XURBAN

Yanco Solar Farm
Landscape & Visual Assessment

For: ib vogt GmbH

February 2019 | Final

Yanco Solar Farm

Landscape & Visual Assessment

Client	**ib vogt GmbH**
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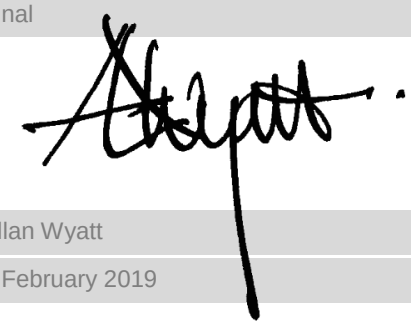
Signed	
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Date	1 February 2019

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1. Introduction

Ib vogt proposes to locate a solar farm on Toorak Road, between Yanco and Leeton in NSW. The proposal infrastructure includes:

- Approximately 205,000 PV solar arrays mounted on single axis tracking systems.
- Electrical cables and conduits.
- Inverter/transformer units, containerised, distributed across the site.
- Battery storage units, containerised, distributed across the site.
- Control room and switchgear to connect the solar farm to a new underground or overhead powerline, including synchronous condenser, other associated structures, lightening protection masts, control and protection equipment.
- Communications tower (20m high), adjacent to the control room.
- An overhead or underground 33kv electrical transmission line to connect the proposal to the Yanco substation.
- Extension works within existing Yanco substation footprint to allow for solar farm connection.
- Site office, compounds, parking areas, access tracks and perimeter fencing.
- Operations and maintenance buildings with associated car parking.
- Site access points via Toorak Road and Research Road.
- Internal access tracks.
- Lighting, CCTV system, security fencing.
- Vegetative screening.

The proposed Yanco Solar Farm is classified as a 'state significant development' under the NSW Environmental Planning and Assessment Act 1979 (EP&A Act). State significant developments require approval from the Minister for Planning and Environment and the proposal requires an assessment to be prepared in accordance with the requirements of the Secretary of the Department of Planning and Environment.

The Secretary's Environmental Assessment Requirements (SEARs), dated 30 August 2018, relating to visual amenity were as follows:

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

This report covers these assessment requirements, though it is noted that air traffic is considered separately in the Yanco Solar Farm Environmental Impact Statement.

The following report seeks to show the visual impact implications on viewers using the local road network as well as from residential properties within the viewshed of the solar farm. This report also describes the landscape design that responds to this setting.

The subject site

The site is in three sections. Two sections of the solar farm are on the east and west side of Toorak Road and the third section lies between the rail line / Houghtons Road and Research Road south of Toorak Road. **Figure 1** shows the location of the subject and the three sections as well as the surrounding road network.

Figure 1 The subject site (Map source – Google Earth Pro)

The subject site, shown in **Figure 1,** is approximately a 180.7 hectare allotment on multiple titles. The allotments surrounding the subject site are rural properties of differing sizes and the north east corner of the site is close to residential areas of Leeton.

Site layout

The module array layout, upon which the landscape and visual assessment is based, is shown in **Figure 2** (ib vogt, Document No. 2508.M4.001.0.A, Revision 0, dated 19 Nov 2018).

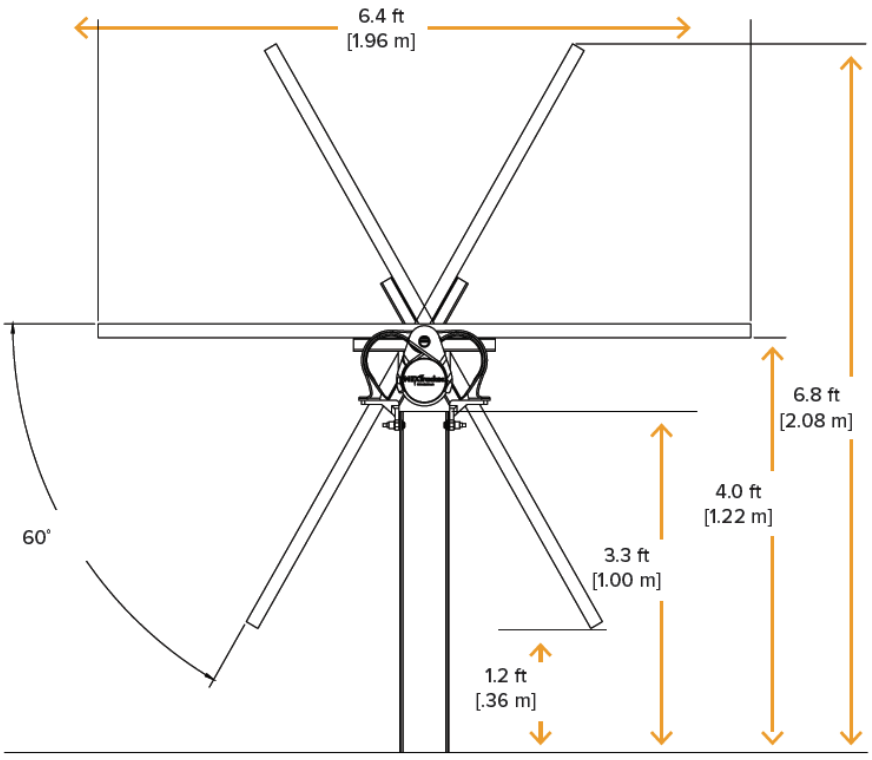
Figure 2 *Module Array Layout (Source: ib vogt)*

The solar panels are in linear banks which generally run north south, although those in the southern section of the solar farm run north east to south west.

Solar panels

The solar panels, which formed the basis for the photomontage model, were the NX Horizon Self-Powered Tracker which is 2.2m above ground line.

Figure 3 *Solar Tracker (Source: NX Horizon Self-Powered Tracker, manufacturer's brochure)*



The solar panels that will be used in the Yanco Solar Farm will be a maximum of 2.2m above the ground line.

Figure 4 *Photo of the proposed solar panels (Source: NX Horizon Self-Powered Tracker, manufacturer's brochure)*

The following report seeks to show the visual impact implications of this proposal and ascertain the appropriateness of the proposed solar farm within the current landscape setting.

2. Methodology

The methodology used within this visual assessment of the Yanco Solar Farm includes the following steps.

The viewshed

Defining the viewshed of the solar farm is based upon the elevations of the components within the solar farm and the parameters of human vision. The viewshed is the study area for this visual assessment.

Planning background

The statutory planning background looks at the areas within the viewshed to determine if there are planning restraints or highlighted areas that would be visually sensitive.

Landscape units and sensitivity

Landscape Units are based on the physical characteristics of the area within the viewshed. The characteristics that assist in defining the landscape units include geology, vegetation, topography and drainage patterns, as well as the extent of man-modifications and urban development.

The landscape sensitivity of the each of the landscape units is the degree to which the particular landscape can undergo further change. Generally, the greater the extent of man-modifications, the lesser its sensitivity to change.

Seen area analysis

Typically, as part of a visual assessment, Geographical Information Systems software (GIS) can provide a Seen Area Analysis (SAA) which illustrates those areas from which the solar farm could be visible, as a whole or in part. The SAA does not take into account vegetation, built form nor minor intervening topographical features such as small road cuttings.

However, the existing topography of the solar farm and the surrounding landscape is one that is very flat and therefore apart from the shielding afforded by the levees containing the major irrigation canals, there is little in the way of topographical relief which would restrict views to the solar farm from the surrounding landscape. Therefore, a SAA has not been prepared for this project.

Viewpoint assessment

The assessment of the potential visual impact is undertaken from indicative viewpoints within the public domain and from residential properties.

Public domain viewpoints

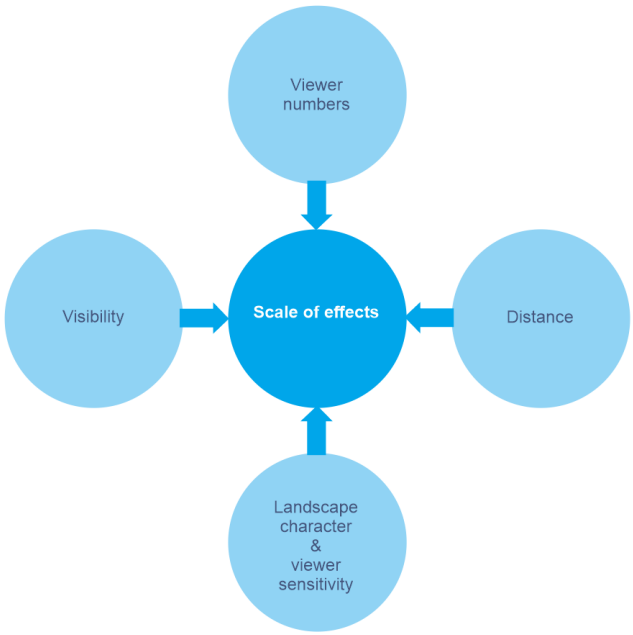
In assessing the visual impact of a solar farm from the public domain, the assessment of visual impact is undertaken from a range of publicly accessible viewpoints and is based on four criteria:

- Visibility: The visibility of the solar farm can be affected by intervening topography, vegetation and buildings.
- Distance: The distance of the viewer from the proposed nearest component of the solar farm. The level of visual impact decreases as distance increases.

- Landscape character and viewer sensitivity: The character of the surrounding landscape, both around the site and adjacent to the viewing location, must be considered. Generally, a man-modified landscape is considered of lower sensitivity and a pristine landscape is considered highly sensitive. A residential townscape would be given a higher sensitivity than an industrial landscape.
- Number of viewers: The level of visual impact decreases where there are fewer people able to view the solar farm. Alternatively, the level of visual impact increases where views are from a recognised vantage point. Viewer numbers from a recognised vantage point would be rated as high.

This is diagrammatically illustrated in Figure **5**.

