline views of the site and no clearly defining visual characteristics for the site within the broader landscape; and
- Agricultural landscapes have existing patterns of development (houses, sheds, storage facilities, fences, power lines etc.) and seasonal cycles of change based on land use. Patterns of land use that visually fit within the scale of existing land subdivision patterns are more easily absorbed.

## 5.7 Landscape Sensitivity

Landscape sensitivity is a measure of the ability of landscape to resist or accept the direct or indirect effects of developments on a landscape without diminishing its value. These values could include physical elements, landscape character and cultural values.

Landscape sensitivity is generally rated as **low** on the following basis:

- The majority of the site is relatively flat cleared grassland with low scenic quality that will accommodate the proposed changes. The site landform will remain and grazing will continue as an activity within the site. Existing perimeter buffer planting will remain and be supplemented under new development conditions.
- The middle part of site is already subject to large-scale high tension power line infrastructure, including lattice towers;
- Small parts of the Site that are identified as potential wetlands in the finer scale ecological assessment (theoretical rather than existing) will have more sensitivity due to biodiversity values but these areas will not be affected by the Proposal;
- The Meningoort Homestead road approach, as a part of the homestead visual setting, is likely to be more sensitive to change and require specific consideration in terms of homestead views.

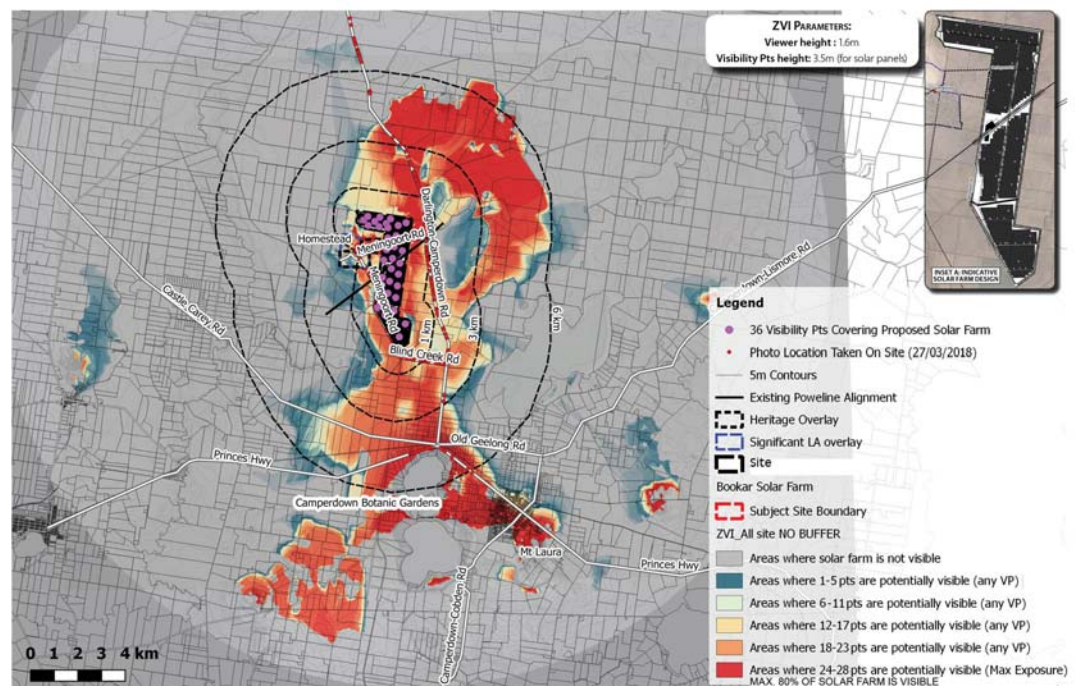
### 5.8 Visibility of the site

ZVI modellings were conducted in GIS to understand the potential visibility of the site and the Proposal, and to identify potential visual receptors. These modellings were used as a basis for ground truthing and photography from identified locations to verify the screening effect of intervening vegetation and structures on visibility.

Based on the Proposal layout (provided by Bookaar Renewables Pty Ltd, (Appendix C) a maximum height of 4m was considered as the most conservative representative height of solar arrays in all possible panel orientations. The Development Footprint cover the most of the Site, excluding any areas of constraints such as the environmental reserve areas, the existing electrical supply easement, drainage lines, a Council Road and planting buffers.

Thirty six (36) visibility points have been used to represent the Development Footprint for ZVI modelling (See **Figure 18-Inset A**). The ZVI is mapped based on the number of visible points can be seen from surrounding areas.

The predicted zone of visibility (ZVI) for the Development Footprint is described in **Figure 18**. This ZVI is modelled based on Digital Terrain Model (DTM) which represents a ‘worst case scenario’ without considering existing vegetation heights. Based on this ZVI modelling (landform only), a maximum of 24-28 visibility points are visible from the red areas (approximately 80% of the Proposal).



**Figure 18** ZVI of Proposal based on landform only (refer Appendix A for A3 full-size figure)

An alternative option ZVI scenario is modelled where a 10m height buffer planting strip (20m width) has been added to the site perimeter. The planting buffer includes the existing vegetation located on the perimeter captured in the survey (See **Figure 19**).

Modelling shows a substantial change in the pattern of viewing with the 10m buffer. The visibility of the solar farm reduces to a maximum of 14 visible points (approximately 40% of the Proposal), and with available visibility generally restricted to elevated and more distant locations and some sections of nearby roads at distances of greater than 1km.

Mt Meningoort Homestead is likely to retain a level of visibility under this modelling scenario, however further growth of the homestead garden will ultimately limit views to the site.

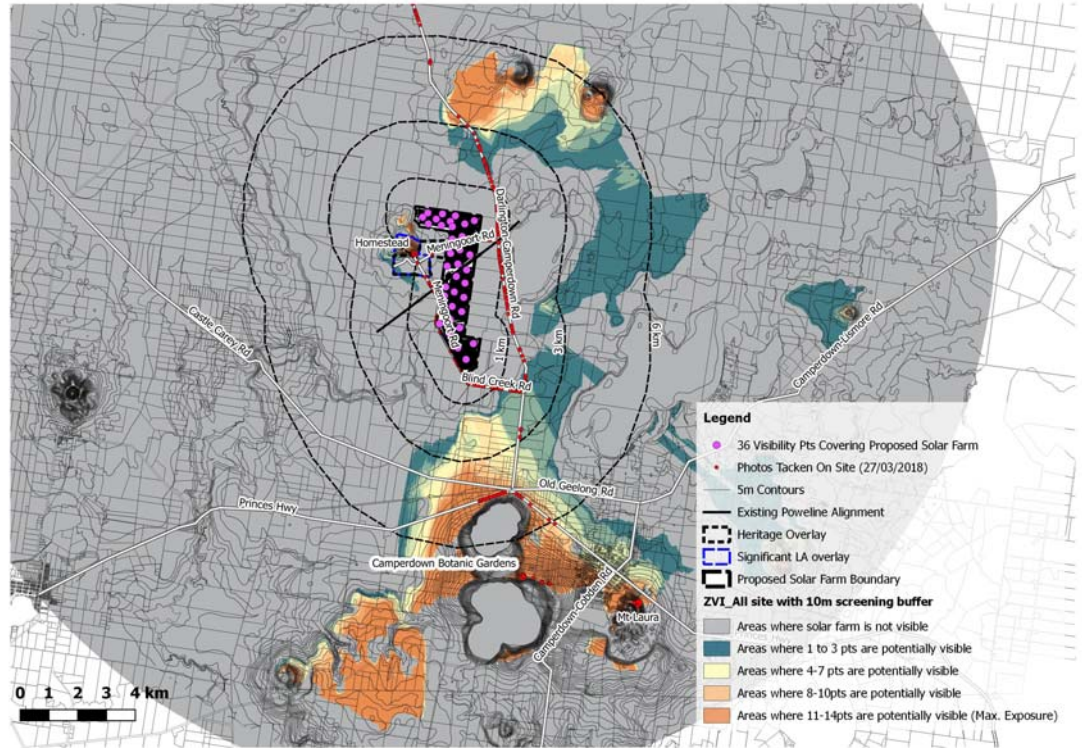


Figure 19 ZVI of indicative solar farm layout (refer Appendix A for A3 full-size figure)

The modelled ZVIs were used as a basis for conducting the site visit (27<sup>th</sup> March 2018) to take photographs (as shown as red dots). Fifty two photos are presented in the photo album (Appendix B) to confirm the effect of intervening landform, vegetation or built forms on screening the Development Footprint.

**5.9 Visual receptors**

Based on the modelled ZVI's and the site visit, four main visual receptor groups were identified which are described in **Figure 20**. Several photos were taken on site from each view receptor groups. Four viewpoints were selected in each group as principal viewpoints for photomontage modelling to understand the likely appearance and size of the Proposal from these locations. These modellings are used as basis for visual impact assessment in the next chapter of report.

**Table 7** describes the context of views from each receptor group and relevant sensitivity to the proposed change. The selected viewpoints are representative of the possible viewing locations, view types and view quality available from publicly accessible locations within the Study Area.

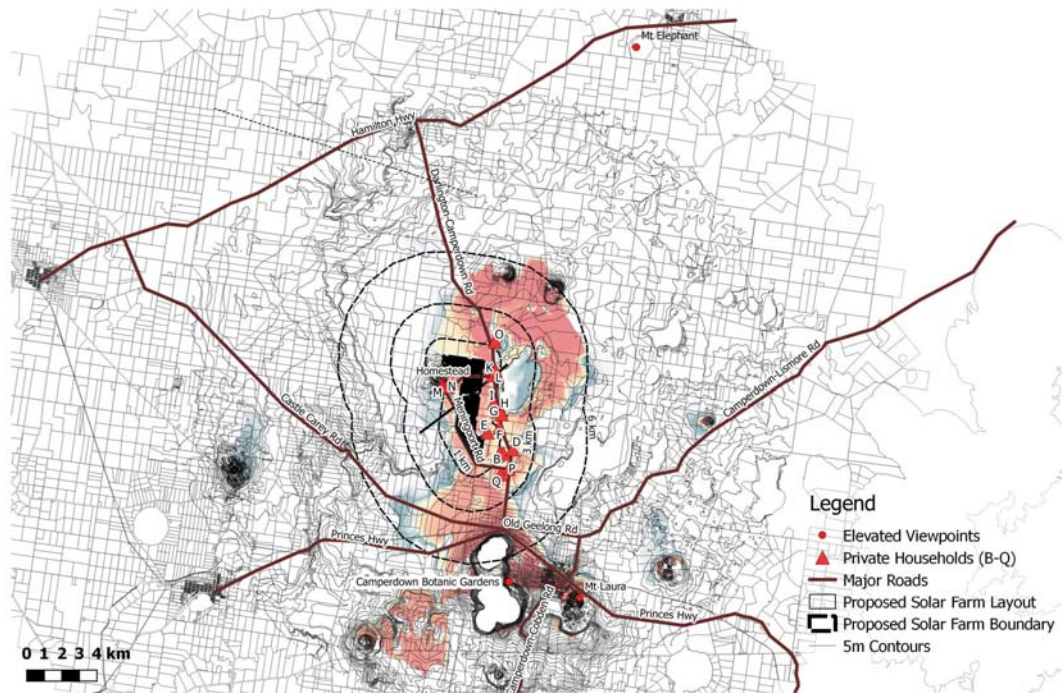


Figure 20 Visual Receptor Groups (refer Appendix A for A3 full-size figure)

Table 7 Visual receptor groups & principal photos and selected viewpoints

Receptor Group	Locations	Approximate Distance to Solar Farm	View Context and Visibility Comments	Visual Sensitivity *	Principal photos from photo album	Selected photo for Photomontage
A) Main road travellers	Darlington Rd, Princes Hwy	500m – 6km Foreground to near background	<ul style="list-style-type: none"> <li>Only limited section of the Darlington Rd has clear view without obstruction to the Proposal;</li> <li>Views are mainly screened by intervening vegetation;</li> <li>Commuters driving with 100km speed along the corridors are likely to have a narrow view focus and have minimal recognition of landscape changes.</li> <li>View distance, elevation and screening vegetation are likely to be significant mitigating factors.</li> </ul>	<b>Moderate-Low</b>	All other photos in photo album not mentioned in other receptor groups	<p>VP01- View from Darlington Rd</p> <p>VP02- View from Princess Hwy</p>
B) Private houses, internal access roads or driveways	Residences Along Darlington Rd & Mt Meningoort & Meningoort Rd as internal access road	500m-2.5km Foreground – Middle ground	<ul style="list-style-type: none"> <li>Views from most of properties are screened by the intervening vegetation;</li> <li>Without mitigation, the Proposal is likely to be visible from internal access roads or driveways from limited locations and as glimpse views.</li> </ul>	<p><b>Meningoort Homestead= Moderate</b></p> <p><b>Other rural residences= Low</b></p>	DSC03071, DSC03082, DSC03228, DSC03233, DSC03234, DSC03238, DSC03246, DSC03254, DSC03264, DSC03267, DSC03273, DSC03277, DSC03279, DSC03295, DSC03301, DSC03310, DSC03323, DSC03329.	VP03- View from Meningoort Homestead



<p><b>C) Elevated locations &amp; designated lookouts</b></p>	<p>- Elevated receptors on eastern side of Botanic Garden on foothills and ridgeline including:                  - Elevated Residential areas of Camperdown                  - Mt Elephant                  - Mt Leura                  - Camperdown Botanic Garden                  - Park Lane residential                  - Mt Sugarloaf</p>	<p>- 26km                  - 12 km                  - 7.5 km                   Distant background</p>	<ul style="list-style-type: none"> <li>▪ <b>Note:</b> the Botanic Gardens viewpoint is considered to represent the nature &amp; the magnitude of the impact from similar elevated areas, including residential settings</li> <li>▪ Considerable distance from these viewpoints to the Proposal;</li> <li>▪ Weather effects play a part in the clarity of the view</li> <li>▪ Panoramic view of the wider regional landscape is available from these locations, but the site is seen as a smaller component of a larger and more complex view involving a variety of landforms and a mosaic of planting patterns across the rural landscape;</li> <li>▪ The site is not seen as a skyline silhouette;</li> </ul>	<p><b>High</b></p>	<p>DSC02892, DSC03116, DSC03131, DSC03149, DSC03165.</p>	<p><b>VP04- View from Camperdown Botanic Garden Lookout</b></p>
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Two selected viewpoints along Darlington Road and Bruce Highway (VP01 and VP02) represent the views from main roads and other flat areas surrounding the Site.

