

Mulwala Solar Farm, NSW

Landscape Character and Visual Impact Assessment

Prepared by RPS Australia East for ESCO Pacific

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Acronyms

AHD	Australian Height Datum
DCP	Development Control Plan
EIS	Environmental Impact Statement
EP&A Act	NSW Environmental Planning and Assessment Act 1979
LEP	Local Environment Plan
LGA	Local Government Area.
REF	Review of Environmental Factors
RMS	New South Wales Roads and Maritime Services
SEARs	Standard Secretary's Environmental Assessment Requirements
SWOT	Strengths Weaknesses Opportunities Threats
VIA	Visual Impact Assessment

Terms

ESCO Pacific	The “client” for which this report was prepared.
Landscape Character	A distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse.
Landscape Character Zone	An area of landscape with similar properties or strongly defined spatial qualities, distinct from areas immediately adjacent.
Magnitude	A term that combines the judgements about the size and scale of the effect, the extent of the area over which it occurs, whether it is reversible or irreversible and whether it is short or long term in duration.
Scenic amenity	The overall pleasantness of the views people enjoy of their surroundings, which provides an attractive visual setting or backdrop for the enjoyment of activities of the people living, working, recreating, visiting or travelling through an area.
Sensitivity	A term applied to visual receivers, combining judgements of the susceptibility of the receiver to the specific type of change or development proposed and the value related to that receptor.
Solar array	Solar panels linked together to form an ‘array’.
Visual amenity	The overall pleasantness of the views people enjoy of their surroundings, which provides an attractive visual setting or backdrop for the enjoyment of activities of the people living, working, recreating, visiting or travelling through an area.
Visual catchment	Extent of potential visibility to or from a specific area, feature or project.
Visual prominence	Is determined by the size, height and colour of proposed infrastructure elements and the degree to which the landscape within which they sit can assist in reducing their visual prominence (e.g. screening vegetation, land-form, etc.).
Visual receiver	Individuals and/or defined groups of people who have the potential to be affected by a proposal.

1.0 Introduction

1.1 Report Purpose

RPS Australia Asia Pacific has been commissioned by ESCO Pacific to undertake a visual impact assessment for a proposed 218 hectare, 80 megawatt (MW) Solar Photo Voltaic Generation (SPVG) facility (the proposal) to be constructed in the regional township of Mulwala, NSW. The proposal would include associated grid connectivity to Essential Energy and TransGrid electricity networks.

On the 5th February 2018 a Environmental Assessment Requirements (EARs) was provided by NSW Department of Planning and Environment. The EARs document stipulates specific requirements for the Environmental Impact Statement (EIS) and states that a visual assessment of the proposal must be carried out to determine its likely impacts, as per below:

“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 visual impact assessment delivers an objective statement of the probable impacts on the visual environment resulting from the construction of the proposal. The report outlines the results from site assessment, describing the present landscape character. It documents the assessment of visual impact resulting from the proposal and provides an indication for suitable mitigation measures. This document will form part of a broader Environmental Impact Statement for the project.

1.2 Study Limitations

This VIA is intended to be an objective document based on professional analysis of the proposal design. It seeks to establish the anticipated visual impacts of the proposal on a wide range of existing and potential viewers. The assessment has been developed using a range of conceptual level information and therefore is generally broad in its approach.

Landscape and visual assessment requires qualitative (subjective) judgements to be made. The assessment process aims to be objective and describe any changes factually. Potential changes as a result of the Project have been defined, however the significance of these changes requires qualitative (subjective) judgements to be made. The conclusions of this assessment therefore combine objective measurement and subjective professional interpretation.

The services and the purpose undertaken by RPS under the Contract in connection with preparing this report were limited to those specifically detailed in the Contract and this report, and are subject to the scope limitations set out in the Contract and this report. Other than as expressly stated in this report to the contrary, the opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. RPS has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions

made by RPS described in this report. RPS disclaims liability arising from any of the assumptions being incorrect.

1.3 Methodology

This report uses an industry standard in its approach to visual impact assessment that is systematic, consistent & based on professional, value judgement of commonly accepted & adopted criteria in the industry.

The methodology adopted for this report is guided by policy and guidelines outlined in ‘Beyond the Pavement’ (NSW Transport Roads & Maritime Service) and the ‘Environmental Impact Assessment Practice Note Guideline for Landscape Character and Visual Impact Assessment 2013 (NSW Transport Roads & Maritime Service).

In lieu of the above guiding documents, the methodology for this visual impact assessment involves the following activities:

1. Desktop study using aerial photography to identify the potential visual catchment and possible visual receptors.
2. Ground-truthing of assumptions reached through initial desktop studies.
3. Ground-truthing: visiting the site and reviewing the surrounding vantage points from publicly accessible areas. Where possible, with permission from land owners, the site is assessed from within private property.
4. Describing and evaluating the existing landscape character and visual environment in order to establish a baseline for the visual assessment.
5. Mapping the visual envelope based on field studies & data while identifying sensitive visual receptors. Sensitive visual receptors are people who would might experience a visual impact.
6. Undertaking a visual impact assessment using the grading matrix, considering visual sensitivity (of the visual amenity or viewpoints) and the magnitude of the visual change, to arrive at an overall level of effect or impact.
7. Views from habitable room windows, outdoor areas of the home yard dwelling are treated as sensitive receptors. Views from residual land beyond the home yard area (such as cropping/grazing land, recreational land etc) are treated as less sensitive receptors.
8. This Visual Impact Assessment Report adopts the standard methodology of sensitivity relating to proximity - the greater the distance between the visual receptor and the proposal, the lesser the visual sensitivity of that visual receptor.