Figure 5 *Visual impact – publicly accessible viewpoints*

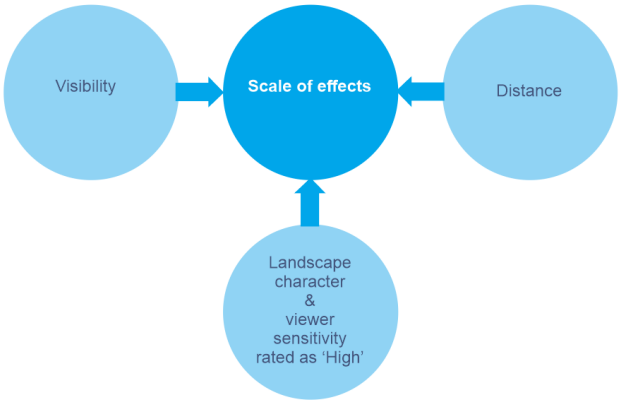


These four criteria need to be considered in the assessment of visual impact. However, the ratings of each criterion are not numerically based and cannot be simply added together and averaged to arrive at an overall rating.

Private domain viewpoints

The assessment of visual impact from residential properties is slightly different to one undertaken from publicly accessible viewpoints. An assessment of viewer numbers is not relevant, and the landscape sensitivity is always rated as “high,” as it must be recognised that people feel most strongly about the view from their house and from their outdoor living spaces. Furthermore, occupants of residential properties are regularly observing from their house whereas persons viewing the Solar farm Area from publicly accessible viewpoints are typically only at those points for comparatively short periods of time.

Figure 6 *Visual impact – residential viewpoints*



The visibility of the solar farm and the distance between the residential location and the solar farm are the two criteria that vary within an assessment of the visual impact from a residential property. Viewer sensitivity is always rated as "high".

The same 'Scale of Effects is used for both the assessment of the visual impact from publicly accessible viewpoints and from residential locations.

Scale of Effects

The scale of effects, for rating the overall visual impact of the solar farm from publicly accessible and residential viewpoints, range from no impact (**nil**) to a potentially **positive** visual impact. Negative visual impacts are graded from **negligible** to **high**.

Nil – there would be no perceptible visual change.

Positive – would be a visual change that improves the outlook or view.

Negligible – minute level of effect that is barely discernible over ordinary day-to-day effects. The assessment of a "negligible" level of visual impact is usually based on distance. That is, the solar farm would either be at such a distance that, when visible in good weather, the solar farm would be a minute element in the view within a man-modified landscape or it would be predominantly screened by intervening topography and vegetation.

Low – visual impacts that are noticeable but that will not cause any significant adverse impacts. The assessment of a "low" level of visual impact would be derived if the rating of any one of four criteria, that is visibility, distance, viewer numbers and landscape sensitivity, is assessed as low.

Therefore, a solar farm in a landscape which is man-modified, and which already contains many buildings or other structures, may be rated as a low level of visual impact. Similarly, if the distance from which it is viewed means that its scale is similar to other elements in the landscape it would also be assessed as a low level of visual impact.

Medium – visual impact occurs when significant effects may be able to be mitigated / remedied. The assessment of a "medium" visual impact will depend upon all four-assessment criteria being assessed as higher than "low."

High or unacceptable adverse effect – extensive adverse effects that cannot be avoided, remedied or mitigated. The assessment of a "high or unacceptable adverse effect" from a publicly accessible viewpoint requires the assessment of all four factors to be high. For example, a highly sensitive landscape, viewed by many people, with the solar farm in close proximity and views that were unable to be screened or filtered would lead to an assessment of an unacceptable adverse effect.

Photomontages

Photomontages can assist in the assessment of individual viewpoints by illustrating the scale of the solar farm and particularly the solar panels in the existing landscape.

The photomontages show the changes in a 60^{O} horizontal field of view. This horizontal field of view represents the central cone of view in which symbol recognition and colour discrimination can occur. The vertical field of view is between 10^{O} - 15^{O}. The field of view of human vision is shown in **Figure 7.**

Figure 7 *Horizontal and vertical fields of view*

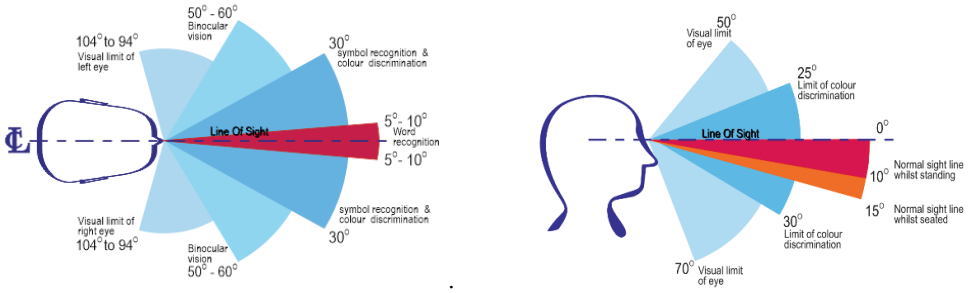


Figure 7 is based upon a diagram within '*Human Dimension and Interior Space*', *Julius Panero & Martin Zellnik, Witney Library of Design,1979*. Similar data can be found in the more recent publication entitled '*The Measure of Man and Woman, Revised Edition', Henry Dreyfuss Associates, John Whiley & Sons, 2012*.

The photomontages appended to this report are shown with a 60^{O} field of view. Panoramas are included to show the full extent of the solar farm and the entire wireframe image that was the basis of the photomontages

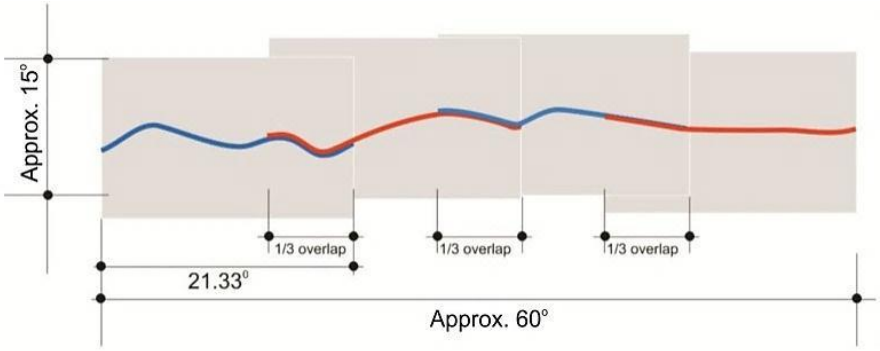
It is recognised that the small photographs and the A3 photomontages included within this assessment whilst technically accurate, are not perceptually accurate, as objects in smaller images do not appear to be of the correct scale. The A3 images, which are appended to this report (Annex B), are clearer than the smaller images in the text, as these are larger. A0 photomontages have been prepared and will be made available and these provide a clear indication of the actual visual impact – these are perceptually accurate.

Camera data

The photography used in the photomontages was taken with a 60 mm lens on a Nikon D5 digital camera. This lens has a picture angle of 26.5^{O} and a horizontal angle of view of approximately 21.3^{O}. (*http://nikonimaging.com/global/products/lens/af/micro/af_micro60 mmf_28d/*).

The camera was held at eye level, approximately 1.65 m above ground level. Four photographs overlapped 1/3 to create an image approximately the same as the central cone of view of human vision, i.e. 50-70^{O} horizontal and 15^{O} vertical. **Figure 8** demonstrates the overlap of the photographs which are used to create the panorama in the photomontages.

Figure 8 *Photomontage construction*



Computer modelling and the wireframe model

The computer modelling of the solar farm to create the photomontages utilises computer-based 3D data. Cadastral data as well as the proposed panels within the solar farm are modelled within a computer program (3D Max). A virtual camera is set up in the model at the GPS coordinates for each of the photographs that are being used within the panorama.

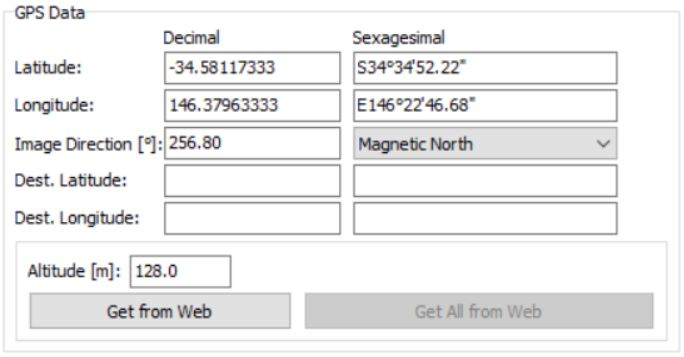
The digital model or wireframe view is then overlaid on the photographic panorama. Known points within survey information such as topography, building locations or other infrastructure are registered into the base photographs (or other predetermined points). For technical accuracy, these points must align. This verifies the location and apparent height and scale of the solar farm.

After the background reference points have been aligned, the visible components of the solar farm, are rendered.

GPS Coordinates and camera metadata

GPS coordinates at each publicly accessible or residential viewpoint were recorded on a separate hand-held GPS as well as on camera metadata from a GPS unit attached to the camera. This attached GPS unit gives both the GPS coordinates, the altitude of the camera as well as the bearing (Geographic North / Magnetic North) along the centre point of each photograph.

Figure 9 *Photography meta data (Source: GeoSetter)*



The locations from which the photographs were taken are also marked on a digital map within Google Earth Pro and the image and location was checked against the Google Earth Street View image, where this was available, to provide a further check on the veracity of the location.

Where distances and bearings are given for the public domain and residential viewpoints, these were calculated using Google Earth. Google Earth provides True North (Geogrpahic North) bearings.