The view from Meningoort Homestead (VP03) represents the view from Residences along Darlington Rd and Meningoort Rd and the internal access road. It also represents the view from the most sensitive viewpoint surrounding the Site.

The view from Camperdown Botanic Garden Lookout represents the view from elevated viewpoints (whether elevated residences in Camperdown or lookouts) towards the Proposal. This viewpoint is selected as the closest publically accessible lookout to the Proposal and represents the best available view from this receptor group. Other elevated viewpoints would have similar or less prominent views to the proposal based on lower elevations or greater distance to the Site.

**5.10 Baseline conditions – key findings**

The baseline analysis indicates:

- The regional volcanic plains landscape is characterised by relatively flat to gently undulating terrain with intermittent volcanic cones and lake formations. On a comparative basis, the landscape of the Site represents an area of relatively low scenic quality given its flat terrain, simple, repetitive plantation forms and the presence of a major power line easement through the centre of the site.
- Long distance (6+km), elevated views of the site incorporate a wider range of landscape features such as volcanic cones and lakes with higher scenic quality values, but at these distances the site becomes a smaller part of a more complex visual landscape that is formed by patterns of grazing land and windrow plantations. In that context, the site is not seen as a separate or distinctive landscape area.
- The long established cultural landscape that has developed in the Study Area and its surroundings is based on grasslands with a combination of windrow plantations (native and exotic) and scattered planting. Homesteads, driveways and concentrations of outbuildings are typically surrounded by gardens and / or shelter plantings that partly visually separate them from their surroundings.
- Meningoort Homestead is a setting on an adjoining site that has designated cultural heritage and landscape values. While the homestead and its gardens are not directly affected by the Proposal, the broader rural setting is likely to play a supporting role in the visual character and scenic quality of the homestead setting and on that basis has been specifically considered within the design of the Proposal and any visual mitigation measures.

- The site is considered to have a moderate visual absorption capability based on its low elevation, relatively flat landform and shelter planting patterns.
- The site has a relatively low level of landscape sensitivity given its existing land use characteristics and the protection and spatial separation given to environmental and cultural heritage features.
- The pattern of viewing study indicates that the site has a relatively high visibility potential when no vegetation is present but a significantly lower visibility potential when vegetation is considered, particularly from flat areas nearer to the site. Elevated landform areas have a significantly higher view potential, but these locations are at significant distances from the site (6+km) and in this context, it is seen as a background element and part of a broader landscape mosaic.

## 6. Impact assessment

As the result of the baseline assessment four viewpoints within three receptor group areas were identified for more detailed analysis and photomontage simulations. These viewpoints are representative locations from which the Proposal is likely to be visible from publicly accessible viewpoints.

Photomontage simulations describe the likely appearance of the Proposal and describe and rate the likely visual effects based on the **sensitivity** and **magnitude of change**.

### 6.1 Representative view points

Figure 21 shows the location of selected viewpoints including:

- VP01- View from Camperdown-Darlington Road;
- VP02- View from Princes Highway;
- VP03- View Meningoort Homestead;
- VP04- Camperdown Botanic Garden Lookout.



Figure 21 Selected viewpoints for photomontage modelling (refer Appendix A for A3 full-size image)

## 6.2 Modelling parameters

The following development components are modelled in 3D in accordance with the technical details provided:

- Modular solar arrays up to 4m high (at maximum angle);
- A 20m high lattice structure tower;
- Area for batteries extruded to 8m high; and
- Substation area to 8m high.

Photomontage modellings were prepared as wireframe or fully rendered images.

The wireframe view (VP02) is provided to show the location of the Proposed Development against the existing view. The model indicates that the development is likely to be extensively screened by existing foreground vegetation.

The rendered views from VP01, VP03 and VP04 show the appearance of the Proposal with and without buffer planting in order to understand the effects of proposed mitigation measures. The proposed 20m wide buffer planting is modelled at a conservative height of 4m with native tree species which is considered to represent around 8 years growth under average conditions. In reality, plant growth rates and vegetation buffer sizes may well exceed these heights, particularly where Acacia and other fast growing species are used.

The visual impacts resulting from the Proposal are discussed for each viewpoint and similar views in the receptor group considering the **sensitivity of viewers** and **magnitude of change**. In assessing the level of magnitude of change from these viewpoints, the effects of glare and glint are also considered which was prepared by a specialist consultant in this field. The results of glare and glint study are summarised below.

The publicly accessible viewpoints selected for detailed analysis are locations that are considered to best represent the nature and magnitude of changes experienced as a result of the Proposal. These locations represent both typical and worst case scenarios. Other locations, such as Mt Elephant, Mt Leura and a range of residential settings for example, may experience views to the site, but the nature of the effects is likely to be the same or less than the selected receptor locations.

## 6.3 Glare and glint impacts on visual amenity

A glare and glint study was prepared by the UK company **Pager Power** (26<sup>th</sup> April 2018) to assess the effects of sunlight and reflection resulting from the solar farm on surrounding roads, dwellings and Council nominated viewpoints. Their Executive Summary findings are summarised below (without alteration) and considered within the overall LVIA analysis.

### **Report Purpose**

*Pager Power has been retained to assess the possible effects of glint and glare from the proposed Bookaar Solar Farm located in south western Victoria, Australia. This assessment pertains to the possible effects upon surrounding roads and dwellings. The analysis includes modelling of a tracking system that optimises the panel angle throughout the day to maximise electricity generation.*

### **Pager Power**

*Pager Power has undertaken over 300 glint and glare assessments in locations such as Australia, India and Europe. The company's own glint and glare guidance is based on industry experience and extensive consultation with industry stakeholders including airports and aviation regulators.*

### **Guidance**

*There is limited glint and glare guidance for the assessment of proposed solar photovoltaic (PV) developments. Pager Power's methodology is based on independent studies, consultation with stakeholders and experience drawn from completion of over 300 glint and glare assessments.*

The available studies have measured the intensity of reflections from solar panels with respect to other naturally occurring and manmade surfaces. The results show that the reflections produced are of intensity similar to or less than those produced from still water and significantly less than reflections from glass and steel.

### **Glint and Glare**

The definition of glint and glare used by Pager Power is as follows:

- Glint – a momentary flash of bright light;
- Glare – a continuous source of bright light.

### **General Effects of Glint and Glare**

Glint and glare effects can only ever occur when the weather is clear and sunny. In the scenario where a solar reflection is possible towards a road user or resident in a surrounding dwelling, the individual will also be looking in the general direction of the Sun. This means the Sun and solar reflection will be visible simultaneously. The Sun is a significantly brighter source of light. Lastly, at any one location, only a particular area of solar panels will produce a solar reflection towards it. Not all receptors will experience a solar reflection at the same time.

## **Results**

### **Surrounding Roads**

Solar reflections are theoretically possible towards approximately 2.6km of road classified as an arterial road. Road users are expected to be travelling at (up to) 100 km/h with a low density of traffic expected. Any solar reflection could last for up to 20 minutes, however in reality its duration would depend on the speed of the car travelling through the solar reflection zone. In accordance with the methodology set out in Section 3 and Appendix E, the overall expected impact upon road users with respect to safety is classified as low (at worst) where the reflecting solar panels are visible. Where the solar panels are not visible, there is no impact.

### **Surrounding Dwellings**

Solar reflections are possible towards five surrounding dwelling receptors. At these dwellings views of the proposed solar farm and the reflecting solar panels has not been confirmed. The solar reflections would last for up to 20 minutes per day potentially all year round from windows with a clear view of the reflecting solar panels. The results vary per dwelling therefore see Section 5.3 and Appendix G for the detailed results breakdown for each dwelling. In all cases, a clear view of the reflecting solar panels at the particular time of day when a solar reflection was geometrically possible would be required. In addition, the weather would also have to be clear and sunny. In accordance with the methodology set out in Section 3 and Appendix E, the resulting impact significance is low to moderate at these dwellings. If proposed screening removes the solar panels from view, no impact will be possible.

### **Council Viewpoints**

All three viewpoints (Mt Laura, Camperdown Botanic Gardens and Mt Elephant) are beyond 7km from the proposed solar farm and are situated north and south of the panel area. It is Pager Power's methodology to consider receptors within 1km of a solar panel. Furthermore, no solar reflection would be expected at these viewpoints considering the geographic relationship to the proposed solar farm. Considering this, no impact is expected at these viewpoints.

### **Mitigation**

Four metre high screening\* will be installed at the site boundary between the dwellings where a solar reflection may be possible. This will likely remove any visibility of the solar panels because the landscape is relatively flat, the distance between receptors and panels is relatively large and the solar panels are 4m tall at their maximum tilt, equal to the screening height. Therefore any predicted impacts at these dwellings, and also the roads, would likely be removed.

**\*Tract Note:** For modelling purposes within the LVIA process 4m high buffer planting has been assumed. This height assumes around 8 year’s growth of a mixed native plantation. This is a deliberately conservative figure. Better growing conditions are likely to result in higher growth rates.

Over time the height of vegetation screening would increase to > 10m and provide significantly more visual screening potential.

**6.4 Viewpoint 01- Camperdown-Darlington Road**



**Figure 22a** VP01-Existing Photo- 124° Field of View (FOV) (refer Appendix A for full size figure)



**Figure 22b** VP01-Photomontage showing Proposal (refer Appendix A for full size figure)



**Figure 22c** VP01-Photomontage showing the Proposal with planting buffer (refer Appendix A for full size figure)

Camperdown-Darlington Road is the closest main access road to the Site which connects Camperdown to Darlington. The Development Footprint has 800m to 1.6km setback from this road corridor. The road width changes along the way and some parts of the road are narrow and allow only one car to pass. The numbers of users travelling along this corridor is 600 movements per day as given in the Transport Impact Assessment for the Proposal in the Planning Report, and primarily used by local people or trucks. The views from the road towards the Development Footprint are partially screened by the intervening vegetation, windbreaks and existing dwellings.

The visual context along Darlington Road includes views of pastoral land with cattle, scattered trees and rural households, windbreaks, powerlines, fences and small structures. Elevated cones such as Mt Noorat and Mt Meningoort are partly visible but not dominant landscape features and provide a visual backdrop for the views over the Development Footprint. Lake Bookaar is visible on the opposite side of Darlington road which provides more visual interest when travelling north or south along the road.

Unobstructed views from Darlington Rd to the Development Footprint are available along a 4.5km stretch of road near Lake Bookaar (See Figure 12 on Glint and Glare Study-Appendix D). The overall sensitivity of viewers along this road, taking into account their speed, duration of view and direction of travel, is considered **low to moderate**.

Viewpoint 01 is taken along the road near the large scale powerline crossing the Site and represents the closest unobstructed view available from a limited section of Darlington Road (worst case scenario). **Figure 22a** shows 124° (human vision) of horizontal FOV. Based on the modelled photomontage (**Figure 22b**), the Proposal is visible in the middle ground (900m to 2.5km) which occupies the majority of the Field of View (FOV) with minimal and sporadic screening in the foreground. However, due to distance and the low profile of the Proposal, it only occupies 2 degree of vertical FOV which is likely to make the view barely discernible from this viewpoint.

The proposed solar panels are shown in the early morning sun (worst case) with maximum visible height facing to the viewer, however, the dark blue colour of the panels will provide minimal contrast with the backdrop vegetation and help to visual blend with the surrounding visual setting. The proposed batteries close to the powerline are visible above the solar panels. However, it will not extend above the

backdrop vegetation. The colour of the battery house is a key consideration in order to blend into the backdrop vegetation (dark grey is likely to be a visually recessive colour, but this should be confirmed at the detailed design stage). The 20m lattice structure tower will appear smaller than the existing power poles and is not discernible within the view.

Considering the distance, contrast and low reflection impacts, the overall **magnitude of change** is considered **low** from this viewpoint without any mitigation measures. The combination of sensitivity and magnitude of change results in **low visual impact** from this viewpoint.