Key information reviewed as part of this report included:

1. Mulwala Solar Farm Project EIS Information Brief
2. ESCO Pacific - Mulwala Solar Farm Project Layout
3. Federation Council - Development Control Plan 2013
4. Corowa Local Environmental Plan 2012
5. NSW Globe - cadastral information

1.4 Report Structure

This visual impact assessment has been structured in accordance with the Roads and Maritime Environmental Impact Assessment Practice Note: Guideline for Landscape Character and Visual Impact Assessment (EIA-N04) (Roads and Maritime, 2013). This industry standard framework has been adopted and marginally customised to suit the needs of the project.

2.0 Project Outline

2.1 Site Description

The Mulwala Solar Farm will be constructed approximately 85km west of Albury in Mulwala, a town within the Federation Council LGA, in the Riverina region of Southern New South Wales, on the NSW - VIC border. The site earmarked for the proposal is located approximately 1.1km north of the Mulwala Township (NSW) and 4.0km north of Yarrawonga (VIC) as expressed in **Figure 3: Regional Context**. The Proposal will be within a relatively close 1.5km proximity to Lake Mulwala, a man-made reservoir created with development of the Yarrawonga Weir across the Murray River.

Much of the Mulwala and Yarrawonga urban development has occurred on the banks of Lake Mulwala, where urban development has sprawled out from this central location, possibly to take advantage of the water views.

As highlighted in **Figure 4: Local Context**, the site is bound by three local roads; Tocumwal Street to its south, Savernake Road to its east, and Lambruck Lane divides the site into two primary areas. The Murray Valley Highway, a state-controlled road, is located approximately 5km to the south of the proposal and assists with east-west traffic.

The properties within the broader region are largely rural in land usage, featuring small to large scale grazing and cropping activities. These agricultural activities are supported by the Murray River irrigation system, an assortment of weirs, canals and holding ponds which assist in delivering fresh water throughout the region. Approximately 420m south of the proposal site is the Mulwala Canal, extending north-west from Lake Mulwala.

Localised, more urban development is surrounds the southern half of the site. The east of the site is relatively recent residential development, and directly to the south of the site is industrial development.

The topographic nature of the proposal site and the greater region in which its located is relatively flat, with any noticeable difference in topography approximately 30km north west of the proposal site in Berrigan, NSW.

The proposal site is divided into two main areas which are divided by Lambruck Lane, a road running east-west off Savernake Road. The northern half is the larger of the two areas; from east to west, at its widest point the proposal will be approximately 1.5km in width and from north to south 1.6km in length. The southern half is approximately 2km in width and 1km in length. Both halves feature large areas of Native Vegetation. Although these vegetated areas form part of the site, they cannot be developed. The solar farm will thus circumvent these areas.

The proposal will be developed over the property of a single landholder, and cover an actual area of roughly 218Ha. These properties are currently zoned R2 - Low Density Residential & RU1 - Primary Production (2012, Corowa Local Environmental Plan).

Table 1: Site Particulars

Item	Outline
Site Title (general)	Private
Address	Corner of Tocumwal Street & Savernake Road, Mulwala NSW
LGA	Federation Council
Coordinates	LAT - 35°57'29.18"S LON - 146° 0'2.29"E
Zone	R2 Low Density Residential, RU1 Primary Production
Adjoining Zones	R2 Low Density Residential, RU1 Primary Production, IN1 General Industrial
Current Titles	N/A
Lot & Plan	DP752290, DP134511, DP100773
Site Total Area	Two primary lots: 249 + 172 Ha
Current Land Usage	Primary Production

2.2 Topography

The topographic character of the proposal site, and the Riverina District generally, has been shaped by the overarching geology of the Oaklands Basin, a 3,800 square kilometre area covering the regional towns of Mulwala, Jerilderie, Griffith, Coleambly, Oaklands and Albury (NSW Gov. Planning & Environment, 2018).

The dominating geological characteristic of the Oaklands Basin is the relative linear and flat nature of its topography. As depicted within **Figure 1: Aerial image of the Mulwala-Yarrawongs Weir**, there is very little topographic relief, with any noticeable difference only evident 10km north-west of the proposal site, where a 240m high mountain exists, roughly 100m above the average level of Mulwala.

The average elevation of the Mulwala region has been depicted in **Figure 2: Mulwala Elevation**; the low-lying nature is represented by the light green shade indicating an elevation between 120-140m above sea level. The proposal site is reflective of this regional locality; generally flat with very little topographic relief. The proposal site itself is relatively flat and lower lying than the surrounding lands, averaging about 125m above sea level in height.

The flat nature of the proposal site and the region can result in a higher level of visual exposure to any development due to the lack of visually inhibitive terrain in the landscape. However, the lack of development potential on higher terrain results in conditions where visual receivers can be positioned within a closer proximity to development, without being visually impacted. Localised, low-lying vegetation also plays a key role in mitigating views in regions with a flatter geological character. Due to the curvature of the earth and the incidence of vegetation, viewing potential of particularly low-lying development is greatly reduced.