3. Viewshed

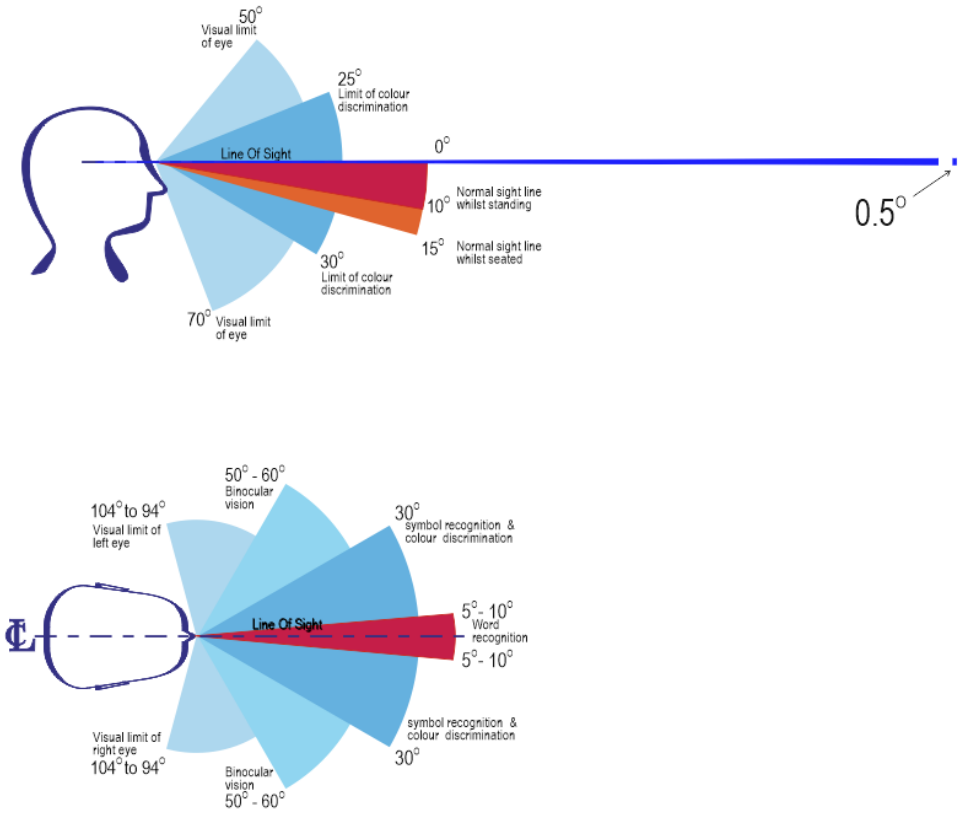
The area that may potentially be visually affected by a development is called the viewshed. The viewshed is not the same as the extent of visibility, as it may well be possible to see components of the solar farm from areas outside the viewshed. Rather, the viewshed is the area from which there could be a visual impact.

Yanco and the surrounding rural area in which the solar farm is proposed to be located is a landscape that includes many man-made elements. In this type of landscape, the viewshed is defined by a distance at which the largest element of the solar farm (the solar panels) would be an insignificant or negligible element in a viewer's field of view.

The central field of view in human vision is approximately 10^{O} (15^{O} whilst sitting). An object which takes up less than 5% of this 10^{O} cone of view and may be discernible. However, it is an insignificant element in a landscape which has other signs of human modification.

The vertical field of view is between 10^{O} - 15^{O}. The field of view of human vision is shown in **Figure 10** which also shows the vertical field of view and the basis for the calculation of the viewshed for the solar farm.

Figure 10 *Viewshed limit at 0.5^{O}*



The figure above is based on a diagram within '*Human Dimension and Interior Space'*, *Julius Panero & Martin Zellnik, Witney Library of Design,1979*. Similar data can be found in the more recent publication entitled '*The Measure of Man and Woman, Revised Edition', Henry Dreyfuss Associates, John Whiley & Sons, 2012*.

Extent of viewshed

The viewshed for the solar farm is based on the distance at which a 2.5 m vertical solar panel (this is larger than the 2.2 m described previously) takes up just 0.5^{O} of the vertical field of view.

At a distance of 300m, a 2.5m solar panel would take up less than 0.5^{O} of the vertical field of view. Therefore, a distance of 300 m is used to define the edge of the viewshed or study area for this visual assessment.

Zones of visual impact

Within a viewshed, differing zones of visual impact can be determined based upon the distance of the viewer to the solar panels. The visual impact of the solar farm at 300m is obviously less than the visual impact of the solar farm seen from a distance of 25m, as the apparent height and scale of the solar farm changes as a person moves nearer or farther away.

For the purposes of assessing the effect of distance, the zones of visual impact are defined and graphically shown in **Figure 11**.

Figure 11 Diminution of visual impact based on distance

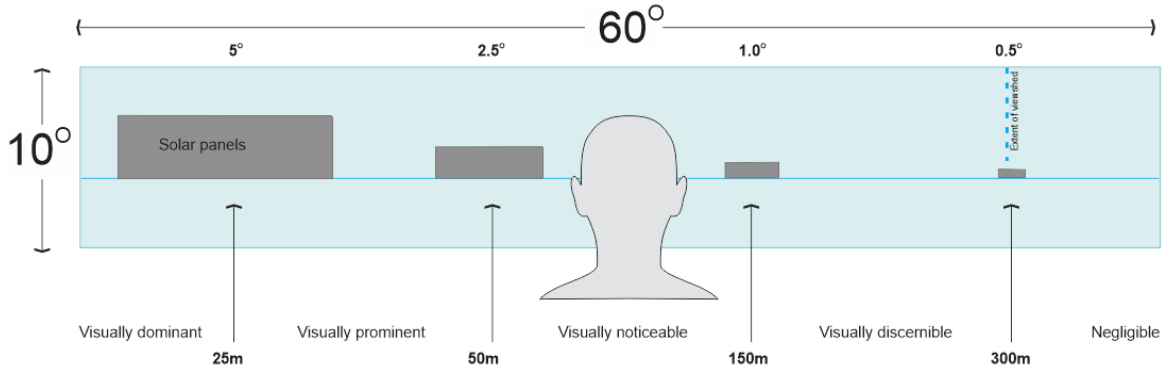


Table 1 shows the zones of visual influence based on the proportion to which a 2.5 m high solar panel is apparent within the vertical field of view.

Table 1 Zones of visual influence

Distance from an observer	*Visual Impact*
>300 m	The extent of the viewshed would occur when the visual impact is negligible. At a distance greater than 300m, a 2.5 m high solar panel is no longer an easily recognisable element in a man-modified landscape. This 300 m distance is adopted as the edge of the viewshed.
150-300 m	In the band between 150-300 m the solar panels would be discernible in most lighting conditions. At the outer edge of this range, in all but exceptionally clear lighting conditions, the solar panels would become increasingly imperceptible.
50-150 m	Visually noticeable visual impact would occur between the range of 50-150 m where the solar panels would be visible in the landscape in most lighting conditions. Landscape between the viewer and the solar farm can reduce visual impact.
25-50 m	Visually prominent visual impact occurs at distances between 25-50 m where the solar panels are visually prominent in the landscape. .
<25 m	Visually dominant visual impact would occur when a viewer is 25 m or less from the solar panels. The component of the solar farm visible at this distance would be dominant. Vegetation, van be effective as a screen, and must be at least as high as the solar panels.

These bands or zones of visual influence do provide a guide to the potential visual impact of the solar farm based solely on distance.

4. Planning background

The subject site is within the Leeton LGA and is subject to the '*Leeton Local Environmental Plan 2014*' the aims of which are:

a) to encourage sustainable economic growth and development.

b) to preserve rural land for all forms of primary production.

c) to identify, protect, conserve and enhance Leeton's natural assets.

d) to identify and protect Leeton's built and cultural heritage assets for future generations.

e) to allow for the equitable provision of social services and facilities for the community.

f) to provide housing choices for the community.

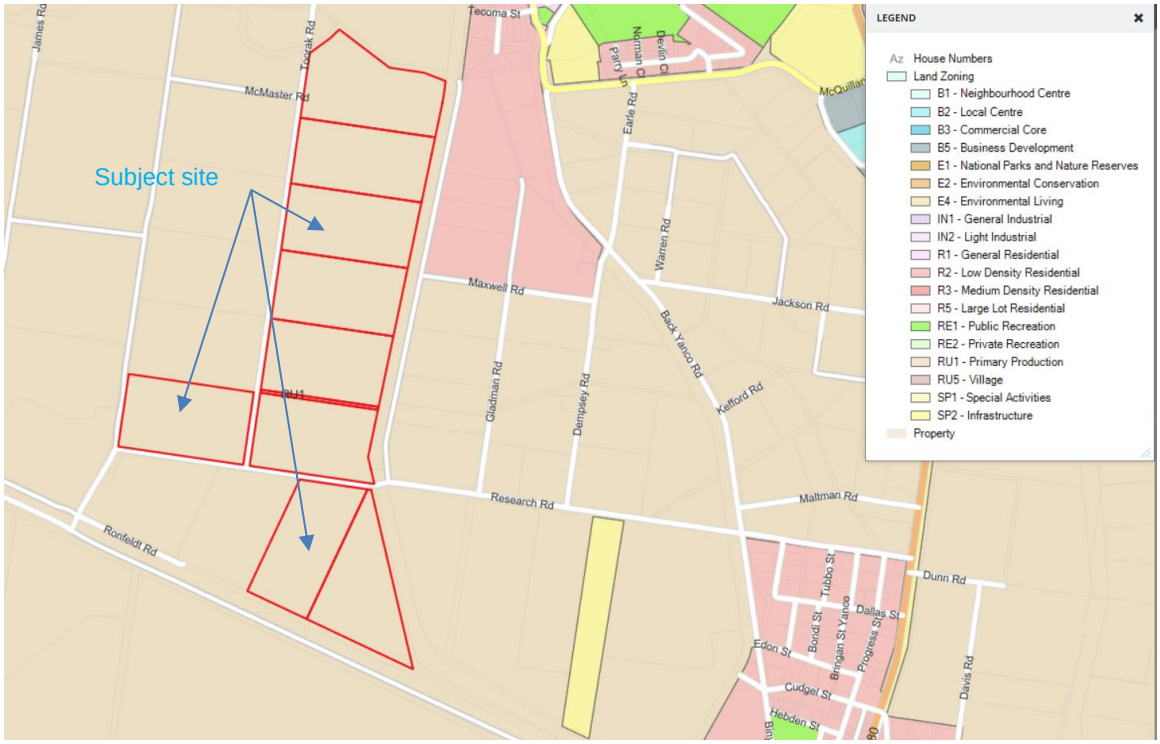
g) to minimise land use conflicts and adverse environmental impacts.

h) to promote ecologically sustainable development.