As shown in **Figure 22c**, 4m high boundary planting within the development site will completely mitigate visual impacts and appear as a normal component of the regional agricultural landscape.

## 6.5 Viewpoint 02- Princes Highway



**Figure 23a** VP02-Existing Photo (refer Appendix A for full size figure)

Princes Highway is a major road corridor located 5.8 km south of the Site. The road will carry high levels of local and visitor traffic. Views from the highway include a mixture of rural views and rural residential views that change in scale and distance due to the presence of structures and tree planting. The result is a fairly complex pattern of viewing where it is potentially difficult for drivers to identify individual landscape features with the viewing angles and duration available to them at speed **Figure 23a**. Mt Meningoort is visible between trees.



**Figure 23b** VP02-Wireframe View (refer Appendix A for full size figure)

Based on the wireframe model shown in **Figure 23b**, only glimpses of the Proposal is potentially visible from this location and that assumes that drivers can appreciate the view at the speed they are travelling. As the Proposal has a low profile, the intervening vegetation and landform effectively screen the views from this view sector (south-low). This is likely to apply to both drivers and residents.

Considering the **moderate sensitivity** of viewers travelling along this corridor and **negligible to no magnitude of change** resulting from the Proposal, **no visual impacts** are expected from this and similar locations. Princes Highway receives no glint or glare impacts from solar panels.



**Figure 23c** VP02- Photomontage showing the Proposal with 4m planting buffer (refer Appendix A for full size)

This viewpoint, along with Viewpoint 01 (Darlington Road), represent the likely views from public locations on flat areas toward the Proposal. If the Proposal is not screened by the intervening vegetation and landform, the proposed planting buffer effectively screen the available views. The overall visual impacts from this view receptor group are considered **negligible to no impacts**.

## 6.6 Viewpoint 03- Meningoort Homestead



**Figure 24a** VP03-Existing Conditions Photo (refer Appendix A for full size figure)



**Figure 24b** Photomontage showing the Proposal without proposed planting buffer (refer Appendix A for full size figure)



**Figure 24c** VP03- Photomontage showing the Proposal with planting buffer (refer Appendix A for full size figure)

Mount Meningoort Homestead setting is designated as a sensitive landscape. The heritage-listed homestead is located in on the foothills with panoramic views to the farming lands. Mt Leura and Camperdown provide a visual backdrop for these views to the south.

The homestead is located at the end of a long driveway on foothills and surrounded by an established garden and mature trees. It is located approximately 1km from the Proposal boundary. The garden and vegetation on the eastern side of Homestead provides a substantial visual buffer towards the Proposal (**Figure 24a**). Panoramic views are available from the homestead veranda to the surrounding landscape. Considering the nature of views from Meningoort homestead to the surrounding rural landscape and its status as a heritage-listed place, the viewer sensitivity is considered **high** from this viewpoint (considering the limited visitation and the nature of views).

Based on the rendered photomontage (**Figure 24b**), the Proposal is predominantly screened by the existing vegetation in the foreground. Only glimpses of the northern part of Proposal are visible at 1.8km distance between the existing vegetation. The visible part of Proposal occupies a very limited section of the FOV which will result in a **low magnitude of change**. The glare and glint assessment indicates that there will be no impact on this receptor.

On that basis, the combination of the viewer sensitivity and magnitude of change would result in a **Moderate level** of visual impact from this viewpoint in the short term only.

**Figure 24c**, indicates that the Proposal including a planting buffer (at 4m height only) may still be barely visible as a thin band from this viewpoint, however, the level of impact will reduce as the vegetation buffer and garden plantings increase in height and eventually eliminate all views to it. Long rural views will still be retained after the Proposal is constructed. It is considered that the overall effect of the Proposal on the character, quality and composition of views from the homestead will be minimal in the short term and will decrease further over time. It is considered that the development approach is compatible with the landscape and heritage values of the site.



## 6.7 Viewpoint 04- Camperdown Botanic Garden (Gnotuk Lookout)



**Figure 25a** VP04-Existing Photo (refer Appendix A for full size figure)



**Figure 25b** VP04-Photomontage showing the Proposal with planting buffer (refer Appendix A for full size figure)



**Figure 25c** VP04-Photomontage showing the Proposal with planting buffer (refer Appendix A for full size figure)

This viewpoint is one of the nominated viewpoints by Council and represents the closest view (7.5km) from elevated viewpoints surrounding the Site. This view represents the views available from elevated viewpoints including elevated private residences in Camperdown and lookouts (Mt Leura and Mt Elephant) to the Proposal. This viewpoint is selected as the closest publically accessible lookout to the Proposal and represents the best available view from this receptor group. Any visual impacts on other locations in this receptor group, including nearby residential locations, will be similar in nature and no greater in magnitude than this viewpoint.

The photo is taken from Gnotuk Lookout which offers panoramic views across the twin crater lakes of Lake Bullen Merri and Lake Gnotuk (**Figure 25a**). Mount Meningoort is a prominent landscape feature visible in the back ground with open grasslands, scattered trees and windbreaks in front which collectively form a dominant visual pattern across the landscape.

Open views towards the Proposal are available from bench seats slightly off the vehicular access and the interpretive signage. In the modelled photomontage (**Figure 25b**), the Proposal will be visible in the broader landscape context. The Proposal is contained within a pattern of scattered vegetation and windrow plantations surrounding the site and is generally visually absorbed into the patterns and colours of the wider landscape setting. The staggered outline of the Development Footprint helps to blend the Proposal in the landscape.

From this view direction, the length of Development Footprint appears shorter and occupies less of the FOV. The Proposal occupies 10.5° of horizontal field of view (FOV) which is around eight percent (8%) of human binocular vision (124°). Distance from the site and the relative size of the Proposal within the wider field of view are major mitigating factors.

The modelling takes into account the photo time and date recorded on site in the modelling of virtual sun and the rendering of the solar farm. All texture and detail within the site is lost at this distance. The proposed planting buffer will reduce the visibility of the Proposal but not eliminate views (**Figure 25c**). A more mature buffer plantation above 10m in height is likely to further reduce but not eliminate views from this viewpoint.

On the basis of modelling, the Proposal will potentially result in a **low (minor adverse) impact** on the view receptor, primarily due to the viewing distance, the broad field of view and the ability of the existing landscape to absorb changes that fit within existing landscape colours and patterns. Mitigation planting will have a minimal but positive effect from this viewpoint.

## 6.8 Impact assessment – key findings

### Visual

The overall impacts resulting from the Proposal on visual receptors are summarised in **Table 8**. The sensitivity of view receptors and the magnitude of change for each viewpoint are listed. Based on the photomontage visualisation completed from the four nominated viewpoints, the overall impact of the Proposal on visual values is considered **low**.

The proposed 20m wide planting buffer will be effective in eliminating views to the site from low elevation viewpoints over time and minimising the impacts from elevated viewpoints.

**Table 8** – Summary of Impacts on Visual

Viewpoint Location	Receptor Group	Viewer Sensitivity	Magnitude of Change	Visual Impact without Planting buffer	Visual Impact with Planting buffer (20m wide/ 4m high)
VP01 Darlington Road	A	Low	Low	Low	Nil
VP02 Princes Hwy	A	Moderate	No change	No impacts	Nil
VP03 Meningoort Homestead	B	High	Low	Moderate	Low & reducing over time
VP04 Camperdown Botanic Garden	C	High	Low	Low	Low & reducing over time

The impacts on landscape are discussed in the conclusion section.

### Landscape

The baseline assessment concludes that the landscape of the Site has a relatively low scenic quality and a relatively low sensitivity to change based on its physical characteristics, existing pastoral land use and existing features infrastructure, including roads, fencing and the existing high tension power line infrastructure.

Sensitive parts of the Property, including parts of Mount Meningoort are separated from the Development Footprint, including the identified areas of sensitivity including wetlands, drainage line, Meningoort Road (crossing the northern part of the Development Footprint).

The existing vegetation buffer on the perimeter of the Development Footprint is integrated in the proposed 20m wide buffer planting. The existing powerline which crosses the Development Footprint eliminates the need for a new transmission line and minimises the visual impacts associated with the Proposal. Ancillary facilities including battery, substation and telecommunication tower are located near the existing powerline and in already disturbed areas. The Proposal does not include any major landform changes and will be limited to minimal excavations associated with the track and building construction.

## 7 Mitigation and enhancement measures

The objective of mitigation is to avoid, reduce, remedy or offset any significant adverse effects on the environment arising from the Proposal. Mitigation may also compensate for unavoidable effects or residual impacts.

Mitigation measures may potentially involve modifications to intrinsic parts of the Proposal design or other measures, including off-site changes that reduce negative impacts.

While the overall visual impact of the Proposal has been determined as **low** on landscape and surrounding visual receptors, a range of mitigation measures are recommended to minimise the level of residual visual impacts during detailed design, construction and operation.

Mitigation measures during the detailed design process should consider:

- **Reduction/treatment of reflective surfaces:** Design infrastructure such as steel surfaces or chain fences to be non-reflective and with low colour contrast material.
- **Using colour treatments:** Selection of colours on visible structures and surfaces to blend with the surrounding landscape and avoid obvious colour contrasts or reflective surfaces. Where there are a series of adjoining structures, consider subtle colour shifts within a colour range.
- **Design lighting for minimal offsite impact:** Lighting that is required to meet operational and maintenance needs should be minimised and sited / shielded to avoid panel reflection / radiance and offsite impacts.
- **Screening planting buffer:** . A dense planting buffer based on native species is required to screen views to the Proposal from near viewpoints (ie. Meningoort Road) and to reduce the magnitude of impacts from more distant view points. Regular establishment and maintenance regimes are required to maximise the growth rate and screening effect.

### Landscape buffer strategy

A native vegetation buffer located around the edges of the Site has been incorporated into the Development Plan.

The regional landscape has been extensively modified over time to become an open agricultural landscape with fencing, paddocks, wind row plantations (Pine, Cypress and mixed native species), group planting around settlements and other typical rural features along with a range of large scale built elements such as power transmission towers.

The proposed landscape treatments have been designed to fulfil the requirements of a landscape buffer, but to also produce a landscape that visually integrates the site with the cultural landscape of the surrounding Western Plains landscape.

The proposed landscape buffer treatments are intended to provide the following:

- A landscape outcome which is sensitive to both the indigenous and cultural landscapes of the region;
- A landscape buffer that will improve the environmental value of the site and provide a softened green edge to the internal works areas;
- Opportunities to create, with the exception of existing exotic windrow plantations, an indigenous environment, using endemic species where possible to give the site an improved landscape character and ecological value;
- Opportunities to create a landscape to encourage use by indigenous fauna;
- Reduce views into the site through vegetation screening; and
- Provide planting that reduces the spread of dust and windborne weeds.

### **Construction & Operation**

Mitigation measures during the construction and operation periods should consider:

- Minimising vegetation clearing inside and outside of the specific development footprint;
- Avoidance of temporary light spill beyond the construction site where temporary lighting is required;
- Rehabilitation of disturbed areas; and
- Ongoing maintenance and replacement of buffer planting on the perimeter to maintain visual screening of external views where appropriate.

## 8. Evaluation

The LVIA indicates that:

- The regional **volcanic plains landscape** is characterised by relatively flat to gently undulating terrain with intermittent volcanic cones and lake formations. On a comparative basis, the landscape of the Site represents an area of relatively **low scenic quality** given its flat terrain, simple, repetitive plantation forms and the presence of a major power line easement through the centre of the site.
- The Site has a **low landscape sensitivity** due to the modified nature of the agricultural landscape.
- Long distance (6+ km), elevated views of the site incorporate a wider range of landscape features such as volcanic cones and lakes with higher scenic quality values, but at these distances the Site becomes a smaller part of a more **complex visual landscape** that is formed by patterns of grazing land, remnant vegetation and windrow plantations. In that context, the site is not seen as a separate or distinctive landscape area, but rather as part of a landscape mosaic.
- The **long established cultural landscape** that has developed in the Study Area and its surroundings is based on grasslands with a combination of windrow plantations (native and exotic) and scattered planting. Homesteads, driveways and concentrations of outbuildings are typically surrounded by gardens and / or shelter plantings that partly visually separate them from their surroundings.
- **Meningoort Homestead** is a setting on an adjoining site that has designated cultural heritage and landscape values. While the homestead and its gardens are not directly affected by the Proposal, the broader rural setting is likely to play a supporting role in the visual character and scenic quality of the homestead setting and on that basis should be specifically considered within the design of the Proposal and any visual mitigation measures.
- The Site is considered to have a **moderate visual absorption capability** based on its low elevation, relatively flat landform and shelter planting patterns.
- The site has a relatively **low level of landscape sensitivity** given its existing land use characteristics and the protection and spatial separation given to environmental and cultural heritage features.
- The visibility of the Development Footprint is limited due to the flat landscape and presence of scattered trees and windbreaks
- The pattern of viewing study indicates that the Site has a relatively **high visibility potential when no vegetation is present** but a significantly lower visibility potential when vegetation is considered, particularly from flat areas nearer to the site. **Elevated landform areas have a significantly higher view potential**, but these locations are at significant distances from the site (6+ km) and in this context, the site is seen as a background element and part of a broader landscape mosaic. On that basis, **the overall impact from distant receptor locations is considered to be low**

Mitigation of impacts is most likely to be achieved through:

- Developing a screen planting buffer around the perimeter of the Proposal
- Design lighting for minimal offsite impacts; and
- Managing colour contrasts and reflectivity of visually exposed surfaces.