Figure 2: Mulwala Elevation (2018, topographic-map.com)

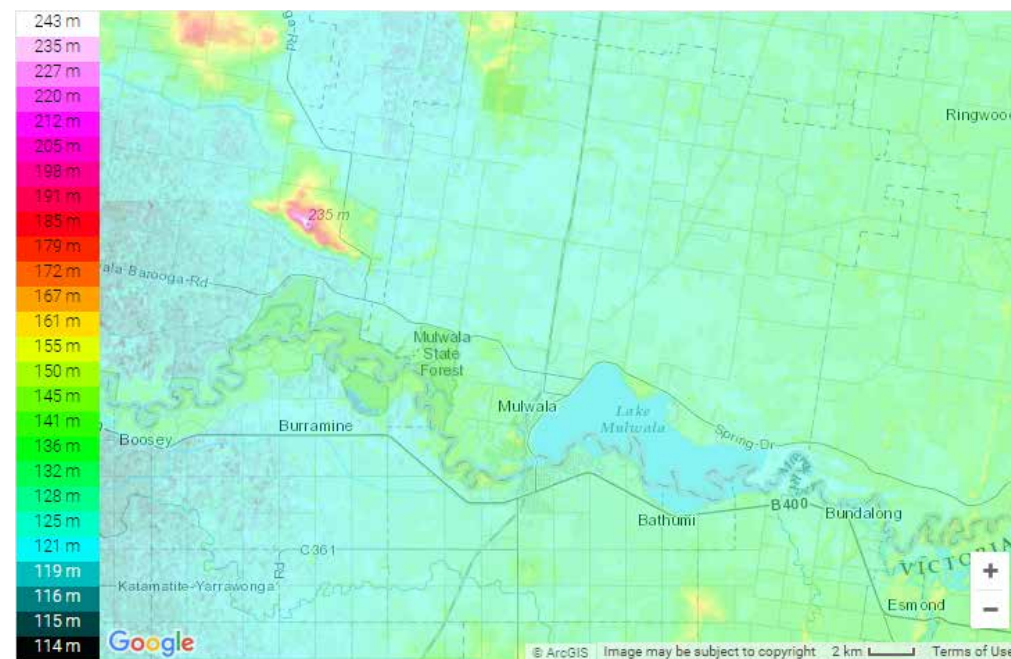


Figure 1: Aerial image of Lake Mulwala - Yarrawonga Weir (2018, CitiesTips.com)



Figure 3: Regional Context



Figure 4: Local Context



2.2 Proposal Summary

2.2.1 Proposal Outline

The Mulwala Solar Farm is a proposed 80 megawatt (MW) utility-scale Solar Photo Voltaic Generation (SPVG) facility, and includes infrastructure associated with grid connectivity to the regionally positioned Essential Energy & TransGrid electricity networks

As depicted in **Figure 6: Project Proposal - Solar Farm Layout** the total site area is approximately 215 hectares (Ha), on land adjoining Tocomwal St, Mulwala Savernake Rd, and Mulwala-Barooga Rd in the Local Government Area of Federation Council in Mulwala NSW.

Table 2: Proposal Outline

Address	255 Savernake Road Mulwala 2647
LGA	Federation Council
Lot Description	DP752290 DP134511 DP100773
Property Total Area	Two Primary Lots - 253 + 173 (426) Ha (approx.)
Project Total Area	215 Ha (approx.)
Current Land Usage	Agricultural - cropping & grazing
Solar Farm Capacity	80 MWac
Connection	Essential Energy & TransGrid electricity networks
Total Solar Panels	up to 300,000 (each with 340w capacity)
Solar Panel Dimension*	2.0m x 1.0m
Solar Array Configuration*	94 panels, 94m in length (approx.)
Number of Arrays*	4500

**Indicative of a typical design*

2.2.2 Solar Array Configuration

The solar farm will be comprised of approximately 300,000 solar panels, arranged in rows or solar arrays as per **Figure 5: Array Technologies - Solar Arrays**. While numbers associated with a typical design have been provided above, the identification of solar panels & fixing systems (configuration & number of arrays) will be identified during the procurement phase. The arrays will not exceed 4.0m above ground level or encroach beyond the identified site area. The height of the solar panels will vary as they follow the sun however they will not exceed 4.0m in height. These arrays will be positioned in a north-south alignment and tilt in an east to west movement to follow the path of the sun in a linear fashion / axis.

The individual solar panels will be fixed onto a metal mounting structure which will be secured to the ground via piling or fastening to footings. The mounting structure will be responsible for supporting and tilting the solar panels.

2.2.3 Ancillary Structures

There will be a number of Power Conversion Units (PCU) throughout the site which will convert the power generated from the solar panels from DC to AC electricity. These units will be contained within the scale of 40 foot shipping containers with an approximate dimension of 2440mm width, 12300mm length and a maximum height of 3500mm.

To the south of the site will be a smaller 2 Ha size area dedicated to associated solar farm infrastructure, including a Site Office, Maintenance Shed, Switch-yard and Battery Storage facilities. **Figure 7: Artist Impression: Viewing north from Tocomwal Street** provides a schematic representation of the solar farm configuration.

2.2.4 Night Lighting

During both construction and operational phases of the solar farm there is expected to be a moderate and minimum level of light spill respectively.

Lighting associated with the construction phase will likely to result from the installation of the solar arrays and the associated infrastructure. However, as the solar farm is constructed over a relatively short period of time, any light nuisance arising from construction will be short lived. Moreover, mitigation measures such as mesh fencing will be erected to minimise views to illuminated construction site areas.

During the operational phase of the proposal there will be a very minimal level of light spill resulting from the maintenance of the solar farm. This light spill however will be isolated to specific areas and is unlikely to impact of neighbouring properties.