Zoning

The subject site comprises nine separate titles all of which are zoned 'RU1 - Primary Production' under the Leeton LEP. **Figure 12** shows the current zones and red outline designates the subject site.

Figure 12 Zoning (Map source – Leeton Shire Council GIS)



There is an area on the east of the subject site that is zoned 'R2 – Low Density Residential'. The land on all other abutting boundaries is zoned 'RU1 - Primary Production'.

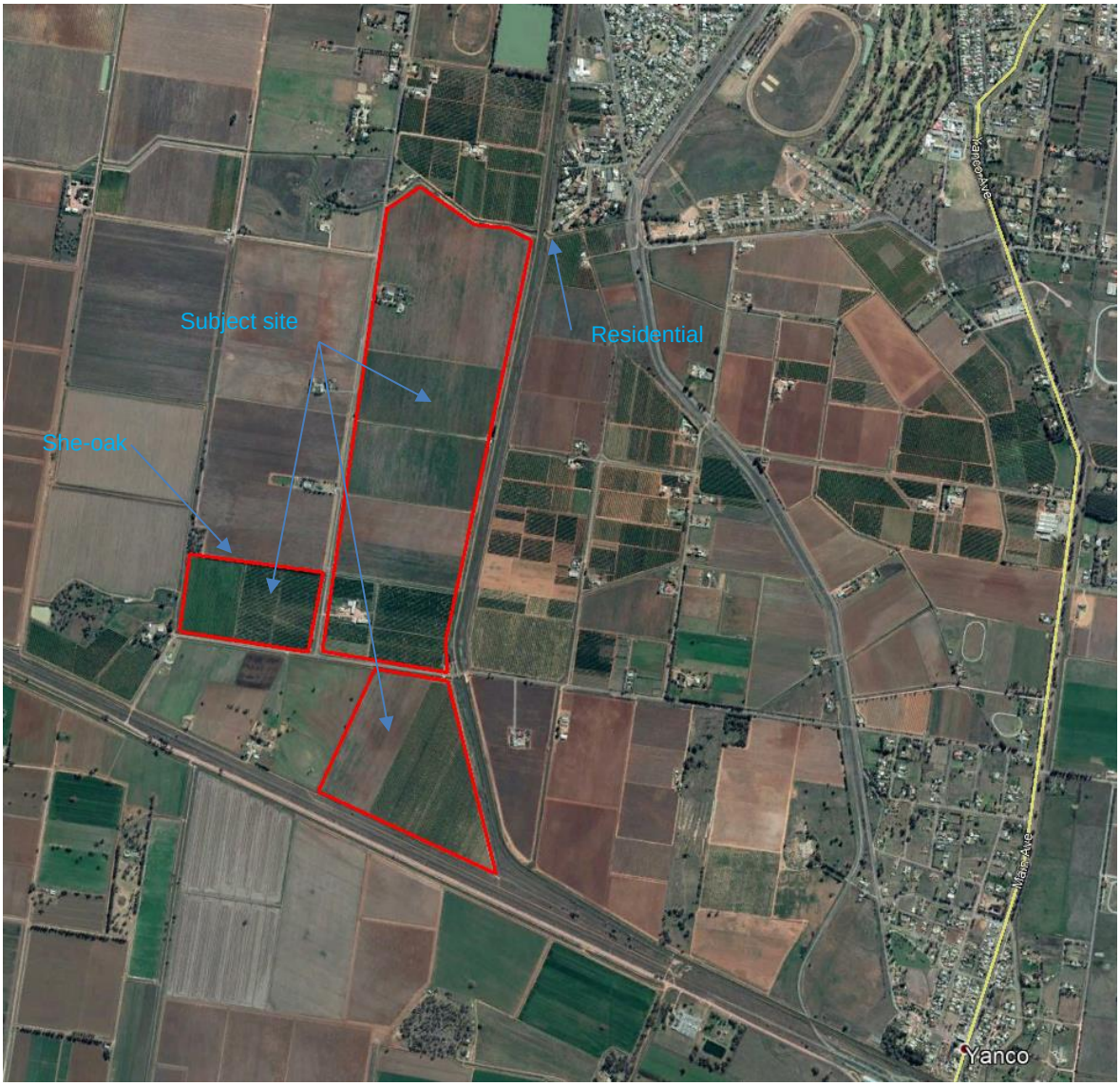
5. Landscape units & sensitivity

The subject site is bordered by rural farmland with associated residential properties.

Existing land uses and vegetation

Figure 13 shows the current site and adjoining land uses. The location of the subject site is shown by the red outlined areas.

Figure 13 *Property location (Source: Google Earth, Imagery 31 August 2017)*



There is limited native vegetation on the subject site, as most of the land has been cleared for farming with grape vines and orange orchards common. A strip of She-oak (*Allocasuarina sp.*) has been established along the boundary of the south western section of the subject site, which is just visible in **Figure 13.**

The subject site and the surrounding area within 300 m of the solar fam (the viewshed) is rural farmland apart from a small area of residential which is located within 300 m of the subject site in the north east corner. Views from this location are discussed later in this report.

Topography

The subject site and the surrounding landscape is very flat. Google Earth gives levels of between 237 m AHD and 239 m AHD across the entire subject site. The area with the viewshed (300 m from the edge of the solar farm) is of similar elevation. Minor topographical relief is given by the levee bank which runs along the eastern side of the subject site. This levee bank is in the order of 1-1.5 m above the surrounding plain.

Figure 14 *Levee bank and orange groves*

The levee bank is on the right of Figure **14**, whilst an existing orange grove is on the left. A powerline runs parallel to the levee bank and irrigation canal.

Existing vegetation

An example of the existing grape vines, which run parallel to Toorak Road, are shown in Figure **15**.

Figure 15 *Existing planting along Toorak Road looking east*

Figure **15** is taken from the subject site with Toorak Road to the left. It is apparent in this Figure that the subject site is exceptionally flat with views in this direction showing no topographical variation.

Other planting occurs as individual trees and in hedgerows visible on the plain. In Figure **16** is an example of the She-oak planting mentioned previously adjacent to a grape vine area.

Figure 16 *Existing planting*

Such hedgerow planting is rare in areas within or surrounding the subject site. Orange groves are also common.

Figure 17 *Existing orange groves north of the subject site*

The orange groves and grapes are the dominant species visible around the subject site. Planting of Eucalypts and She-oak is relatively uncommon.

Sensitivity

The sensitivity of the rural areas would be assessed as low as these are areas which regularly undergo change. Whether the land is tilled, or crops are altered from year to year. Grapes can be removed and replaced with oranges or pasture. These rural areas undergo regular change.

The residential areas are considered to have a high degree of sensitivity as these are people's homes and they are sensitive to changes in the views that they see every day.

6. Proposed landscaping

The proposed landscaping was, in part, based on community consultation.

Community consultation

Community consultation has been undertaken in accordance with the proposal's Community Consultation Plan. As part of the plan, respondents have been surveyed on their views regarding solar farm development and local visual amenity.

Specific questions relating to visual impacts were included in a feedback form distributed via:

- A Project Website (http://yancosolarfarm.com.au) that went live in August 2018 with a dedicated email address for feedback.
- Direct engagement with neighbours though phone calls, letters, emails and face to face meetings.
- Community Information Sessions held on Open Days were held in Leeton on 9 August and 11 December 2018.
- A newsletter issued to residences in November/December 2018.

Concerns raised relating to this assessment include loss of visual amenity (direct views from neighbouring residences general/broader views from roads and public viewpoints impacting the landscape amenity) and glare as a result of the solar farm infrastructure.

ib vogt staff made contact with neighbours to the solar farm proposal site during June 2018 to advise of the proposal and provide staff contact details should people have any further queries. Contact with neighbours was made by telephone, letters, door knocking, emails, distribution of a newsletter and face to face meetings between June 2018 and January 2019.

A private information session for near neighbours to the proposal site was held in Yanco 8 August 2018 to provide information about the solar farm proposal (letters were issued during July to invite neighbours to the session). Layout plans were displayed at the information session, with information about the proposed height of the solar panels and vegetation screening options.

ib vogt staff held face to face meetings with site neighbours on 10 December 2018 to provide an update regarding the proposal, including the landscape plan and photomontages of the solar farm infrastructure and proposed vegetation screening options.

Proposed plant species

Species were selected on the advice of a local grower of indigenous species and the selection was also vetted by the fauna and flora consultants on the project. The proposed planting methodology was similar to that used successfully on other projects in similar climates across Australia and this was also vetted by a local landscape contractor.

The plants utilised in the proposed landscape buffer planting and heights that may be anticipated in 5-10 years are listed below.

Botanical Name	Common Name	Height
Acacia decora	Western Global-wattle	2-4 m
Acacia oswaldii	Umbrella Wattle	3-5 m
Allocasuarina cristata	Belah	5-10 m
Allocasuarina luehmannii	Buloke	5-10 m
Callitris glaucophylla	White Cypress-pine	5-10 m
Eucalyptus melliodora	Yellow Box	5-10 m

Eucalyptus populnea	Brimble Box	5-10 m

It is recognised that this is a harsh environment for growing trees and these heights are much below the eventual mature heights that these species can grow to.

However, the heights that have been used in the photomontages, which are discussed later in this report, show a range of random heights of the proposed vegetation between 4-6 m in height with the occasional Eucalypt being modelled at 7 m in height.