## 9. Conclusion

The Proposal is located within a rural area which is characterised by a patterned landscape of paddocks with windrow plantations and scattered tree planting. The landscape has the capacity to absorb low scale land use and visual changes of the type associated with the Proposal, particularly from nearby low level viewpoints where views to new features can be managed effectively by existing and new vegetation screening.

Distant elevated viewpoints are likely to retain views of the Proposal, but at the distances involved, the land use changes proposed within the site are likely to be seen as a part of the larger regional landscape mosaic and with a low impact rating that does not represent a significant adverse impact on the landscape character or scenic qualities of the location.

With effective mitigation measures the Proposal is considered to have a low landscape impact and an overall low visual impact on the setting, including the Meningoort Homestead where planting works and existing landscape features will effectively screen any land use changes over time.

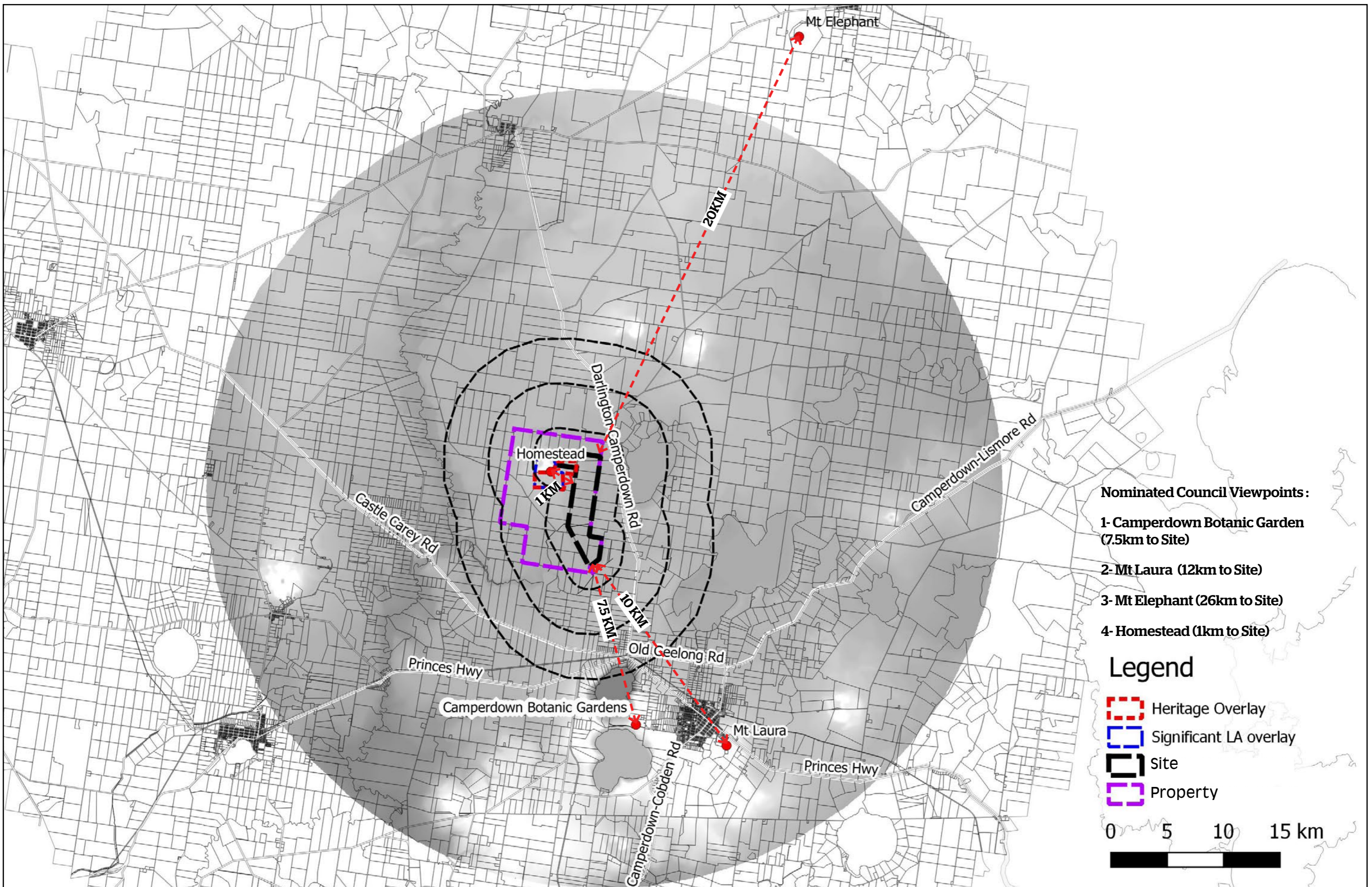
From my analysis I am satisfied that the Proposal would not represent an unacceptable impact on the regional or local landscape.

## Appendices

**Appendix A** Full Size Figures @ A3

**Appendix B** Photo Album

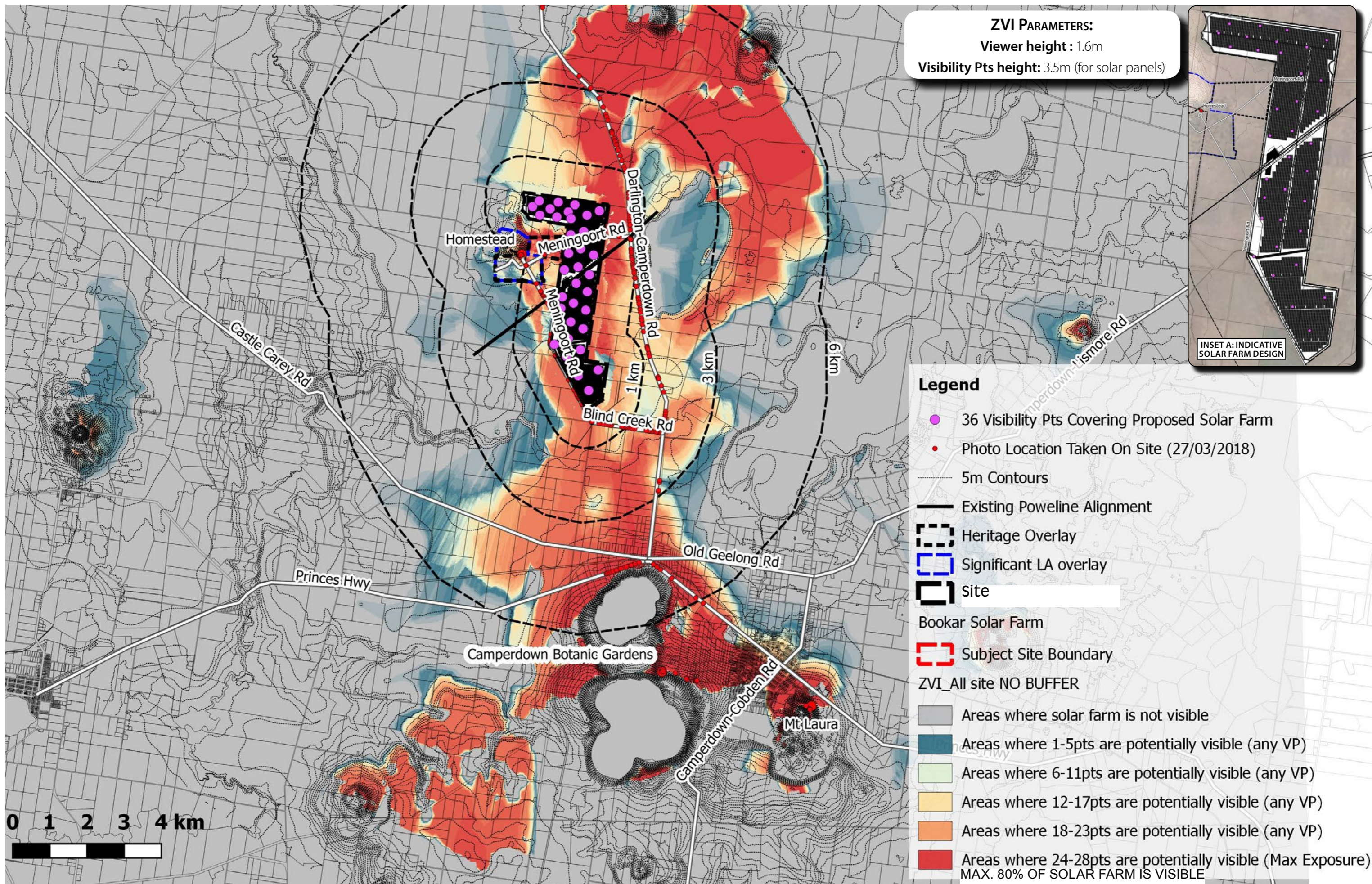
**Appendix C** The Proposal plans & description (Provided by Bookaar Renewables Pty Ltd)