Figure 5: Array Technologies - Solar Arrays



Figure 6: Project Proposal - Solar Farm Site Layout



Figure 7: Artist impression: Viewing north to proposal from Tocumwal Street



2.3 Planning Context

2.3.1 Local Government Policy

Where possible, any development should be informed by the Corowa Shire 'Development Control Plan' (Corowa Shire, 2013), in order to establish a high level of aesthetic synergy with the greater Local Government Area. This should be considerate of the broader objectives & strategies within the Local Government DCP, in addition to more specific design parameters such as those relating to industrial development.

The Development Control Plan states the general objectives and principles for development over all development sectors. Chapter 3.0 - Industrial Development > Section 3.2 - Landscaping outlines the minimum standard requirements for any scale of industrial development. The policy also extends to design parameters relating to landscaping of industrial developments. The relevant extract from this policy has been provided in **Figure 8: Corowa Development Control Plan 2013**.

2.3.2 Land Zoning & Land Use

The proposal is to be constructed over a number of lots which currently exist under different land zone classifications. Much of the northern and southern lots are zoned RU1 Primary Production, accounting for roughly 75% of the area. The remaining (approximately) 25%, to the bottom right hand corner of the proposal, is zoned R2 Low Density Residential, as highlighted in **Figure 4: Land Zoning Map**.

Various land zoning classifications adjoin, or are in close proximity to, the proposal site. The north and west of the site are bounded by RU1 Primary Production. To the east of the proposal site is R2 Low Density Residential. IN1 General Industrial is positioned south of the site. Mulwala-Savernake Rd is zoned SP2 Infrastructure. Directly south-east of the proposal is R1 General Residential, and further east is RE1 Public Recreation.

The land zoning classifications, and related land use, should be used as a manner of gauging the sensitivity of receivers, existing and future. Of least concern with respect to visual impact are those properties situated within IN1 General Industrial land zoning areas, which facilitate a more transient & worker-based type of patron, and thus are non-sensitive receptors. Properties within zones RU1 Primary Production generally contain a low density residential dwelling, which is a prime sensitive receptor. These properties are typically well landscaped and are rarely impacted by low-lying development, however all dwellings must be assessed for potential visual exposure.

The R2 Low Density Residential and R1 General Residential land zoning areas to the east and south-east of the proposal site respectively, should be the focus of visual impact minimisation, primarily due to the higher density of existing and future residents likely in these areas. Moreover, the lot directly to the east of the proposal site has been recently subdivided and dwellings are currently being constructed throughout the subdivision.