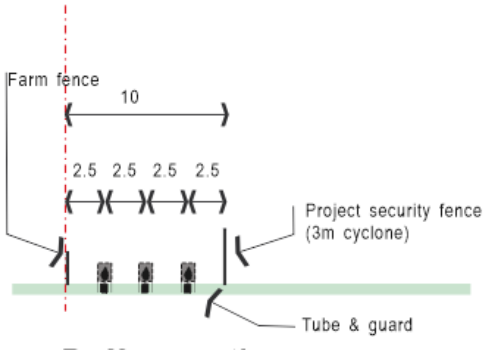
This is much less that the heights obtained by the She-oak shown in Figure **16** and provide a conservative basis for the imagery. However, it is stressed that given the flat topography and the lack of elevated viewing locations, the proposed landscaping only needs to reach a height that is slightly higher than the proposed solar panels (say 3 m in height) for the vegetation to be effective as a screen or visual buffer.

Proposed planting methodology & layout

The proposed vegetation is proposed to be planted in three rows within the 10m buffer planting zone and the plants in each row are planted at 2 m centres.

A typical section through the proposed landscape buffer is shown in Figure **18**.

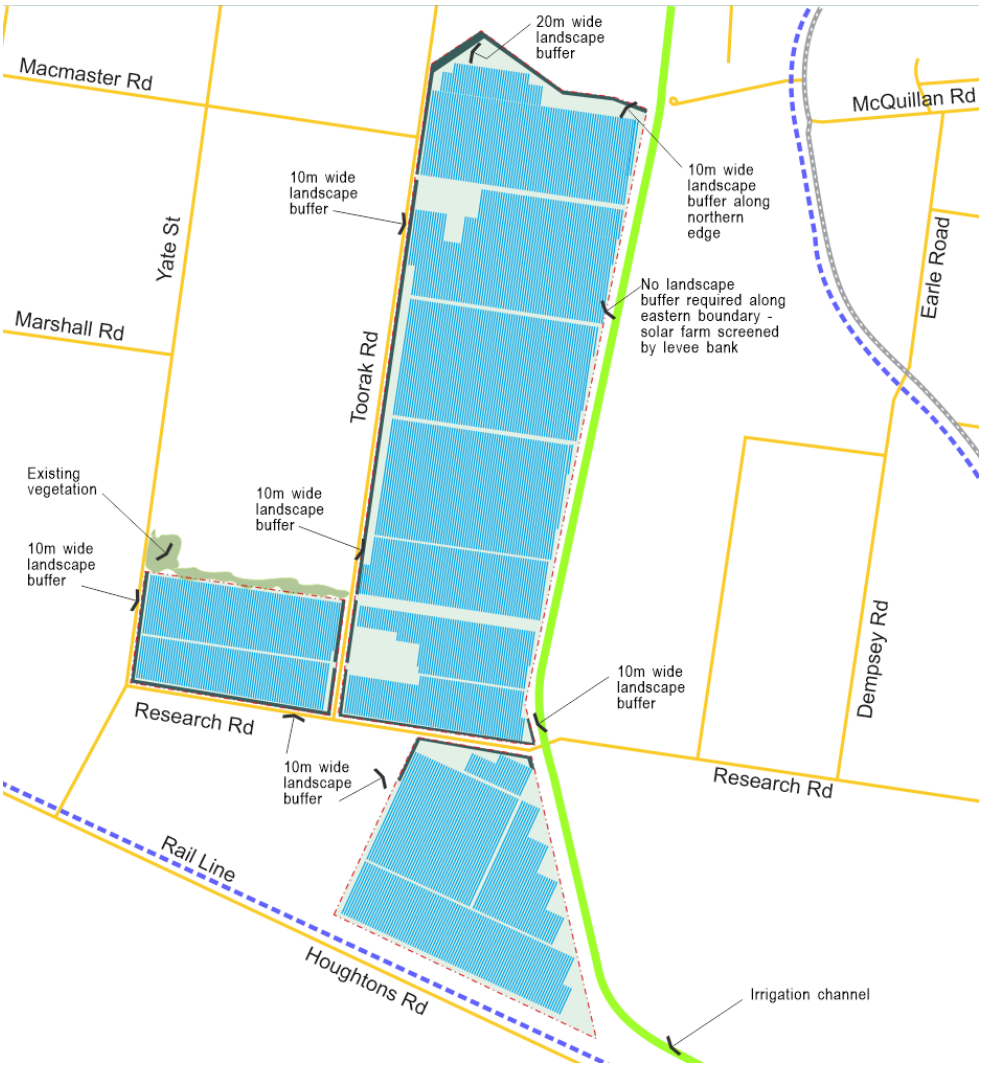
Figure 18 *Section through proposed 10 m wide planting buffer*



This means that there is a high degree of redundancy within the planting design which allows for plant losses. Plant losses are also minimised by the fencing around the planted areas which prevent losses from grazing. Rabbit guards are also specified as part of the initial planting.

The location of the proposed buffer planting is shown in Figure **19**.

Figure 19 *Proposed planting*



The landscape buffer planting is shown on the northern, western and southern sides of the solar farm. An A3 version of this plan is appended to this report.

7. Visual assessment

The visual assessment is partly based on the impact and visual change at a number of selected locations. Figure **20** shows the location of the twenty viewpoints (yellow and blue pine) and the blue pins identify those viewpoints for which photomontages were prepared. The red line designates the subject site.

Figure 20 *Viewpoint locations (Map source: Google Earth Pro)*

These viewpoint locations were selected to show the visual impact generally from locations close to the solar farm. As the viewshed analysis in Chapter 3 has shown, the viewshed of the solar farm is around 300 m as the solar panels are 2.2 m high. Apart from needing to be in relatively close proximity, viewpoints were also selected that would indicate the level of visual impact from nearby residential properties, either on adjoining farm or within the residential areas of Leeton and Yanco.

The location of adjacent residential properties and their reference numbers which are used in the following assessment is shown on Figure **21**.

Figure 21 Residential locations (Map source: Google Earth Pro)

The pink ballo0ns and the reference numbers for adjacent residential properties will mbe used as appropriate in the following evaluation of the visual impact from the twenty selected viewpoints (Refer Figure **20**).

Viewpoint 1 – 50 Maxwell Road

Viewpoint 1 (VP1) is taken from the driveway of a residence (R13) approximately 420 m east of the solar farm's eastern border. This viewpoint is taken from the entry gate as there are no views from the house and yard.

Figure 22 *VP1 – Existing view looking east*

At this distance and given the presence of the intervening irrigation canal bund, there would be no views from this location to the solar farm. For these reasons the visual impact from VP1 would be assessed as **Nil**.

Viewpoint 2 – Gladman Road

Viewpoint 2 (VP2) is approximately 540 m to the east of the proposed solar farm. House R16 is the north east of this viewpoint. Figure **23** is a view looking west towards the solar farm.

Figure 23 *VP2 – Existing view looking west*

This location shows the existing canal and an orange grove between the roadside edge and the solar farm. The view to the solar farm would be completely screened by existing planting. For these reasons immediately after construction the visual impact from VP2 would be assessed as **Nil**.

Viewpoint 3 – 215 Research Road

Viewpoint 3 (VP3) is located on a road easement south of Research Road which provides access to a rural property and associated residence (R19). VP3 is approximately 430 m east of the edge of the solar farm.

Figure 24 *VP3 – Existing house*

The existing house (R19) adjacent to VP3 is orientated to the north, whilst the closest edge of the solar farm is to the east.

Figure 25 *VP3 – Existing view looking east*

A minor embankment which runs along the edge of a irrigation canal would screen views to the solar panels further to the east. A residential property (R20) is located on the western side of this embankment and is not visible.

The proposed solar farm would not be visible from VP3 although from locations further to the east, in front of the house, the solar panels may just be visible. For these reasons the overall visual impact from VP3 would be assessed as **Negligible**.

Viewpoint 4 – Research Road

Viewpoint 4 (VP4) is located where Research Road crossed a low bridge over a major irrigation canal immediately to the east of the solar farm. The boundary of the solar farm is approximately 60 m from eastern boundary of the solar farm. Figure **26** shows the view towards the west along Research Road.

Figure 26 *VP 4 – Existing view looking west*

There is a slight rise at the bridge which would allow views to the solar farm. This landscape already contains visible infrastructure, including the bridge and associated canal engineering as well as power lines and a shed in the foreground.

This For these reasons the overall visual impact from VP4 would be assessed as **Low**, immediately after construction.

Landscaping is proposed along both sides of Research Road and returning north and south along the eastern boundaries. Once this landscaping was established the overall visual impact would reduce to **Negligible** to **Nil**.

Viewpoint 5 – Amato Road at end of Maxwell Road

Viewpoint 5 (VP5) is located at the corner of Amato Road and Maxwell Road, which is an un-made road easement. VP5 is approximately 85 m from the eastern boundary of the solar farm. This viewpoint looks towards the east. The existing irrigation canal and its associated bunds would be between the solar farm and this viewpoint.

Figure 27 *VP 5 – Existing view looking south*

The upper sections of the solar panels may be just visible. However, this is a little used road withy few viewers. For these reasons the overall visual impact from VP5 would be assessed as **Negligible.**

Viewpoint 6 – Amato Rd

Viewpoint 6 (VP6) is located on Amato Road close to a residential area on the outskirts of Yanco.

Figure 28 *Residential properties to the east of VP6*

These residential properties lie to the east of VP6 and are on the closest residentially zoned land adjacent to the solar farm. These residential properties are on large allotments and typically have screen planting along their rear boundary which would screen views to the solar farm if it was possible for the solar farm or solar panels to be seen.

As well as screen planting on the residential allotments, the proposed site is also screened by an embankment along the western edge of the irrigation canal. The view from the top of the embankment looking west is shown in Figure **29** and this looks over the subject site.

Figure 29 *View from the top of the irrigation canal embankment looking west*

The area on the opposite side of the irrigation canal which is currently planted with grape vines, is the proposed site for the solar farm and is visible from the top of the embankment. However, as the following photomontages will demonstrate, this is not a view that is possible from the adjacent lower lying residential properties.

VP6 is taken at the end of Amato Road and the solar farm would be on the right of Figure **30**. As discussed previously the existing irrigation canal embankment would completely screen the solar farm from view. The residential properties discussed above would be behind this view.