**Figure 12-Council Nominated Viewpoints**

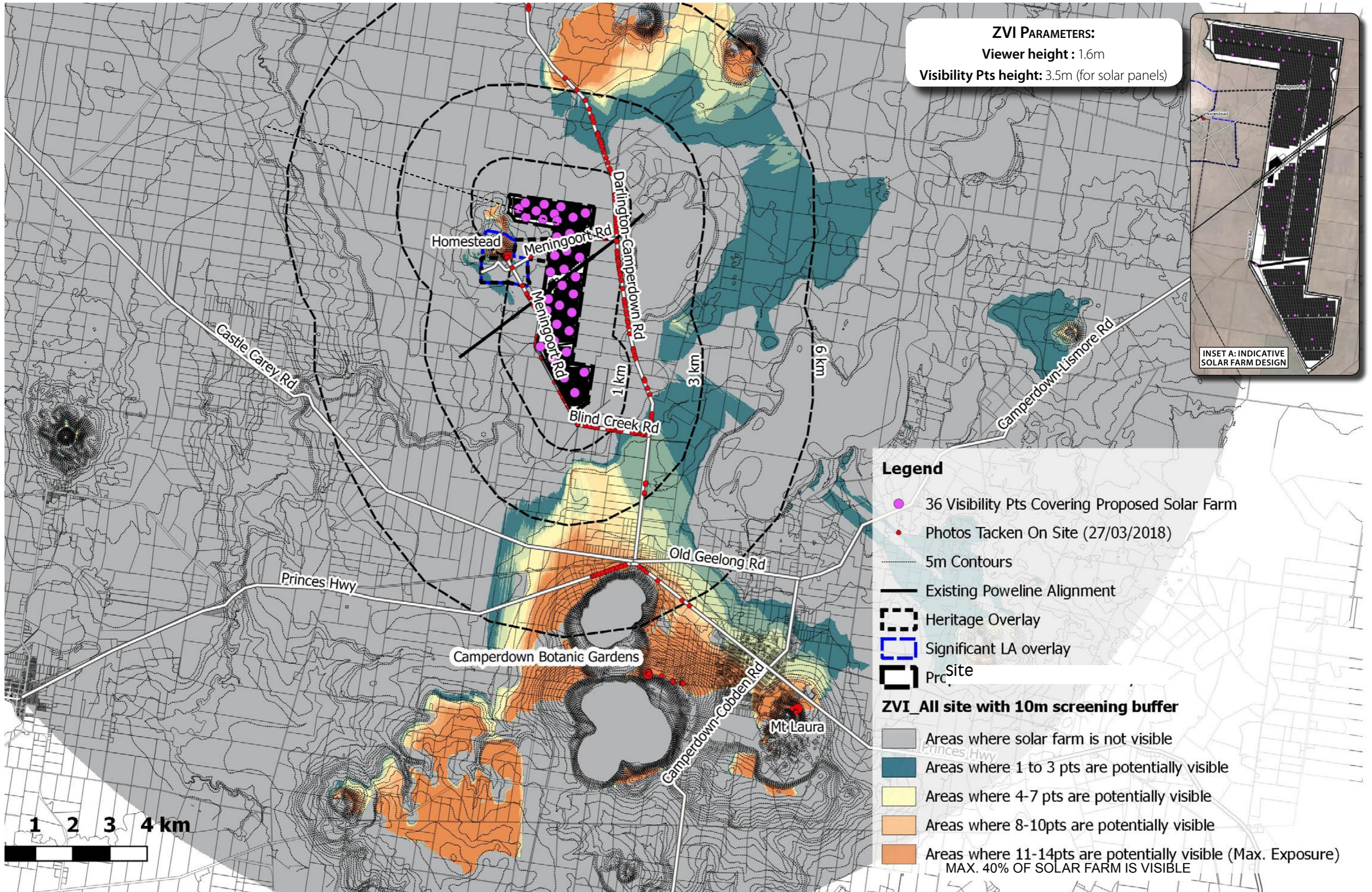
Bookaar Solar Farm LVIA





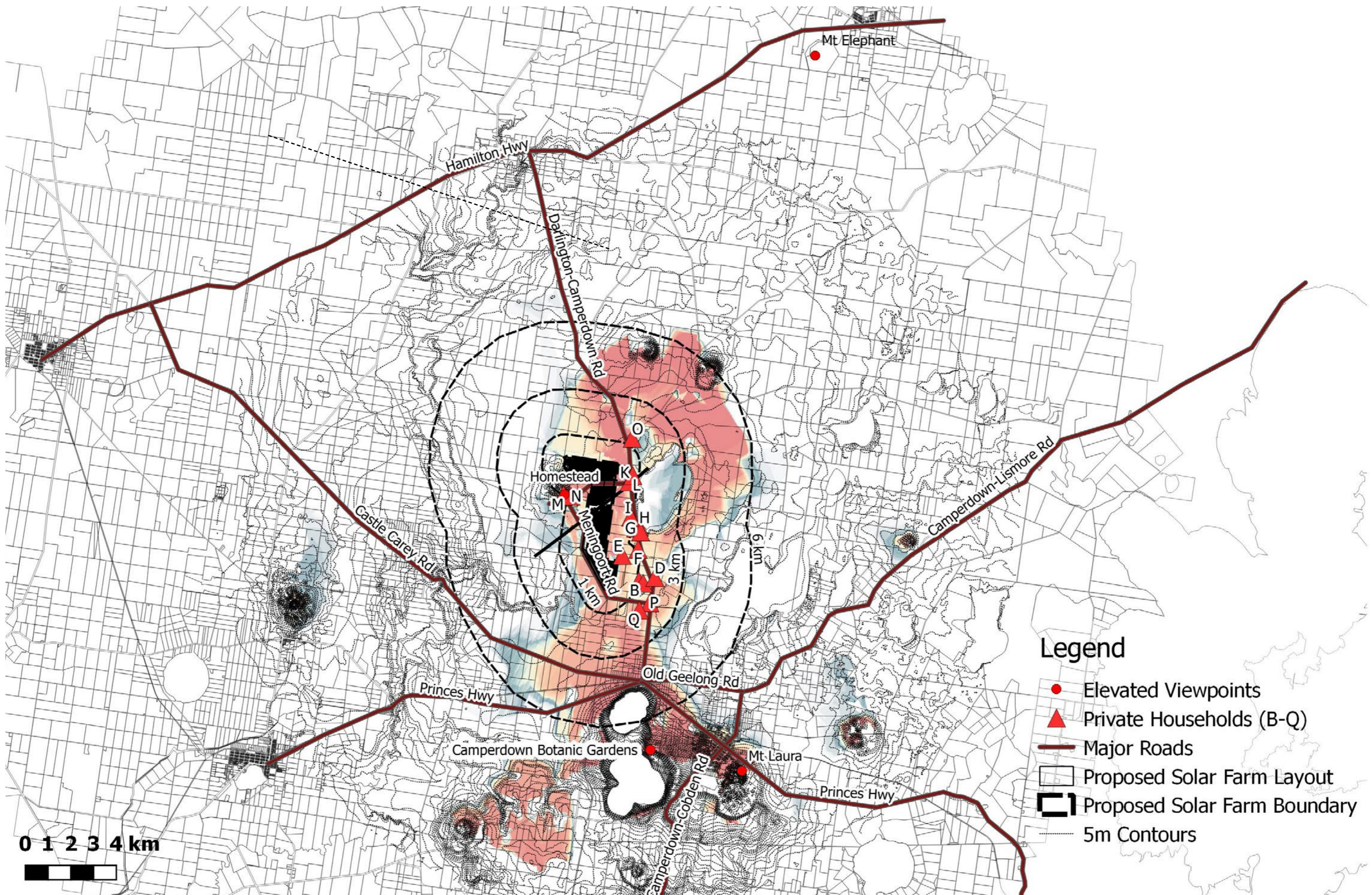
**Figure 18- ZVI of Proposal based on landform (landform only without vegetation)**

Bookaar Solar Farm LVIA



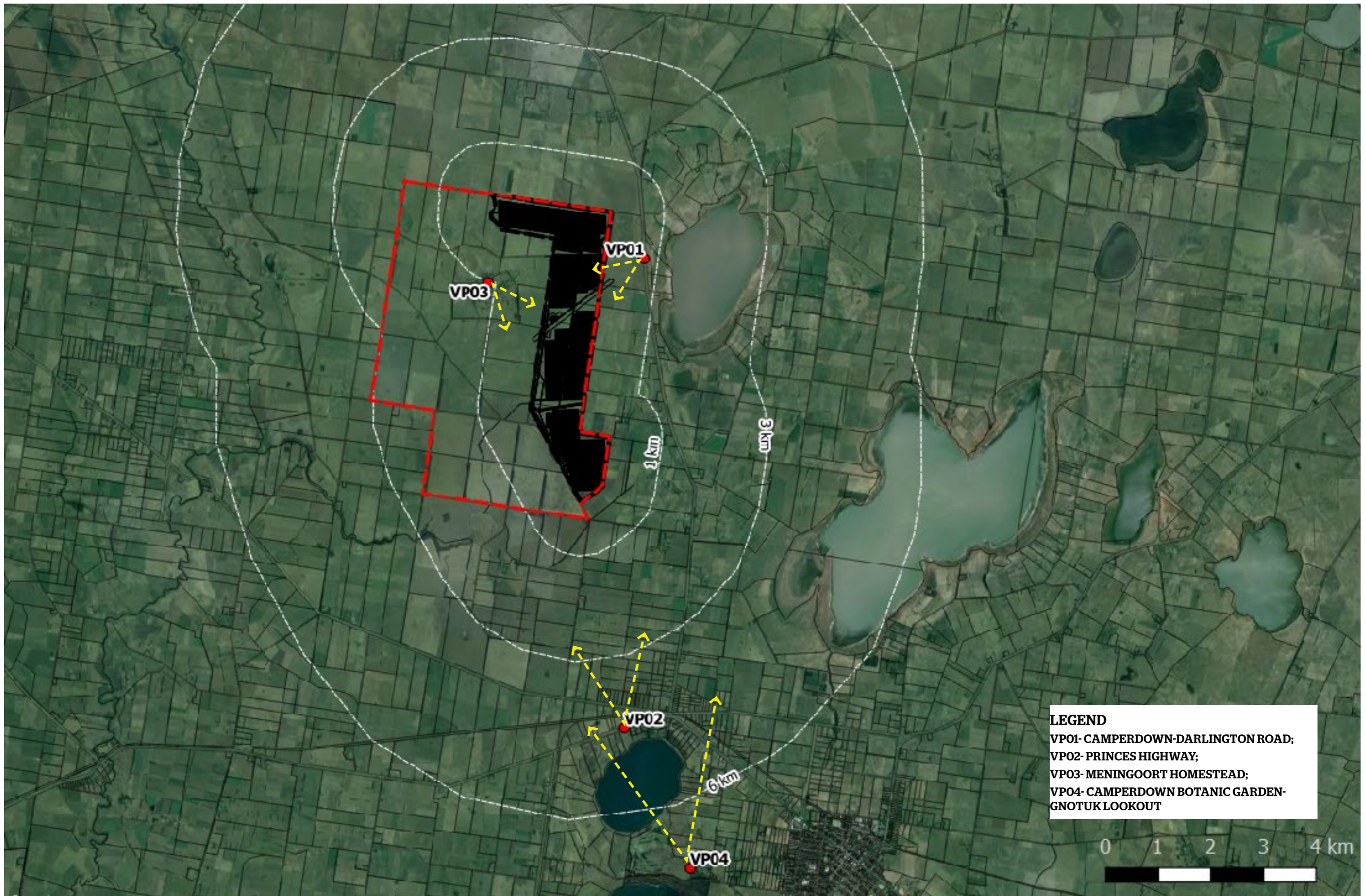
**Figure 19- ZVI of Proposal with 10m perimeter screening planting (including existing and proposed buffer)**

Bookaar Solar Farm LVIA

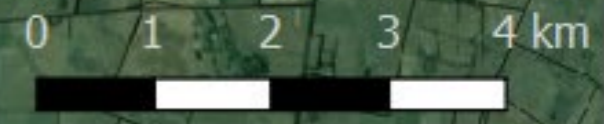


**Figure 20- Visual Receptor Groups**

Bookaar Solar Farm LVIA



**LEGEND**  
 VP01- CAMPERDOWN-DARLINGTON ROAD;  
 VP02- PRINCES HIGHWAY;  
 VP03- MENINGOORT HOMESTEAD;  
 VP04- CAMPERDOWN BOTANIC GARDEN-  
 GNOTUK LOOKOUT



**Figure 21- Selected viewpoints for photomontage modelling**

Bookaar Solar Farm LVIA





Selected frame showing the middle of proposed development

Panoramic view taken on site



50mm Focal Length (40° FOV)

Figure 22a-VP01 Darlington Road-Original Photo

Bookaar Solar Farm LVIA



50mm Focal Length (40° FOV)

**Figure 22b- VP01 Darlington Road- Photomontage showing the Proposal without planting buffer**

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50mm Focal Length (40° FOV)

**Figure 22c- VP01 Darlington Road- Photomontage showing the Proposal with 4m high planting buffer**

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Tract



Photomontage is based on single point GPS location.

50mm Focal Length (40° FOV)

**Figure 23a - VP02 - Princes Highway - Original Photo**

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Tract





Photomontage is based on single point GPS location.

50mm Focal Length (40° FOV)

**Figure 23b - VP02 - Princes Highway - Photomontage showing the extent of the indicative solar farm layout**

Bookaar Solar Farm LVIA

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Tract



Photomontage is based on single point GPS location.

50mm Focal Length (40° FOV)

**Figure 23c - VP02 - Princes Highway - Photomontage showing the Proposal with 4m high planting buffer**

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Tract



Panoramic view taken from verendah with 24mm lens  
cropped to 50mm for photomontage modelling



**Photomontage is based on single point GPS location.**

**50mm Focal Length (40° FOV)**

**Figure 24a - VP03 - Meningoort Homestead - Original Photo**

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**Tract**



Photomontage is based on single point GPS location.

50mm Focal Length (40° FOV)

**Figure 24b - VP03 - Meningoort Homestead - Photomontage showing the Proposal without planting buffer**

Bookaar Solar Farm LVIA

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REV 01 DRWN AT CHKD MR APPROV RW DATE 09.07.2018

Tract



Photomontage is based on single point GPS location.

50mm Focal Length (40° FOV)

**Figure 24c - VP03 - Meningoort Homestead - Photomontage showing the Proposal with 4m high planting buffer**

Bookaar Solar Farm LVIA

PROJECT\_DRG NO 0318-0077\_14

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Tract



**Figure 25a-VP04 Camperdown Botanic Garden-Original Photo**

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REV 01 DRWN AT CHKD MR APPROV RW DATE 09.07.2018

Tract



**Figure 25b-VP04 Camperdown Botanic Garden - Photomontage showing the Proposal without planting buffer**

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REV 01 DRWN AT CHKD MR APPROV RW DATE 09.07.2018

Tract



**Figure 25c- -VP04 Camperdown Botanic Garden - Photomontage showing the Proposal with 4m high planting buffer**

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PROJECT\_DRG NO 0318-0077\_17