Figure 8: Corowa Development Control Plan 2013

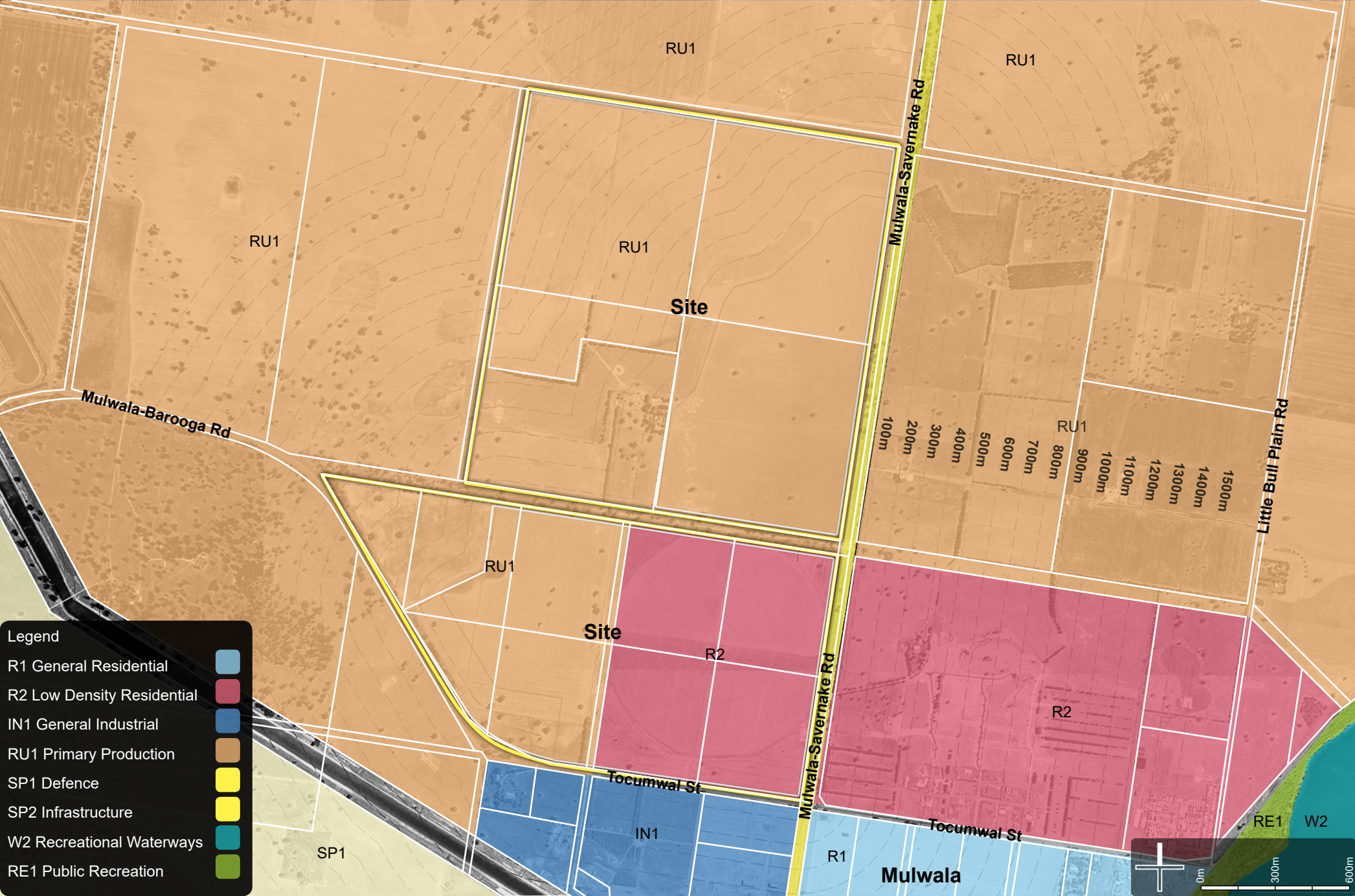
Objectives

1. Front landscaping that contributes to an attractive streetscape.
2. Landscaping as a means of screening outdoor areas from adjoining properties and from public places (including roads)

Standards

1. All industrial sites are to be appropriately landscaped.
2. Proposed landscaping elements are to be clearly identified on development application plans submitted to Council with a comprehensive landscape plan required to show all areas of vegetation, pathways and vehicles access areas.
3. All landscaping is to be maintained in good condition at all times. Dead plants should be removed and replaced at the earliest opportunity.
4. A range of species types are to be used in the landscaping and these should be various heights to create interest and help screen storage and car parking areas.
5. Landscaping areas are to be protected from vehicle activity areas by a minimum 100mm high kerb, wheel stops or other similar barrier devices to prevent the damage to these vegetated areas.
6. The landscaping must have an irrigation system installed.
7. Existing mature trees should be incorporated in the development where possible.
8. Where ever possible native plant species are to be utilised in landscaping with preference given to drought tolerant species.

Figure 9: Land Zoning Map



3.0 Existing Landscape Character

3.1 Purpose & Method

This chapter outlines the existing landscape character within a local context to obtain an appreciation of the visual environment, and thus a visual baseline. This baseline will be used as a measurement to gauge the influence of the proposal.

The methodology inherited for the landscape character used herein is based on an objective assessment of the landscape attributes of a place. The proposal area is viewed as a whole site within a broader context for the purpose of evaluation, and to assist with developing guidelines to manage and plan for the landscape character type and its relationship with the site and proposal.

3.2 Landscape Character

The dominating feature of the regional and local landscape character is the regularity of surface level; there is a minimal degree of topographic relief resulting in a largely horizontal and linear landscape aesthetic. Any vertical relief generally comes from the presence of trees, rural dwellings and associated rural infrastructure. This topographic nature is demonstrated in **Figure 2: Mulwala Elevation**, highlighting the significant distance between contours, indicating a highly flat and level region.

The landscape character of the greater Mulwala area is also typified by the patchwork of rural properties which subsist on the regions vast open spaces, largely focussed on cropping and livestock grazing. These agricultural properties are generally partitioned and identifiable due to the different types of rural infrastructure, including unsealed roads, landscape buffers or tree plantings and fencing. Additional property separation exists due to the presence of the Murray Darling Basin's irrigation network of channels, canals and weirs.

The built form found within Mulwala rural landscapes are generally associated with agricultural activities. This includes buildings, sheds, loaders & other infrastructure. Dwellings are typically located centrally to the property lots and along property and are scattered on rural properties throughout the region, and a number of these circumvent the site. Although each dwelling is generally screened with landscaping, they form clusters of visual receptors due to their proximity to the site.

This industry-focussed infrastructure & development has resulted in a visual quality and a degree of visual variety which contributes greatly to the landscape character of the region, as represented in **Figures 7.1 - 7.4**. Although the landscape character is linear in terms of overall composition, a distinct rural landscape character can be distinguished.

Approximately 1.2km to the south of the proposal is the Mulwala Township, and further south 4.15km from the site is the larger of the two townships, Yarrawonga. Both house a significant proportion of the regions residents (Australian Bureau of Statistics, 2016). Established around 1872, the township was modelled on the grid-style urban structure existing today, and contrasts to the balance of the regions pastoral landscapes. The township is juxtaposed diagonally through the rural landscape, contrasting with the generally north-south alignment of the rural properties.

The Mulwala township represents one of the principle visual receptors due to its broad scale and its north-south alignment. However, due to its distant proximity to the site, and the presence of screening vegetation, exposure to the site would be negligible.

The distinctly vast and open landscape character of Mulwala results in a locale with a significantly broad visual catchment. Moreover, the flat nature of the terrain and minimal landscaping results in a site with a high visual exposure.

3.3 Scenic or Significant Vistas

The overarching rural land use of Mulwala and the greater region in which it sits has resulted in a network of transport infrastructure characterised by long and narrow straight roads, and sharper turns onto crossroads. Much of these straight roads are lined with native vegetation, including trees and small shrubs, allowing intermittent views into adjoining rural properties. These views are desirable vistas, contributing greatly to the landscape character and beautification of the region, and benefiting the experience of motorists and the regions residents.