Figure 30 *VP 6 – Existing view looking south and west*

This existing view is to the low embankment or bund which is constructed on either side of the irrigation canal.

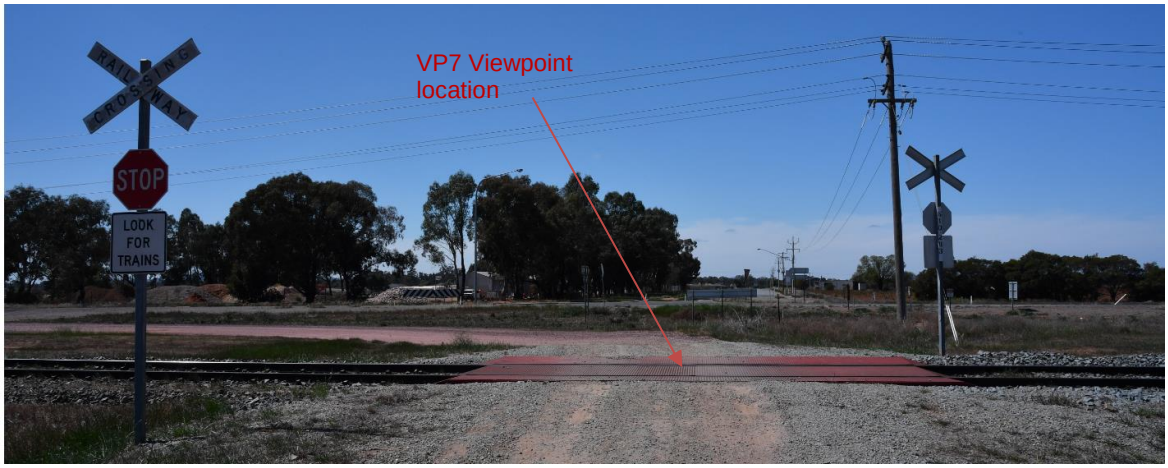
Figure 31 *VP 6 – Photomontage*

Figure **31** is titled 'Photomontage', but in reality, it shows the solar farm as a red outline as the solar panels are behind the embankment in the foreground. No sections of the solar panels would be visible from this location. The visual impact from VP6 would be assessed as **Nil.**

Viewpoint 7 – McQuillan Rd and Back Yanco Rd intersection

Viewpoint 7 (VP7) is located on the slight rise as McQuillan Road crosses the railway line, which runs parallel to the Back Yanco Road. This viewpoint is approximately 500 m east of the solar farm. McQuillan Road is a un-sealed road providing access to rural properties on the west of the railway line.

Figure 32 Viewpoint location



The road over the railway line is the location from where the following photographs were taken, is shown in Figure **32**. The Back Yanco Road is parallel to and behind the railway line.

Figure 33 VP 7 – Panoramic view looking south to west

This is a panoramic view with the solar farm in the distance. The residence (R11) on the right would have no views from the property to the solar farm.

The solar panels would either, not be visible at all in the distance or, at worst case, they may just be discernible. Therefore, the visual impact from VP7 would be assessed as **Negligible** to **Nil**.

Viewpoint 8 – 269 Toorak Road (R07)

Viewpoint 8 (VP8) is located at the rear fence of a residence (R07) on Toorak Road, adjacent to the northern boundary of the solar farm. This viewpoint is approximately 30 m north of the solar farm's northern boundary. The solar panels would be further away, behind the proposed landscape buffer.

The house is orientated towards the north as illustrated in Figure **35.**

Figure 34 Existing house (R07) northern elevation

The existing house and the location from where the photographs were taken is shown Figure **35**.

Figure 35 VP 8 – Existing house (R07) southern elevation

It is apparent from Figure **35** that the house is orientated to the north and there are few locations from within the southern edge of this property that would have a view of the solar farm. Photographs were taken adjacent to the side fence.

From this location, the view is across a minor irrigation canal to the existing grape vines on the subject site. The edge of the irrigation canal is visible in Figure **36** and Figure **37**.

Figure 36 VP 8 – Existing view

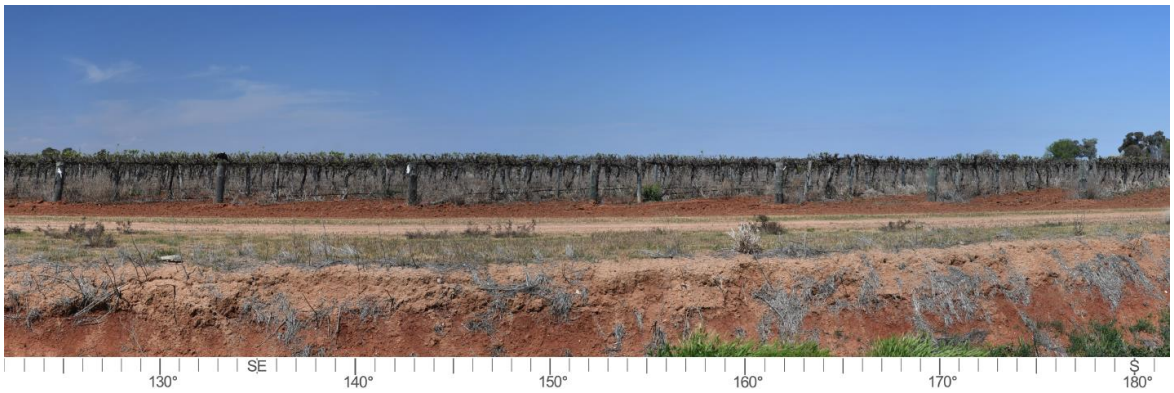
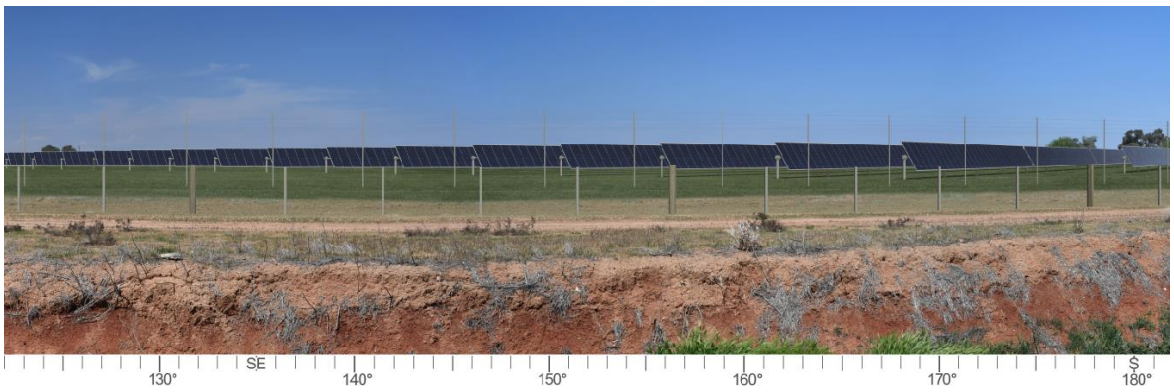
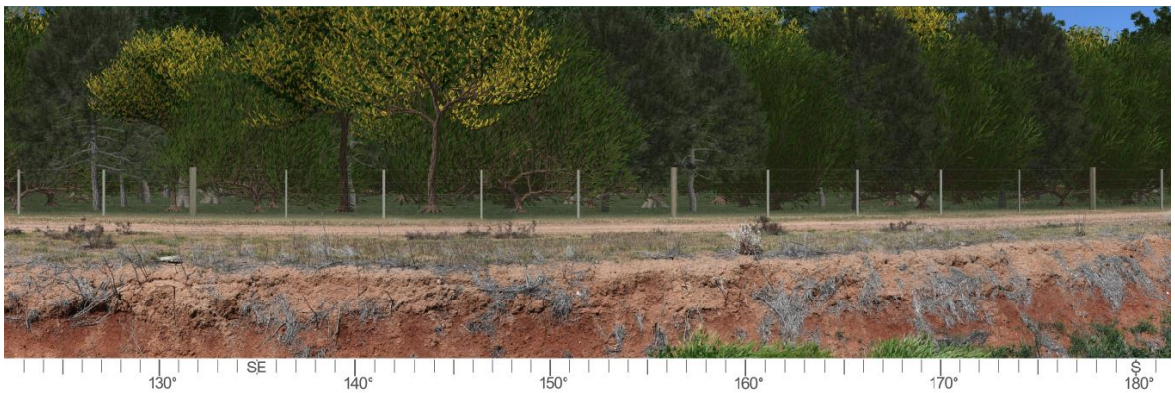


Figure 37 VP 8 – Photomontage without vegetation



The solar panels will be visible and they similar in scale to the grape vines, however they are a different element in this landscape, albeit visible from few existing locations in the residential property to the north.

Figure 38 VP 8 – Photomontage with vegetation



The proposed vegetation buffer would screen all views to the solar farm as shown in Figure **38**.

For these reasons the level of visual impact from VP8 is assessed as **Medium** immediately following construction, but this would reduce to **Negligible** or even **Positive** once vegetation establishes along the edge of the irrigation canal.

Viewpoint 9 – Toorak Rd, driveway to House R05

Viewpoint 9 (VP9) is located at the driveway entry to House R05 in Toorak Road. This viewpoint is approximately 20 m east of the solar farm.

Figure 39 *Viewpoint location*

The road over the irrigation canal is the location from where the following photographs were taken, is shown on Figure **39**. The house on this property is well set back from the road, approximately 125 m from the solar farm boundary. This house also has a well-established garden which would potentially screen views to the solar farm.

Figure 40 *VP 9 – Panoramic view looking north to east*

VP9 is taken from the slight rise as the entry road crossed the embankment. The bridge over the canal is higher than the surrounding land, therefore the photographs are taken from a higher elevation than would be available on Toorak Road.

The solar panels would be visible from the gate, however the house is some distance from the solar farm and, although visible immediately after construction from the gate, the visual impact would be more significant if the house was at this location, closer to the solar farm. However, as the house is some distance from the solar farm, the visual impact from the gate immediately after construction would be assessed as **Low**.