REV 01 DRWN AT CHKD MR APPROV RW DATE 09.07.2018

Tract



# Appendix B

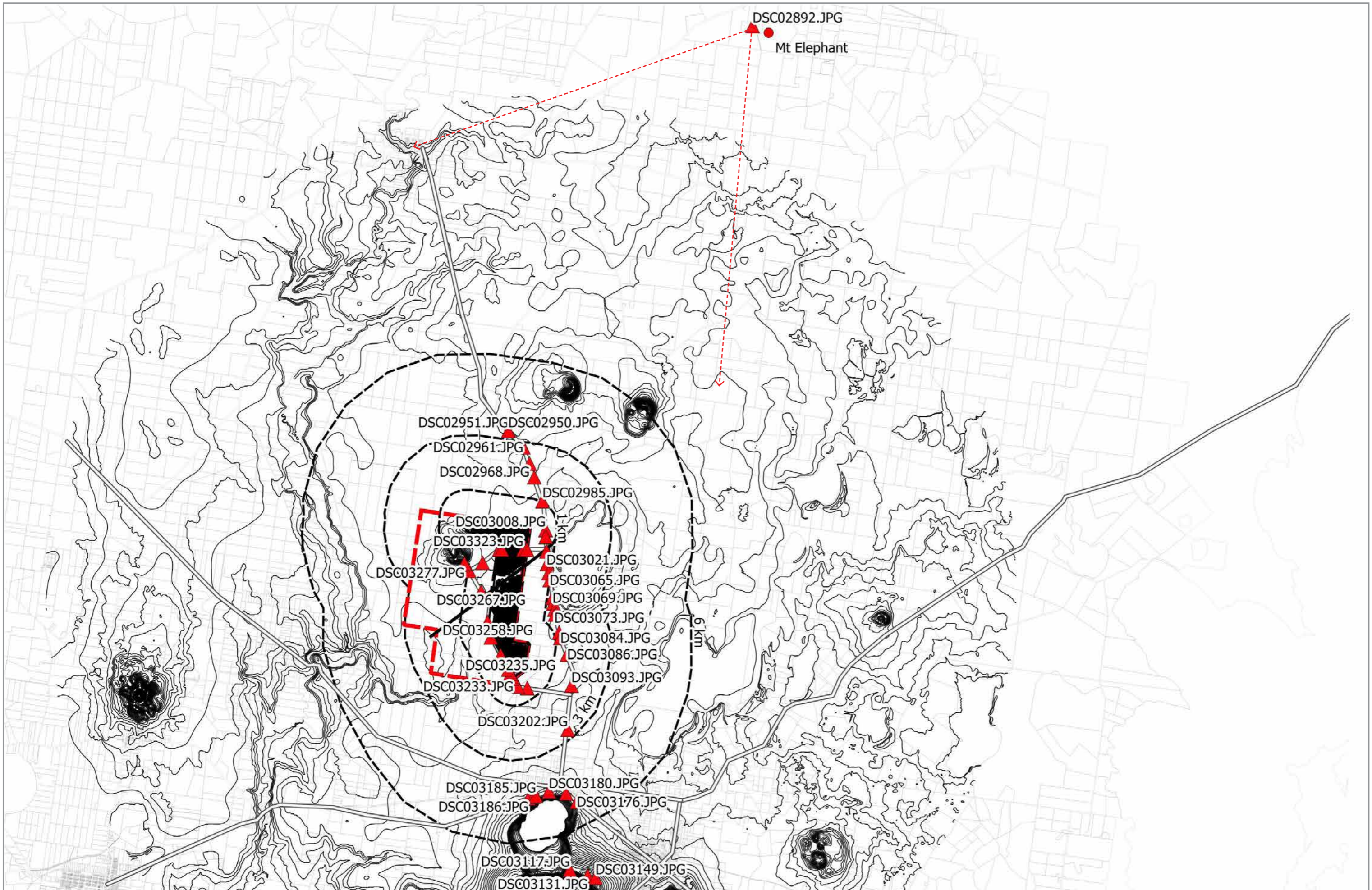
## Meningoort Solar Farm

### Photo Album

Site Visit 27/03/2018

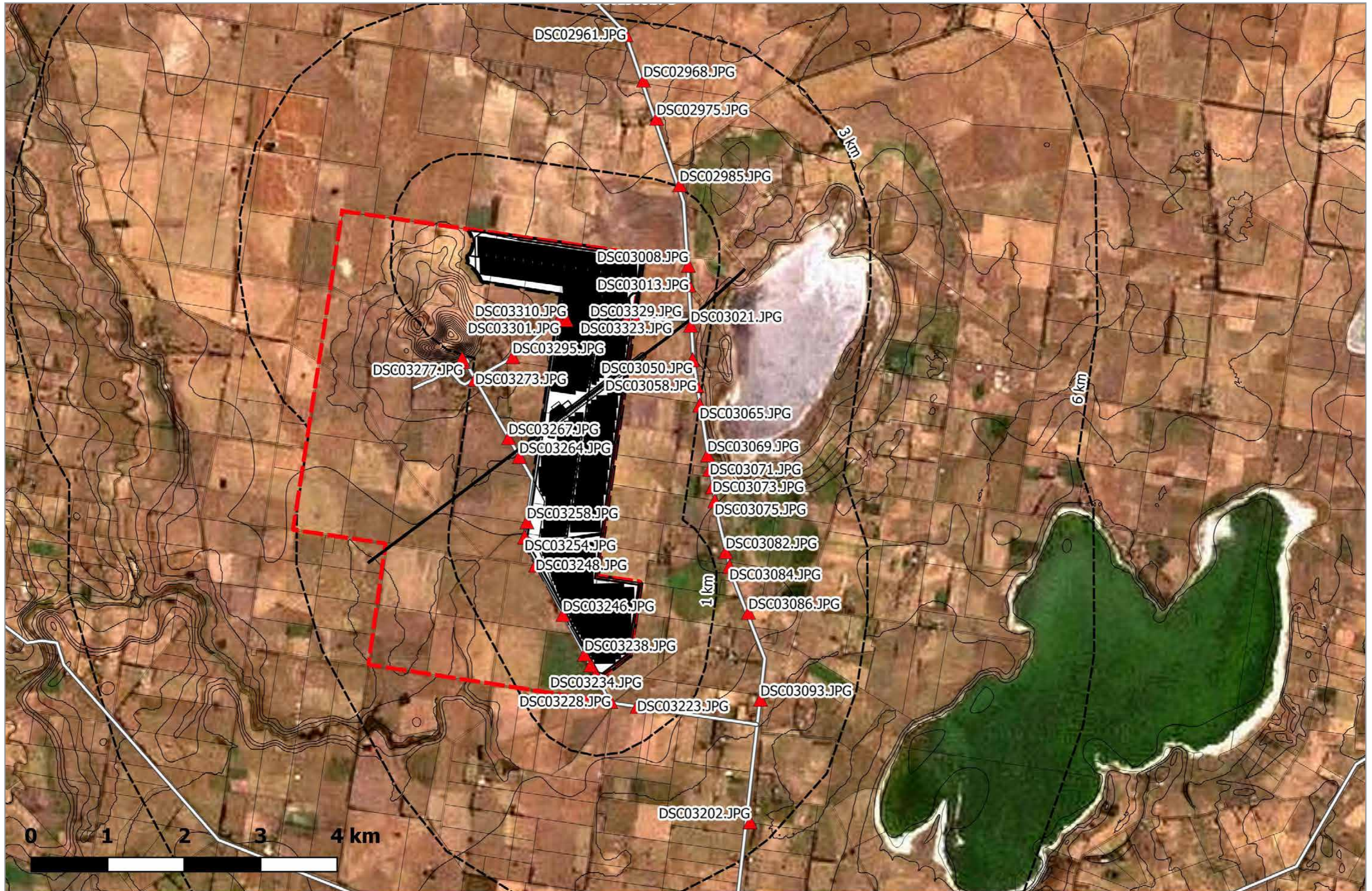
**Note:**

**The location of subject site is roughly indicated on photos in this album.**



**MAP 01- Photo Locations**

Meningoort Solar LVIA



**MAP 02- Photo Locations**

Meningoort Solar LVIA



**MAP 03- Photo Locations**

Meningoort Solar LVIA





✓ Photo from Mt Elephant Rd looking to the site. The subject site is screened by intervening landform (Mt Meningoort).

**Photo Number DSC02892**

Meningoort Solar LVIA



Subject Site

✓ Photo from Darlington Rd looking to the site. The subject site is screened by intervening vegetation.

**Photo Number DSC02951**  
Meningoort Solar LVIA



Subject Site

✓ Photo from Darlington Rd looking to the site. The subject site is screened by intervening vegetation.

**Photo Number DSC02961**  
Meningoort Solar LVIA



Subject Site

✓ Photo from Darlington Rd and Kilnoorat Rd Junction looking to the site. The subject site is screened by the vegetation.

**Photo Number DSC02968**

Meningoort Solar LVIA





Subject Site

✓ Photo from Darlington Rd looking to the site. The subject site is screened by the vegetation.

**Photo Number DSC02975**

Meningoort Solar LVIA

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DATE 03.07.2018

Tract



✘ View from Darlington Rd to the site. The proposed development will be visible.



Subject Site

✘ View from Darlington Rd to the site. The proposed development will be visible.

**Photo Number DSC03008**

Meningoort Solar LVIA



✘ View from Darlington Rd to the site. The proposed development will be partially visible.

**Photo Number DSC03013**  
Meningoort Solar LVIA



✘ View from Darlington Rd to the site. The proposed development will be visible.



Subject Site

✘ View from Darlington Rd to the site. The proposed development will be visible.

**Photo Number DSC03050**

Meningoort Solar LVIA



Subject Site

✓ Photo from Darlington Rd looking to the site. The subject site is screened by the vegetation.

**Photo Number DSC03058**  
Meningoort Solar LVIA



Subject Site

✓ Photo from Darlington Rd looking to the site. The subject site is screened by the vegetation.

**Photo Number DSC03065**

Meningoort Solar LVIA

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Tract





Subject Site

✘ View from Darlington Rd to the site. The proposed development will be visible.

**Photo Number DSC03069**

Meningoort Solar LVIA



✓ Photo from Darlington Rd looking to the site. The subject site is screened by the vegetation & the residence.

**Photo Number DSC03071**

Meningoort Solar LVIA



✓ Photo from Darlington Rd looking to the site. The subject site is partially screened by the vegetation.

**Photo Number DSC03073**

Meningoort Solar LVIA



✘ View from Darlington Rd to the site. The proposed development will be visible.

**Photo Number DSC03075**  
Meningoort Solar LVIA



✘ Photo from Darlington Rd looking to the site. The subject site is partially screened by the vegetation & the residence.

**Photo Number DSC03082**

Meningoort Solar LVIA



Subject Site

Meningoort Homestead

✘ Photo from Darlington Rd looking to the site. The subject site is partially screened by the vegetation.

**Photo Number DSC03084**

Meningoort Solar LVIA

PROJECT\_DRGNO 0318-0077\_D000-00

REV 01

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CHKD MR

APPROV RW

DATE 03.07.2018

Tract



✘ Photo from Darlington Rd looking to the site. The subject site is partially screened by the vegetation.

**Photo Number DSC03086**  
Meningoort Solar LVIA



✓ Photo from Darlington Rd looking to the site. The subject site is screened by the vegetation.

**Photo Number DSC03093**  
Meningoort Solar LVIA





✓ View from Princess Hwy looking to the site. The subject site is screened by the vegetation.

**Photo Number DSC03097**  
Meningoort Solar LVIA



✘ View from Gnotuk Lookout looking to the site. The subject site is visible in the background.

**Photo Number DSC03116**  
Meningoort Solar LVIA

PROJECT\_DRGNO 0318-0077\_D000-00

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DATE 03.07.2018

Tract



✘ View from Gnotuk Lookout looking to the site. The subject site is visible in the background.



**Photo Number DSC03131**

Meningoort Solar LVIA



Subject Site



View from Park Ln looking to the site. The subject site is visible in the background.

**Photo Number DSC03149**

Meningoort Solar LVIA

PROJECT\_DRGNO 0318-0077\_D000-00

REV 01 DRWN AT

CHKD MR

APPROV RW

DATE 03.07.2018

Tract



Subject Site

✘ View from Mt Laura Lookout looking to the site. The subject site is visible in the background.

**Photo Number DSC03165**  
Meningoort Solar LVIA



✓ View from Princess Hwy looking to the site. The subject site is screened by the vegetation.

**Photo Number DSC03176**  
Meningoort Solar LVIA



✓ View from Princess Hwy looking to the site. The subject site is screened by the vegetation.

**Photo Number DSC03180**  
Meningoort Solar LVIA



Subject Site

✓ View from Princess Hwy looking to the site. The subject site is screened by the vegetation.

**Photo Number DSC03192**  
Meningoort Solar LVIA





✓ View from Princess Hwy looking to the site. The subject site is screened by the vegetation.

**Photo Number DSC03193**  
Meningoort Solar LVIA



✓ View from Darlington Rd looking to the site. The subject site is screened by the vegetation.

**Photo Number DSC03202**

Meningoort Solar LVIA



Subject Site

✓ View from Meningoort Rd looking to the site. The subject site is screened by the vegetation.

**Photo Number DSC03223**  
Meningoort Solar LVIA



✓ View from Meningoort Rd looking to the site. The subject site is screened by the vegetation.

**Photo Number DSC03228**

Meningoort Solar LVIA

PROJECT\_DRGNO 0318-0077\_D000-00

REV 01 DRWN AT

CHKD MR

APPROV RW

DATE 03.07.2018

Tract



✔ View from Meningoort Rd looking to the site. The subject site is screened by the vegetation.

**Photo Number DSC03233**

Meningoort Solar LVIA

PROJECT\_DRG NO 0318-0077\_D000-00

REV 01 DRWN AT

CHKD MR

APPROV RW

DATE 03.07.2018

Tract



✘ View from Meningoort Rd looking to the site. The subject site is visible.

**Photo Number DSC03234**

Meningoort Solar LVIA

PROJECT\_DRGNO 0318-0077\_D000-00

REV 01 DRWN AT

CHKD MR

APPROV RW

DATE 03.07.2018

Tract



✘ View from Meningoort Rd looking to the site. The subject site is visible.

**Photo Number DSC03238**

Meningoort Solar LVIA



✘ View from Meningoort Rd looking to the site. The subject site is visible.

**Photo Number DSC03246**

Meningoort Solar LVIA





✘ View from Meningoort Rd looking to the site. The subject site is visible.

**Photo Number DSC03254**

Meningoort Solar LVIA



✓ View from Meningoort Rd looking to the site. The subject site is screened by the vegetation.

**Photo Number DSC03258**

Meningoort Solar LVIA

PROJECT\_DRGNO 0318-0077\_D000-00

REV 01 DRWN AT

CHKD MR

APPROV RW

DATE 03.07.2018

Tract



✘ View from Meningoort Rd looking to the site. The subject site is visible.