The proposal site adjoins a number of these vistas as represented in **Figure 10.1 Viewing proposal site from Mulwala-Savernake Road** and **Figure 10.2 Rural views along Mulwala-Barooga**. Both represent a common landscape aesthetic for the region: open rural grasslands bounded by native woodlands. Where possible these vistas should be retained and copied to minimise the visual impact of the proposal.

3.4 Objectives & Principles

The following objectives and principles are focussed towards maintaining the existing landscape character where possible, through strategic and practical measures.

These urban design objectives include:

- Integrated rural infrastructure / landscape design that permit the landscape to take precedence over the built form.
- Strengthen the vegetated character of the proposal area and express the rural and bushland nature of landscaping.
- Preserve screening to residents within the affected radius immediate area.
- Any urban design features should reflect and be sympathetic to the existing historic, cultural and natural character of the area.
- Design site lighting so not to negatively impact adjacent land uses. For instance, no light spill into adjacent rural properties containing dwellings.

The following landscape design principles would be applied to the Proposal:

- Re-vegetation undertaken to all areas influenced by construction work, where possible.
- The re-vegetation should be indigenous species.
- Use of locally grown endemic plant material wherever possible to assist with landscape blending.
- Maximise the retention of existing visual screening opportunities.
- Consider the existing mature vegetation that has been ear marked for removal. Consider the potential to reflect similar vegetation types found in the area.
- The material and colour palette should reflect the existing urban design character and palette.
- Retain key vistas where possible, through the retention of existing vegetation communities including grasslands and woodlands.
- Where landscape buffers are to be developed, draw upon the structure of the existing vistas.

Figure 10: Landscape Character

Figure 10.1 Viewing proposal site from Mulwala-Savernake Road



Figure 10.2 Rural views along Mulwala-Barooga



Figure 10.3 Rural infrastructure near dwellings on rural lots



Figure 10.4 Industrial area along Mulwala-Savernake Road



4.0 Visual Impact Assessment

4.1 Methodology

The methodology adopted in this Landscape Character and Visual Impact Assessment is based on the Roads and Maritime Service Environmental Impact Assessment Guidance Note (2013): Guidelines for landscape character and visual impact assessment. This structure of the methodology has been modified to align with the features and requirements of this proposal.

Due to the infeasible nature of completing an assessment for each individual visual receiver within a 1.5km radius, this report considers individual visual receivers where possible, and clusters of visual receivers which are used to highlight the influence of the proposal on a broader context.

There are two primary measurements used to determine impacts to the landscape character:

1. Sensitivity of the character
2. Magnitude of the proposal

Sensitivity

Visual sensitivity refers to the character of a setting, the quality of the view, and how sensitive it is to the proposed change (RMS, 2013). Combined with magnitude, sensitivity provides a measure of impact. Visual sensitivity relates to the direction of view and the composition of the view.

The following terms and definitions are from the Landscape Institute and Institute of Environmental Management & Assessment (LIIEMA 2013). These are generally accepted within the industry to identify visual receiver sensitivity;

High	Private residents at home with prolonged viewing opportunities, heritage properties and landscapes.
Moderate	Commercial properties, Travellers on road, rail or other transport routes with an interest in their environment.
Low	Transient type spaces & people at their place of work whose attention is on their work.

The higher the visual quality of the landscape, the greater the significance of introducing new development and therefore the higher the sensitivity. For example, road widening would be ranked lower than changes to national parkland. A place with a more consistent character would be visually sensitive to new development than a place with less consistency.

Magnitude

The magnitude of a visual effect is the degree of change the visual landscape undergoes as a result of the proposed development. It is the measurement of the overall scale, form and character of a development Proposal when compared to the existing condition (RMS, 2013).

Magnitude also takes into consideration the distance between the viewer(s) and the Proposal. Judging the magnitude of visual effects takes account of;

- The scale of the change within the view with respect to the addition (or loss) of elements

in the view and change to its composition. This includes the proportion of the view that is taken up by the proposed development.

- The degree of change and/or integration of any new features or changes in the landscape in terms of form, scale and mass, line height, colour and texture.
- The nature of the view of the proposed development and whether the views are permanent, full, partial or glimpses (LIIEMA 2013).

The magnitude of proposal in a landscape character depends on the scope of the proposal. The location of the proposal in relation to the region in question also influences magnitude. Six categories are used in ranking the magnitude of a proposal, ranging from negligible to high.

Impact on the Landscape Character is determined using the matrix shown in **Figure 11: Roads and Maritime impact grading matrix**. Rankings for sensitivity and magnitude are combined to generate the impact in the body of the table.

Viewpoints Vs Receptors

This visual impact assessment uses **Viewpoints** and **Receptors** as subject. **Viewpoints** are general positions looking towards the proposal, and take into account views from a cluster of **Receptors**. **Receptors** are sensitive visual receivers such as houses, roads and other infrastructure that is used frequently.

		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High Impact	High-Moderate	Moderate	Negligible
	Moderate	High-Moderate	Moderate	Moderate - Low	Negligible
	Low	Moderate	Moderate - Low	Low Impact	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Figure 11: Roads and Maritime impact grading matrix.