Once planting was established along the Toorak Road frontage, the level of visual impact from VP9 would reduce to **Negligible**, or even **Positive**. This is demonstrated in the following assessment of VP10 which includes photomontages of the proposed vegetation along Toorak Road.

Viewpoint 10 – Toorak Rd, driveway to House R04

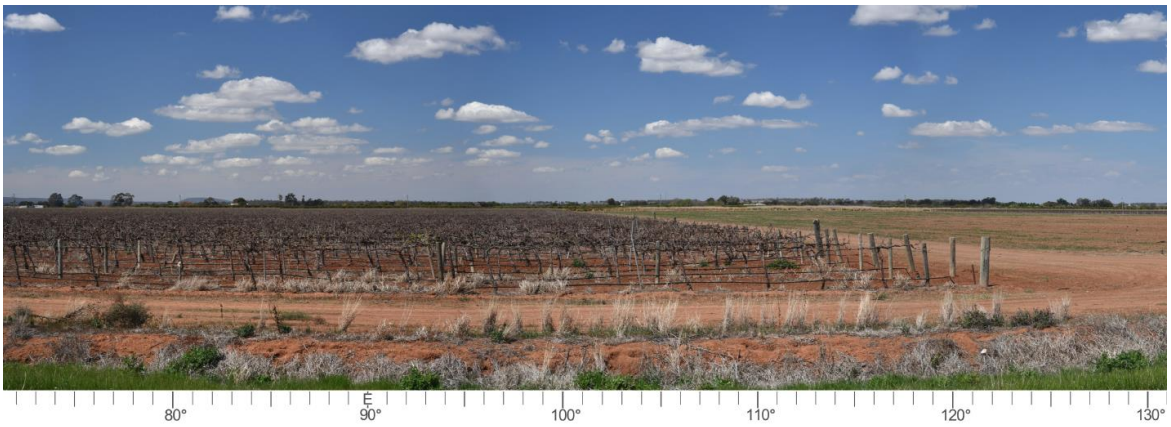
Viewpoint 10 (VP10) is located at the driveway entry to House R04 in Toorak Road. This viewpoint is at a similar distance that that of VP9, that is approximately 20 m east of the solar farm site boundary.

Figure 41 *Entry gate and view to house*

The house on this property is well set back from the road and would be approximately 105 m from the solar farm site boundary.

The location of VP10 is closer to Toorak Road on the slight rise created by the bridge crossing the irrigation canal on this access drive. The bridge over the canal is higher than the surrounding land, therefore the photographs and the resultant photomontages are from a higher elevation than would be available on Toorak Road.

Figure 42 *VP 10 – Existing view looking east to south east*



This is a view of the area where the solar farm is proposed to replace the grape vines on the eastern side of Toorak Road. Some of the Toorak Road frontage has no vines (right hand side of Figure **42**).

Figure 43 VP 10 – Photomontage with no landscaping

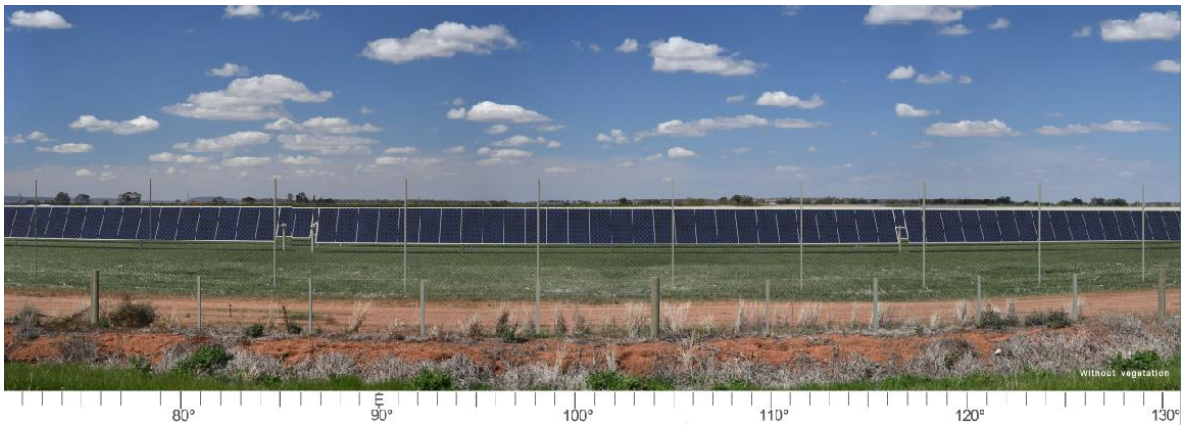
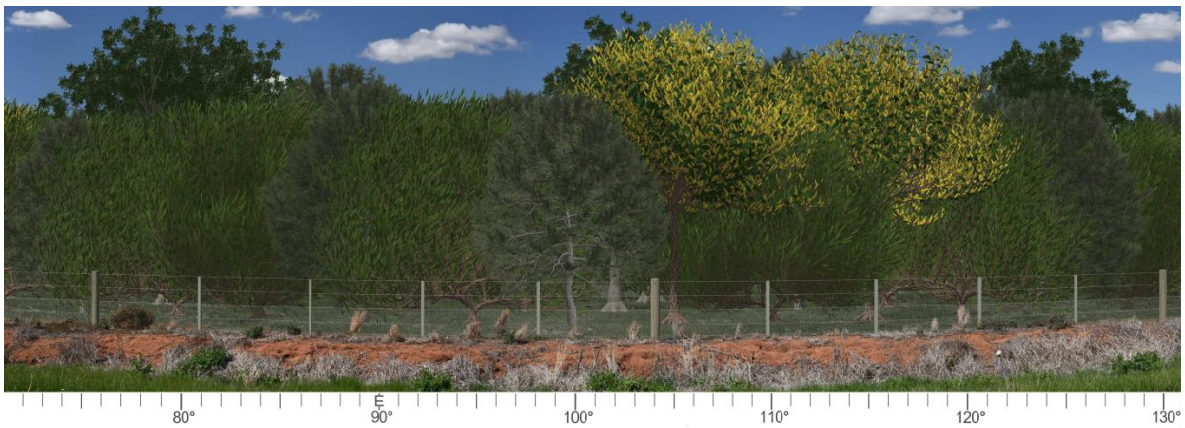


Figure 44 VP 10 – Photomontage with landscaping

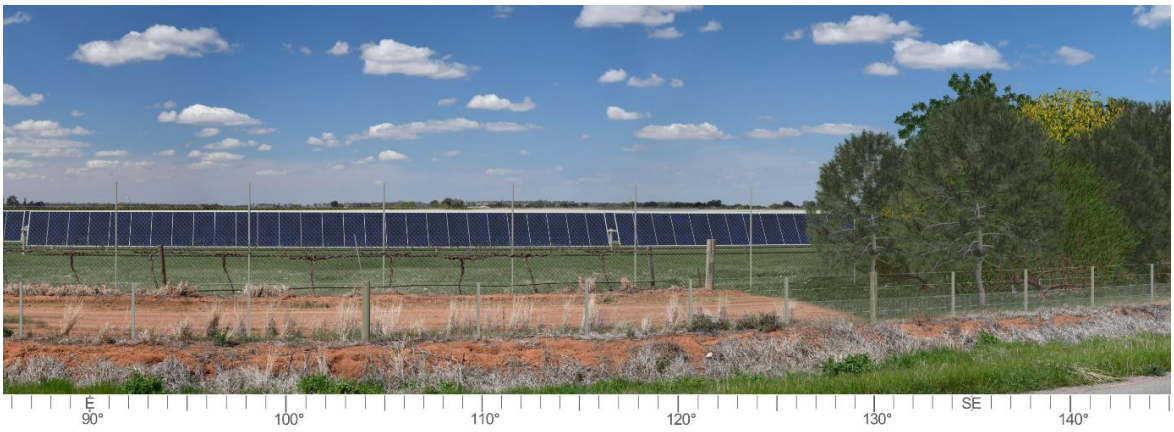


The solar panels would be visible from the gate, however this is some distance from the house and, although visible immediately after construction, the impact would be more significant if the house was at this location, closer to the solar farm. However, as the house is some distance from the solar farm, the visual impact immediately after construction would be assessed as **Low**.

Once planting was established along the Toorak Road frontage, the level of visual impact from VP10 would reduce to **Negligible**, or even **Positive**.

A further photomontage was produced for VP10 which explored the potential for retaining the grape vines within the 10m landscape buffer, in lieu of the proposed landscaping. The existing grape vines are set behind an access track, which means that only one row would be retained within the fenced landscape buffer. This is illustrated in Figure **45**, where the contrast in screening potential of the grape vines and the adjacent area with an established landscape buffer is apparent.

Figure 45 VP 10 – Photomontage with grape vines retained



The grapes photographed in Figure **45** are just leaving in early spring, so they do not provide the visual screen which can be achieved by the proposed buffer landscaping as photomontage to the right of Figure **45**. The vegetation proposed in the Landscape Plan is more effective and unless the retention of the grapes provides a social / agricultural benefit, it would seem that the proposed replacement landscaping is the preferred option.

If a situation occurred where orange groves are planted parallel to the road, the retention of these would be equally effective for screening and would have the additional advantage of being immediately effective.

Viewpoint 11 – 285 Toorak Rd, House R08 & R09

Viewpoint 11 (VP11) is located adjacent to House RO9 which, although accessed from Toorak Road, is approximately 440 m east of Toorak Road. This viewpoint is approximately 340 m north of the solar farm title boundary.

Figure 46 *House HO8*

The house is orientated towards the north and sits within a well-established orange grove. This orange grove screens views to the solar farm, although very narrow view lines may be possible along the access tracks between the orange rows.

Figure 47 *VP 11 – View looking south*

The solar panels may be just visible down these access laneways. Therefore, the visual impact from VP11 would be assessed as **Negligible**.

The impact from the adjacent house (R08) would be similar.