**Photo Number DSC03264**

Meningoort Solar LVIA



✘ View from Meningoort Rd looking to the site. The subject site is visible.

**DRAFT**

**Photo Number DSC03267**  
Meningoort Solar LVIA



View from Meningoort Rd looking to the site. The subject site is not visible.

**Photo Number DSC03273**

Meningoort Solar LVIA



View from Meningoort Rd looking to the site. The subject site is not visible.

**Photo Number DSC03277**

Meningoort Solar LVIA

PROJECT\_DRGNO 0318-0077\_D000-00

REV 01 DRWN AT

CHKD MR

APPROV RW

DATE 03.07.2018

Tract



View from Meningoort homestead looking to the site. The subject site is not visible.

**Photo Number DSC03279**

Meningoort Solar LVIA



✘ View from Meningoort Rd looking to the site. The subject site is partially screened by the existing vegetation.

**Photo Number DSC03295**  
Meningoort Solar LVIA





✘ View from Meningoort Rd looking to the site. The subject site is visible.

**Photo Number DSC03301**  
Meningoort Solar LVIA



View inside the subject site, looking to the south.

**Photo Number DSC03310**  
Meningoort Solar LVIA



View inside the subject site, looking to the north-east.

**Photo Number DSC03323**

Meningoort Solar LVIA



Meningoort Homestead

View inside the subject site, looking to the west.

**Photo Number DSC03329**

Meningoort Solar LVIA

PROJECT\_DRGNO 0318-0077\_D000-00

REV 01 DRWN AT

CHKD MR

APPROV RW

DATE 03.07.2018

Tract

**NOTES:**

1. ALL DIMENSIONS ARE INDICATIVE AND IN "METERS" UNLESS OTHERWISE STATED.
2. DESIGN BASED ON SITE BOUNDARIES PROVIDED IN GOOGLE EARTH FILES BY THE CLIENT.
3. THE DESIGN ASSUMES THAT ALL OBSTRUCTIONS WITHIN THE BOUNDARIES, WHICH COULD SHADE THE PV ARRAY, WILL BE REMOVED PRIOR TO THE INSTALLATION.
4. SITE TOPOGRAPHY IS ASSUMED SUITABLE FOR SINGLE-AXIS TRACKERS INSTALLATION. OTHERWISE EARTHWORKS MAY BE REQUIRED TO FIT SYSTEM SPECIFICATIONS. IT IS ASSUMED THAT THE SITE IS MATERIALLY FLAT AND CONTAINS NO MATERIAL CONSTRAINTS.
5. THE DESIGN ASSUMES THAT ALL MV POWER SUBSTATIONS (MVPS) CONTAIN 2X2,500 KW INVERTERS, 33KV TRANSFORMER AND SWITCHGEAR.
6. SETBACKS CONSIDERED IN LAYOUT ARE SUBJECT TO CHANGE DURING DETAILED DESIGN PHASE.
7. LOCATION OF THE MVPS ARE INDICATIVE ONLY AND ARE EXPECTED TO CHANGE DURING THE DETAILED DESIGN PHASE.
8. THE ON-SITE HV SUBSTATION FLOOR PLAN IS INDICATIVE. FINAL CONFIGURATION IS SUBJECT TO CHANGE ACCORDING TO THE GRID CONNECTION AGREEMENT.

**SYSTEM SPECIFICATIONS**

**MODULE:**  
SUNPOWER 1500V P19 (385 Wp) OR EQUIVALENT  
DIMENSIONS: 2,067 X 998 X 46 MM

**INVERTER:**  
INVERTER CAPACITY: 2,500kVA (@25C) / 2,250kVA (@50C)  
2 INVERTERS PER MV POWER STATION (MVPS)  
N° OF MVPS: 40

**MOUNTING STRUCTURE:**  
SUNPOWER SINGLE-AXIS TRACKER (OASIS 3.0)  
SINGLE-ROW TRACKER (DECENTRALISED)  
4 MODULES IN LANDSCAPE  
4 STRINGS PER TRACKER

**ELECTRICAL CONFIGURATION:**  
N° OF MODULES: 584,000  
STRINGS OF 25 MODULES  
N° OF STRINGS: 23,360  
N° OF INVERTERS: 80  
DC CAPACITY: 224,840.0 kWp  
AC CAPACITY: 200,000.0kW (@25C) / 180,000.0kW (@50C)  
AC/DC RATIO (@50C): 1.3

**LEGEND**

	SITE BOUNDARY
	SECURITY FENCE
	EXISTING OHL LINE BUFFER
	EXISTING PUBLIC ROAD
	EXISTING PUBLIC ROAD BUFFER
	AREA OF POTENTIAL SCREENING
	AREA OF COMMON SPIKED SEDGE
	AREA OF RIVER RED GUMS
	AREA OF PLANTED SUGAR GUMS
	WETLAND AREA
	WETLAND EXCLUSION AREA 5M BUFFER
	DRAINAGE LINES
	2x 2,500KVA INVERTER POWER STATIONS
	INTERNAL ROAD 4 METER WIDE



**SITE LOCATION**  
SCALE: 1:20,000 @ A1



**PLANT LAYOUT**  
SCALE: 1:8,000 @ A1

REV	DATE	DESCRIPTION	DWN	CHKD
01	26/03/18	ISSUE FOR CAPACITY ESTIMATE	RF/PJ	JLG
02	08/05/18	ADD PUBLIC ROAD & SUBSTATION DETAIL	RF/PJ	MM

**GENERAL PRELIMINARY LAYOUT**  
  
INFINERGY  
VICTORIAN SITE - AUSTRALIA

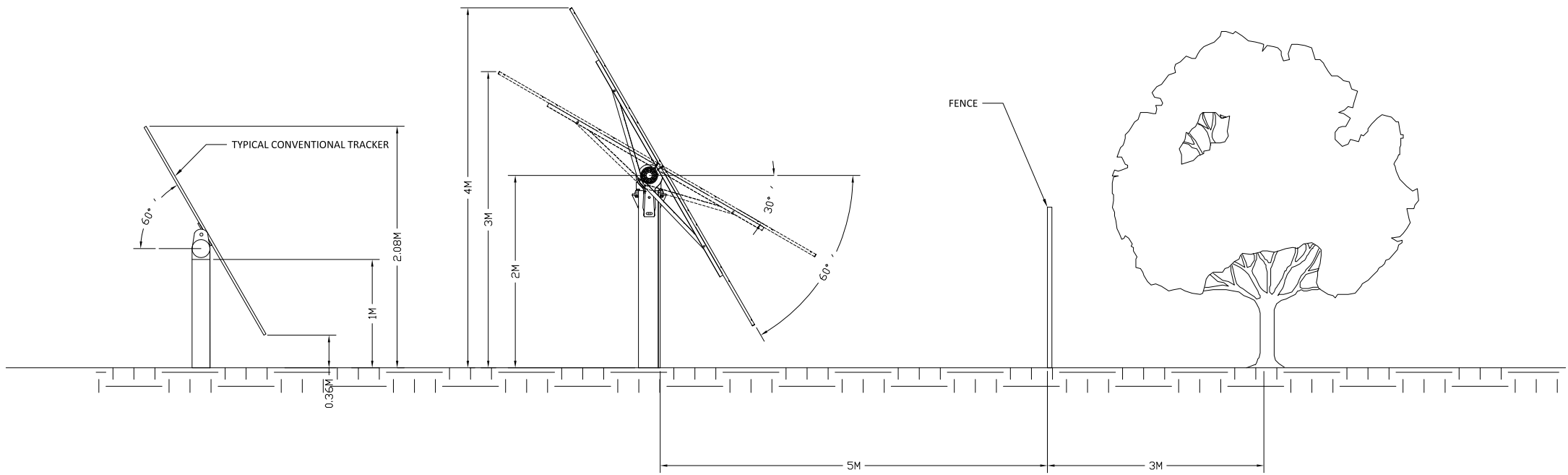
**PRELIMINARY NOT FOR CONSTRUCTION**



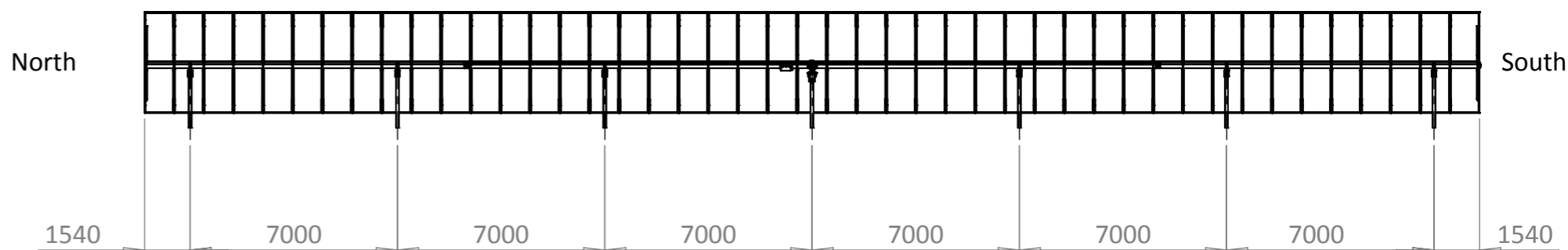
SHEET G001

SCALE 1:8,000 @ A1  
ORIGINAL SIZE: ISO A1

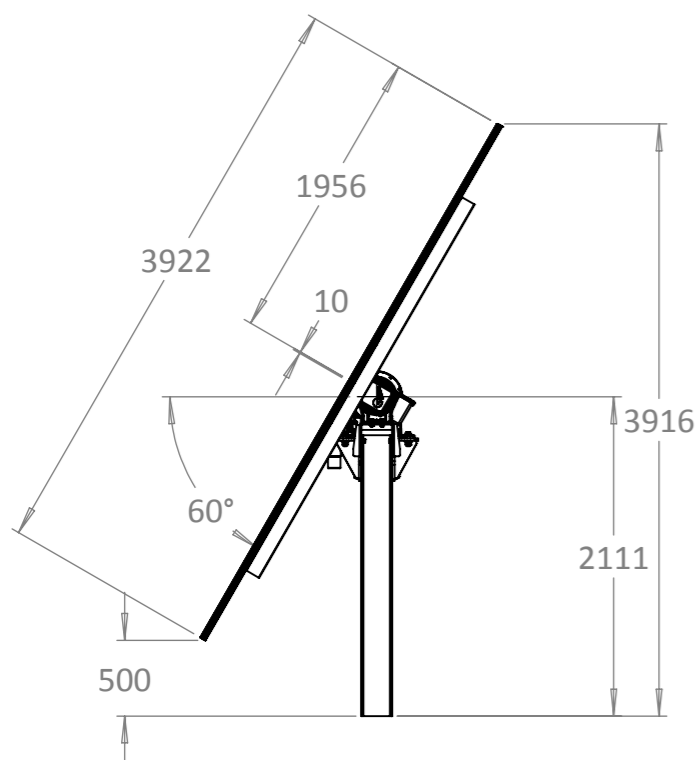
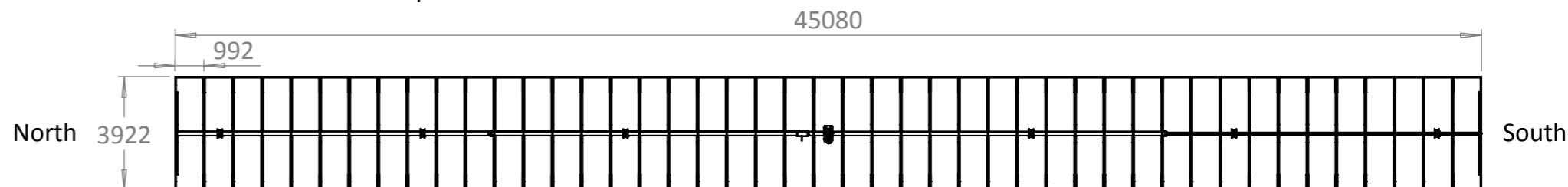
LAT: 38°13'8" S  
LONG: 143°08'7" E