Viewpoint	Location	Impact
VP1	Views southwest towards proposal along Mulwala-Savernake Rd	Moderate
VP2	Views from within property of 290 Savernake Road, Mulwala	Moderate
VP3	Views westerly towards site along Mulwala Savernake Rd	Moderate
VP4	Views north-west towards proposal at southeast corner of site	Moderate
VP5	Views north towards proposal from the industrial area	Negligible
VP6	Views north towards proposal from industrial area	Negligible
VP7	Views east towards proposal from west of site	Negligible

Table 3: Viewpoint Rating Summary

Figure 12: Viewpoint Locations Relative to Site



Figure 13: Viewpoint 1 Artist Impression: Views south-west towards site along Mulwala-Savernake Rd



Figure 14: Viewpoint 2 Artist Impression: Views from within property of 290 Savernake Road, Mulwala



Figure 15: Viewpoint 3 Artist Impression: Views westerly towards site along Mulwala Savernake Rd



Figure 16: Viewpoint 4 Artist Impression: Views north-west towards proposal from southeast corner of site



Figure 17: Viewpoint 5 Artist Impression: Views north towards proposal from Mulwala Township



Figure 18: Viewpoint 6 Artist Impression: Views north towards proposal from industrial area



Figure 19: Viewpoint 7 Artist Impression: Views east towards proposal from west of site



4.2.1 Viewpoint 1: Views south-west towards site along Mulwala-Savernake Rd

Viewpoint Description

Mulwala-Savernake Road is a 26km arterial road linking Mulwala to Savernake NSW, and eventually links-up to the Riverina Highway in Savernake. The single-carriageway rural road is utilised as one of the major links to regions northerly of Mulwala.

Views from the Mulwala-Savernake Road towards the project site are dominated by rural affects, which typically have an agricultural utilisation of grazing and cropping. These rural properties are characterised by large, level expanses separated by unsealed roads. Generally, there is minimal vegetation within the property with any tree of noticeable scale concentrated to the property boundaries. In most cases the vegetation consists of medium to large size native trees and an understorey of grasses, resulting in mostly clear unobstructed views.

Viewpoint	Sensitivity	Magnitude	Impact
Viewing south-west along Mulwala-Savernake Rd	Impacts: <ul style="list-style-type: none"> The solar arrays & associated infrastructure such as buildings, power lines etc may be visible from properties within the area and may result in a change to the existing visual environment The solar arrays will be visible from the road in areas; motorists and other road users may be exposed to indirect glare from the solar farm 		
	High <ul style="list-style-type: none"> Large rural properties with/ open & visible landscape character Native tree's & vegetation to boundaries & roads Locale is flat resulting in a higher visual exposure due to lack of topography Scarcity of sensitive visual receivers As the solar farm represents a departure from existing rural environment the sensitivity is High 	Low <ul style="list-style-type: none"> Relatively low development: solar arrays to 4m height The low nature of the development reduces effective visibility within flat locales Dense vegetation in places, mitigating views along road 	Moderate Impact

Figure 20: Typical view along Mulwala-Savernake Rd to north of proposal site



4.2.2 Viewpoint 2: Views from within the property of 290 Savernake Road, Mulwala

Viewpoint Description

Number 290 Savernake Road, Mulwala is a rural property 1.4km north of the Tocumwal Street and Mulwala-Savernake Road intersection, and is 223m east of the proposal. Internally the site features a range of rural infrastructure including sheds, water tanks and hard-stands. The landscape character of the site is rural, and includes scattered native trees surrounded by open grasslands, a number of exotic trees have been planted within the property. There is a single dwelling, which is aligned directly towards the proposal site. Between the proposal site and the property, there are a number of existing mature native trees and low shrubs lining the road which contribute to visual mitigation. However, due to the intermittent nature of this vegetation, the proposal would be visible from the dwelling.

**Note: The occupying resident has been consulted about the project.*

Viewpoint	Sensitivity	Magnitude	Impact
Views from within the property of 290 Savernake Road, Mulwala	Impacts: <ul style="list-style-type: none"> The solar arrays & associated infrastructure such as buildings, power lines etc would be visible from within the property and may result in a change to the existing visual environment 		
	High <ul style="list-style-type: none"> Large rural properties with/ open & visible landscape character Native tree's & vegetation to boundaries & roads Locale is flat resulting in a higher visual exposure due to lack of topography As the solar farm represents a departure from existing rural environment the sensitivity is High 	Low <ul style="list-style-type: none"> Relatively low development: solar arrays to 4m height The low nature of the development reduces effective visibility within flat locales Dense vegetation in places, largely mitigating views 	Moderate Impact

Figure 21: Typical views from within 290 Savernake Road, Mulwala



4.2.3 Viewpoint 3: Views westerly towards site along Mulwala Savernake Rd

Viewpoint Description

This viewpoint is located along Mulwala-Savernake Road, about 2.7km north of the Mulwala central business district, and represents views possible from a cluster of 4 rural properties east of the proposal, which would be within moderate proximity to the proposal / solar arrays. Views from this vicinity are characterised by the rural nature of the area, typically grazing and cropping, with open expanses of land. On the eastern side of Mulwala-Savernake Road is a landscape buffer comprising of mostly native trees, which are sparse in some areas and visually impenetrable in others. The most densely planted buffers are generally positioned within a closer proximity to residence / dwellings, which cannot be seen from the Mulwala-Savernake Road as a result. The western side of the Mulwala-Savernake Road is much less vegetated.