Viewpoint 12 – Houghton Rd, opposite substation

Viewpoint 12 (VP12) is located on Houghton Road opposite an existing substation. This viewpoint is approximately 1000 m south east of the solar farm.

Figure 48 *Existing substation south of Houghtons Road*

This substation will be connected to the solar farm and will cross Houghton Road further to the west (refer VP13).

Figure 49 *VP 12 – View looking west*

The solar panels will not be visible as they will be screened by vegetation and an earthworks embankment on the north side of Houghtons Road. Therefore, the visual impact from VP12 would be assessed as **Nil**.

Viewpoint 13 – Houghton Rd, at power line crossover

Viewpoint 13 (VP13) is located on Houghton Road at the location where the proposed power line will cross Houghton Road to connect to the substation (Refer Figure **48**). This viewpoint is approximately 170 m east of the solar farm.

Figure 50 *VP 13 – View looking west*

Existing powerline infrastructure is visible, and the solar panels will not be visible as they will be screened by vegetation and an earthworks embankment on the north side of Houghtons Road. Therefore, the visual impact from VP13 would be assessed as **Negligible** to **Nil**.

Viewpoint 14 – Houghton Rd, opposite the subject site

Viewpoint 14 (VP14) is located on Houghton Road directly opposite the subject site. This viewpoint is approximately 80 m south of the solar farm.

Figure 51 *VP 14 – View looking north*

Existing powerline infrastructure is visible; however the solar panels will not be visible as they will be screened by the earthworks embankment on the north side of Houghtons Road. This embankment screens the lower section of the orange groves which are established on the north side of the rail line.

Therefore, the visual impact from VP14 would be assessed as **Nil**.

Viewpoint 15 – 649 Ronfeldt Road, House RO1

Viewpoint 15 (VP15) is located on in the rear yard of a residence that is accessed from Ronfeldt Road. This viewpoint is approximately 320 m west of the southern section of the solar farm and 400 m south of the northern sections located north of Research Road.

Figure 52 *Existing house*

The existing house is orientated towards the east, with a pathway leading from the house to the eastern paddocks and sheds. The viewpoint is located at the end of this path looking east to the closest solar panels.

Figure 53 *Existing view*

The existing view from VP15 is broken by many elements in the foreground including power lines and tanks. However, at a distance of 320m the proposed solar panels are at the edge of the viewshed and they will be difficult to discern. This is supported by the photomontage shown in Figure **54**.

Figure 54 *Photomontage without landscaping*

The photomontages for VP15 demonstrate that the colour change bought about by the solar panels are only discernible on close examination of the photomontage. The landscaping, as it is higher than the solar panels, is more evident.

Figure 55 *Photomontage with landscaping*

However, the overall visual impact from VP15 would be assessed as **Negligible**. This would reduce to **Nil** once the vegetation was established to a height greater than the solar panels.

Viewpoint 16 – Intersection of Yate Rd and Research Rd

Viewpoint 16 (VP16) is located at the intersection of Yate Road and Research Road directly opposite the south western corner of the solar farm. This location is between R02 and R03. This viewpoint is approximately 60 m south west of the nearest corner of the solar farm title boundary.

Figure 56 *VP 16 – View looking north*

Research Road is visible turning right, parallel to the irrigation canal. Existing powerline infrastructure is visible, and the solar panels will be visible as they will replace the orange grove at the intersection. This location has few viewers however buffer planting is proposed along both road frontages.

Therefore, the visual impact from VP16 immediately after construction would be assessed as **Low** and once the vegetation established the visual impact would reduce to **Nil.**

Viewpoint 17 –Yate Road

Viewpoint 17 (VP17) is located on Yate Road, to the north from VP16. At this location Yate Road is a "*Dry weather access only*" road. This viewpoint is approximately 210 m north of the solar farm title boundary.

Figure 57 *VP 17 – View looking south*

This location has few viewers and existing planting to the south will screen views to the solar farm.

Therefore, the visual impact from VP17 would be assessed as **Negligible.**

Viewpoint 18 –Toorak Rd & Macmaster Rd intersection

Viewpoint 18 (VP18) is located on Toorak Road at the intersection with Macmaster Road. This viewpoint is approximately 50 m west of the solar farm title boundary, a similar distance to the entry driveway viewpoints discussed in VP9 and VP10, but in this case this is from the public domain. House R06 is some 250 m further west of VP18.

Figure 58 *VP 18 – View looking east*

This location has few viewers using Macmaster Road and the grape vine planting to the east is similar in height to the proposed solar panels.

For these reasons, the visual impact from VP18 would be assessed as **Low** immediately after construction and this would reduce to **Nil** or **Positive**, once the planting proposed along Toorak Road reached a height greater than the 2.2 m high solar panels.

Viewpoint 19 –Rourke Rd & Houghton Rd intersection

Viewpoint 19 (VP19) is located on Rourke Road south of the intersection with Houghton Road near the entry to the Yanco Agricultural Institute, Leeton Field Station. This viewpoint is approximately 970 m south west of the solar farm.

Figure 59 *VP 19 – View looking north and east*

The road on the left of Figure **59** is Yate Road and Houghton Road is behind a low rise as Rourke Road crosses an irrigation canal. Houghton Road is not visible. The road visible on the right of Figure **59** is the entry road into the Leeton Field Station.

The orange groves to the north are not visible. Therefore, the solar panels would also not be visible and the visual impact from VP19 would be assessed as **Nil.**

Viewpoint 20 –Toorak Road

Viewpoint 20 (VP20) is located on Toorak Road on a slightly elevated bridge as Toorak Road crosses an irrigation canal This viewpoint is approximately 30 m from solar panels to the east and the south west.

Figure 60 *VP 20 – View looking north*

The proposed solar panels would be located on the right-hand side (eastern) of Toorak Road in **Figure 60**. The solar farm would replace the existing grape vines.

Figure **61** shows the view looking south, where solar panels would be on both sides of Toorak Road in an area currently utilised for orange production.

Figure 61 *VP 20 – View looking south west*

A band of orange trees could be retained in lieu of the proposed landscaping. However, this assessment has been based on the provision of the 10 m landscape strip as shown on the accompanying Landscape Plan (Refer Annexure A).

The solar panels would be visible and the visual impact from VP20 would be assessed as **Low** immediately after construction and **Nil** to **Positive** once the landscaping was established to a height greater than the solar panels.

8. Glare, reflectivity & night lighting

Glare & reflectivity

The potential for glare associated with non-concentrating photovoltaic systems that do not involve mirrors or lenses is relatively limited. PV solar panels are designed to reflect as little sunlight as possible (generally around 2% of the light received; Spaven Consulting 2011), resulting in negligible glare or reflection. The reason for this is that PV panels are designed to absorb as much solar energy as possible in order to generate the maximum amount of electricity or heat.

The panels will not generally create noticeable glare compared with an existing roof or building surface (NSW Department of Planning 2010). Seen from above (such as from an aircraft) they appear dark grey and do not cause a glare or reflectivity hazard. Solar photovoltaic farms have been installed on a number of airports around the world.

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

- Steel array mounting - array mounting would be steel.
- Temporary site offices, sheds, PV boxes or PV skids.
- The onsite delivery station.
- Perimeter fencing.
- Permanent staff amenities.

The materials and colour of onsite infrastructure will, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that will blend with the landscape. Where practical:

- Buildings will be non-reflective and in eucalypt green, beige or muted brown.
- Pole mounts will be non-reflective.
- Security fencing posts and wire will be non-reflective.
- Avoidance of unnecessary lighting, signage and logos.
- Retain and protect existing boundary landscaping.

This infrastructure would be relatively dispersed and unlikely to present a glare or reflectivity hazard to residences, motorists or aircraft.

Therefore the impact would be assessed as **Nil** to **Negligible**.

Night lighting

Night lighting would be minimised to the maximum extent possible (i.e. manually operated safety lighting at main component locations). It would be directed away from roads and residence so as not to cause light spill that may be hazardous to drivers.

All outdoor lighting will comply with ‘Australian Standard 4282 – Control of the Obtrusive Effects of Outdoor Lighting.’ There are additional mitigation measures in the standards, that include using asymmetric beams, directing lights inwards and away from reflective surfaces, using shielded fittings and eliminating upwards light spill.

Such lighting would be similar in scale and less frequent than lighting in adjacent farm properties. Therefore, the impact would be assessed as **Negligible**.

9. Conclusion

Views from the public domain

The level of visual impact from the local road network would be **Low** to **Negligible** immediately after construction, but this would reduce to **Nil** or even **Positive**, once the proposed planting reached a height greater than the solar panels.

In part the low level of visual impact is a result of the height of the solar panels, which at 2.2 m in height are not dissimilar to grape vines which are common in the area. This allows a visual confirmation of the potential visual impact as these grape vine areas quickly disappear into the landscape as one moves further away on the local road network. This also supports the relatively small viewshed that is based upon the height of the proposed solar panels.

However, not only does this height reduce the impact from close proximity, the height of the panels also means that landscape can quickly screen views from immediately adjacent roads.

The range of viewpoints in the public domain from which a resident or viewer can see the solar panels is also limited because of the height. Minor topographical features such as the embankment running adjacent to the irrigation can on the eastern boundary is sufficient in height to screen views to the solar farm as illustrated in VP6 where in the photomontage the solar panels are shown as a red outline behind this minor embankment.

Views from the private domain

The visual impact from the private domain is limited to very few houses, most of which are on rural properties. Where these houses are surrounded by vegetation, grape vines or orange groves the visual impact is either **Negligible** or **Nil.**

The only property which has been assessed as having an impact greater than **Low**, was the house at 269 Toorak Road (VP8). Arguably the rating of **Medium** is a conservative assessment as the house is orientated away from the solar farm, however, even this conservative assessment is of short duration. Landscaping along the edge of the irrigation canal to the south of this property would quickly reduce the level of visual impact to **Nil** or **Positive**.

Therefore, the proposed solar farm is appropriately sited with minimal visual impact. The landscape setting which is being established is consistent with landscape elements around Yanco and Leeton.

Annexure A

Landscape plan

Annexure B

Photomontages