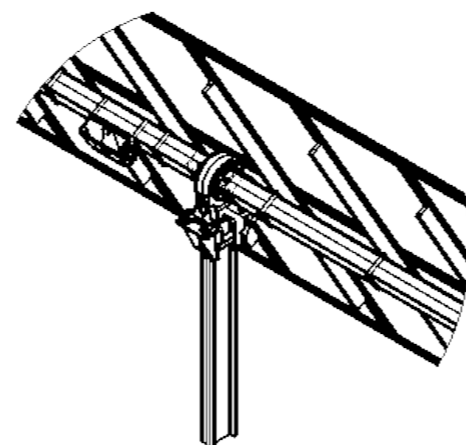
Tracker at 60 degrees tilt angle



Tracker at horizontal position

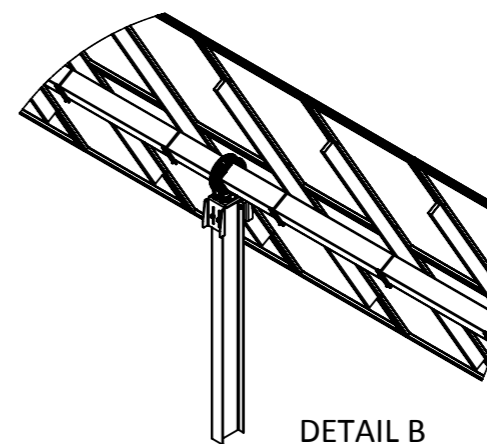


Motor support

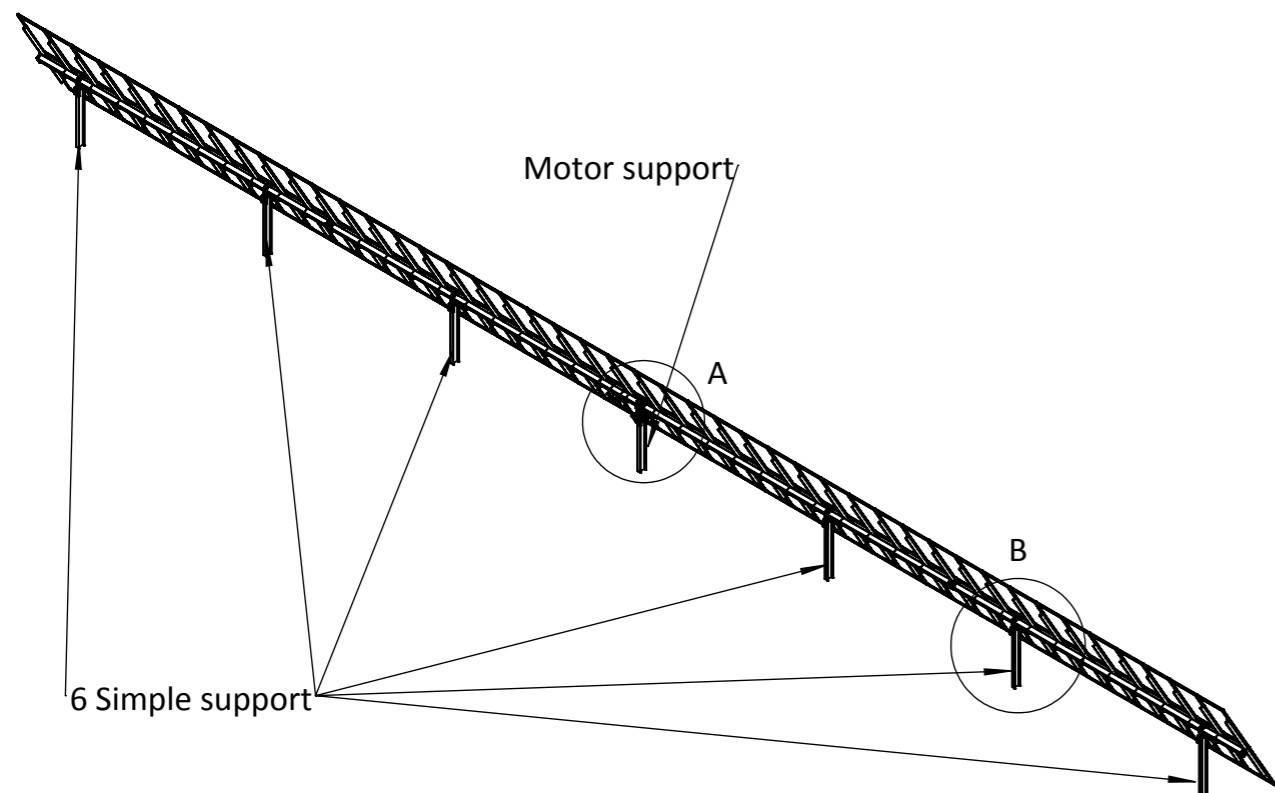


DETAIL A  
ESCALA 1 : 50

Simple support



DETAIL B  
ESCALA 1 : 50

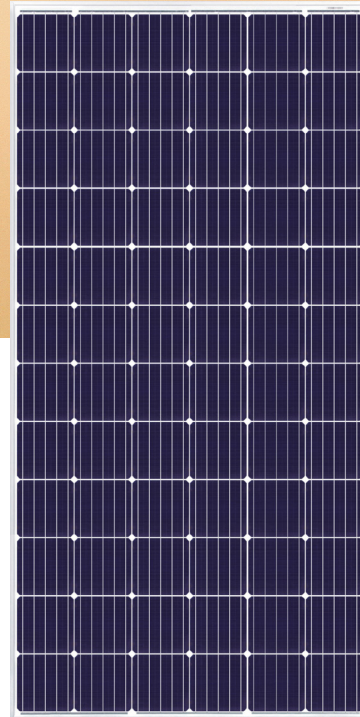


Rev.	Description	Signee	Date
-	-	-	-
-	-	-	-
-	-	-	-
<p>MANUFACTURING GENERAL NOTES</p> <p>DIMENSIONAL &amp; GEOMETRICAL GENERAL TOLERANCES WITHOUT INDIVIDUAL TOLERANCE INDICATION, BASED ON ISO 2768-mk.</p> <p>WELDING GENERAL TOLERANCES BASED ON ISO 13920 &amp; WELDING SYMBOLS IN ACCORDANCE WITH ISO 2553.</p> <p>SURFACE FINISH SYMBOLS IN ACCORDANCE WITH ISO 1302-ISO/R 468.</p> <p>EXCEPT INDICATION DIMENSIONS IN MM &amp; WEIGHTS IN KG.</p>		<p>PROPRIETARY AND CONFIDENTIAL</p> <p>THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF SOLTEC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF SOLTEC IS PROHIBITED.</p>	
<p>APPLY</p> <p>x</p>		<p>Material</p> <p>Según LDM</p>	
<p>Weight (kg)</p>		<p>Lyfecycle</p> <p>-</p>	
<p>Name</p> <p>AJR</p>		<p>Description</p> <p>SF7 2x45</p>	
<p>Date</p> <p>02/06/17</p>		<p>Dwg. no.</p> <p>SF7-05</p>	
Created		<p>Scale</p> <p>1:200</p>	
Checked		<p>Drawing method:</p>	
Appr.		<p>Rev.</p> <p>-</p>	
		<p>Page 1 of 1</p>	
		<p>A3</p>	





New Cell Technology  
with 5 Busbar



Preliminary Technical  
Information Sheet

## MAX POWER2 CS6XA-325 | 330 | 335M

Canadian Solar's new MAXPOWER2 mono modules have use the latest innovative 5 busbar cell technology, significantly increases module power output and system reliability.

### KEY FEATURES



Enhanced reliability with new 5 busbar cell technology



Cell efficiency up to 20.0 %



Outstanding low irradiance performance: 96.5 %



IP67 junction box for long-term weather endurance



Heavy snow load up to 5400 Pa, wind load up to 2400 Pa



Positive power tolerance of up to 5 W



**insurance-backed warranty  
non-cancelable, immediate warranty insurance  
linear power output warranty**



**product warranty on materials  
and workmanship**

### MANAGEMENT SYSTEM CERTIFICATES\*

ISO 9001:2008 / Quality management system

ISO/TS 16949:2009 / The automotive industry quality management system

ISO 14001:2004 / Standards for environmental management system

OHSAS 18001:2007 / International standards for occupational health & safety

\* As there are different certification requirements in different markets, please contact your local Canadian Solar sales representative for the specific certificates applicable to the products in the region in which the products are to be used.

**CANADIAN SOLAR INC.** is committed to providing high quality solar products, solar system solutions and services to customers around the world. As a leading manufacturer of solar modules and PV project developer with about 13 GW of premium quality modules deployed around the world since 2001, Canadian Solar Inc. (NASDAQ: CSIQ) is one of the most bankable solar companies worldwide.

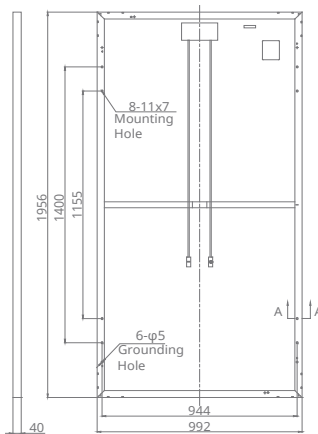
### CANADIAN SOLAR INC.

545 Speedvale Avenue West, Guelph, Ontario N1K 1E6, Canada, [www.canadiansolar.com](http://www.canadiansolar.com), [support@canadiansolar.com](mailto:support@canadiansolar.com)

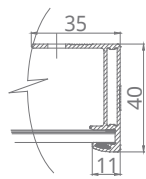


## ENGINEERING DRAWING (mm)

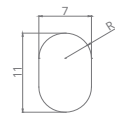
### Rear View



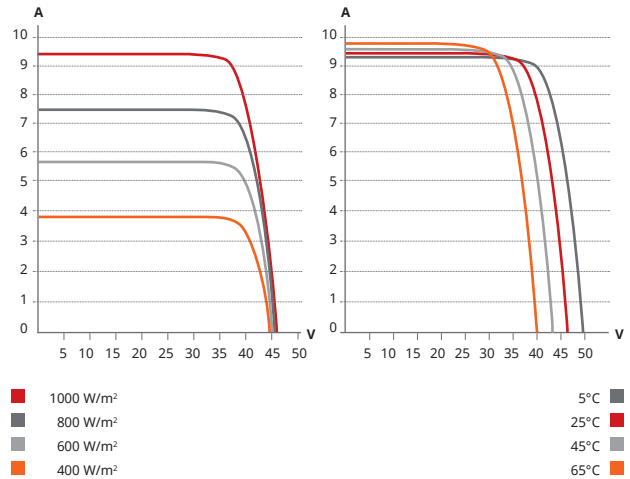
### Frame Cross Section A-A



### Mounting Hole



## CS6XA-335M / I-V CURVES



## ELECTRICAL DATA / STC\*

CS6XA	325 M	330 M	335 M
Nominal Max. Power (Pmax)	325 W	330 W	335 W
Opt. Operating Voltage (Vmp)	37.4 V	37.5 V	37.8 V
Opt. Operating Current (Imp)	8.69 A	8.80 A	8.87 A
Open Circuit Voltage (Voc)	45.8 V	45.9 V	46.1 V
Short Circuit Current (Isc)	9.21 A	9.31 A	9.41 A
Module Efficiency	16.75%	17.01%	17.26%
Operating Temperature	-40°C ~ +85°C		
Max. System Voltage	1000 V (IEC) or 1000 V (UL)		
Module Fire Performance	TYPE 1 (UL 1703) or CLASS C (IEC 61730)		
Max. Series Fuse Rating	15 A		
Application Classification	Class A		
Power Tolerance	0 ~ + 5 W		

\* Under Standard Test Conditions (STC) of irradiance of 1000 W/m<sup>2</sup>, spectrum AM 1.5 and cell temperature of 25°C.

## ELECTRICAL DATA / NOCT\*

Electrical Data CS6XA	325 M	330 M	335 M
Nominal Max. Power (Pmax)	235 W	238 W	242 W
Opt. Operating Voltage (Vmp)	34.1 V	34.2 V	34.5 V
Opt. Operating Current (Imp)	6.88A	6.96 A	7.01 A
Open Circuit Voltage (Voc)	42.0 V	42.1 V	42.3 V
Short Circuit Current (Isc)	7.46 A	7.54 A	7.62 A

\* Under Nominal Operating Cell Temperature (NOCT), irradiance of 800 W/m<sup>2</sup>, spectrum AM 1.5, ambient temperature 20°C, wind speed 1 m/s.

## PERFORMANCE AT LOW IRRADIANCE

Industry leading performance at low irradiance, average relative efficiency of 96.5 % from an irradiance of 1000 W/m<sup>2</sup> to 200 W/m<sup>2</sup> (AM 1.5, 25°C).

The specification and key features described in this datasheet may deviate slightly and are not guaranteed. Due to on-going innovation, research and product enhancement, Canadian Solar Inc. reserves the right to make any adjustment to the information described herein at any time without notice. Please always obtain the most recent version of the datasheet which shall be duly incorporated into the binding contract made by the parties governing all transactions related to the purchase and sale of the products described herein.

Caution: For professional use only. The installation and handling of PV modules requires professional skills and should only be performed by qualified professionals. Please read the safety and installation instructions before using the modules.

## MECHANICAL DATA

Specification	Data
Cell Type	Mono-crystalline, 6 inch
Cell Arrangement	72 (6×12)
Dimensions	1956×992×40 mm (77.0×39.1×1.57 in)
Weight	22.5kg (49.6 lbs)
Front Cover	3.2 mm tempered glass
Frame Material	Anodized aluminium alloy
J-Box	IP67, 3 diodes
Cable	4 mm <sup>2</sup> (IEC) or 4 mm <sup>2</sup> & 12 AWG 1000V (UL), 1150 mm (45.3 in)
Connectors	Friends PV2a (IEC), Friends PV2b (IEC / UL)
Standard Packaging	26 pieces
Module Pieces per Container	624 pieces (40' HQ)

## TEMPERATURE CHARACTERISTICS

Specification	Data
Temperature Coefficient (Pmax)	-0.41 % / °C
Temperature Coefficient (Voc)	-0.31 % / °C
Temperature Coefficient (Isc)	0.053 % / °C
Nominal Operating Cell Temperature	45±2 °C

## PARTNER SECTION