Viewpoint	Sensitivity	Magnitude	Impact
Viewing westerly towards site along Mulwala Savernake Rd	Impacts: <ul style="list-style-type: none"> The solar arrays & associated infrastructure such as buildings, power lines etc may be visible from properties within the area and may result in a change to the existing visual environment The solar arrays will be visible from the road in areas; motorists and other road users may be exposed to indirect glare from the solar farm The solar arrays may be visible from habitable dwellings within properties to the east of the proposal 		
	High <ul style="list-style-type: none"> Rural properties with/ open & visible landscape nature Dense native tree's & vegetation to boundaries & roads The region is generally flat resulting in a higher visual exposure As the solar farm represents a departure from existing rural environment the sensitivity is High 	Low <ul style="list-style-type: none"> Relatively low development: solar arrays to 4m height The low nature of the development reduces effective visibility within flat locales Dense vegetation in places, mitigating views along road Rural dwellings within closer proximity to the proposal Existing mature vegetation along Mulwala-Savernake Road reduces visual impact 	Moderate Impact

Figure 22: Typical view along Mulwala-Savernake Rd to east of site



4.2.4 Viewpoint 4: Views north-west towards proposal at southeast corner of site

Viewpoint Description

Viewpoint 3 is located at the intersection of Mulwala-Savernake Rd - Tocumwal Rd, about 1.2km north of the Mulwala CBD. This viewpoint represents a range of visual receivers circumventing the proposal site with the vicinity, including new residential dwellings about 450m east of the proposal site, and existing and future industrial properties directly across Tocumwal Road.

Views within this area are characterised by a range of different land uses, including residential dwellings on large 5000m2 lots, and industrial/commercial properties consisting of large warehouses. To the south-east of the proposal is a number of undeveloped lots on R1 - General Residential zoned land.

Viewpoint	Sensitivity	Magnitude	Impact
Views north-west towards proposal at southeast corner of site	Impacts: <ul style="list-style-type: none"> The solar arrays & associated infrastructure such as buildings, power lines etc may be visible from properties within the area and may result in a change to the existing visual environment The solar arrays will be visible from the road in areas; motorists and other road users may be exposed to indirect glare from the solar farm The solar arrays may be visible from habitable dwellings within properties to the east of the proposal 		
	High <ul style="list-style-type: none"> Large residential properties with/ open landscape character Large industrial properties with/ open landscape character Some sparse native trees & vegetation to boundaries & roads Locale is flat resulting in a higher visual exposure due to lack of topography & vegetation As the solar farm represents a slight departure from existing environment the sensitivity is Low 	Low <ul style="list-style-type: none"> Relatively low development: solar arrays to 4m height The low nature of the development reduces effective visibility within flat locales Dense vegetation in places, mitigating views along road Distance between existing residential dwellings resulting in low visual impact 	Moderate Impact

Figure 23: Typical view from Mulwala-Savernake Road - Tocumwal Street Intersection



4.2.6 Viewpoint 6: Views north towards proposal from Mulwala Township

Viewpoint Description

This viewpoint is located about 1.5km south of the proposal site and represents a number of different visual receivers within the Mulwala township, including residential dwellings, motorists and pedestrians, and commercial properties. Views within this area are characterised by a range of different land uses, principally residential properties, commercial and land within the public realm such as parks and foreshore areas. The Mulwala township is positioned on the banks of Lake Mulwala and is aligned northeast - southwest in a distinct grid pattern. The township is highly urbanised, the urban form of the township generally consists of detached dwellings on medium to large size lots. The streets and private garden areas contain mature trees and vegetation which limit views past the dwelling.

Viewpoint	Sensitivity	Magnitude	Impact
Views north towards proposal from the Mulwala Township	Impacts: <ul style="list-style-type: none"> The solar arrays & associated infrastructure such as buildings, power lines etc may potentially be visible from properties within the area and may result in a change to the existing visual environment The solar arrays will be visible from the roads in areas; motorists and other road users may be exposed to indirect glare from the solar farm 		
	High <ul style="list-style-type: none"> Residential properties with/ closed landscape character Tall native trees & vegetation to boundaries, roads and lots Locale is flat resulting in a higher visual exposure due to lack of topography & vegetation As the solar farm represents a moderate departure from existing environment the sensitivity is High 	Negligible <ul style="list-style-type: none"> Relatively low development: solar arrays to 4m height The low nature of the development reduces effective visibility within flat locales Dense vegetation in places, mitigating views from township Distance between existing residential dwellings resulting in low visual impact 	Negligible

Figure 24: Typical view from Mulwala township



4.2.6 Viewpoint 6: Views north towards proposal from industrial area

Viewpoint Description

This viewpoint is located at the Barooga Rd - Tocomwal Rd intersection, about 1.4km north-west of the Mulwala Township. This position represents two primary receivers - industrial properties directly south of the proposal, and motorists and pedestrians utilising Tocomwal Road.

Pastoral views within this area result from the prior and existing primary production land usage, with trees to property boundaries and open grasslands. Buffer landscaping has been planted to boundaries resulting in a number of tall tree clusters. Between the Mulwala Township and the proposal is the industrial area, which consists of large warehouses situated on large lots.

Viewpoint	Sensitivity	Magnitude	Impact
Views north towards proposal from south of site	Impacts: <ul style="list-style-type: none"> The solar arrays & associated infrastructure such as buildings, power lines etc may be visible from properties within the area and may result in a change to the existing visual environment The solar arrays will be visible from the roads in areas; motorists and other road users may be exposed to indirect glare from the solar farm 		
	Negligible <ul style="list-style-type: none"> Large industrial properties with/ open landscape character Large rural properties with/ open landscape character Some tall clumps of native trees & vegetation to boundaries & roads Locale is flat resulting in a higher visual exposure due to lack of topography & vegetation As the solar farm represents a slight departure from existing environment the sensitivity is Low 	Negligible <ul style="list-style-type: none"> Relatively low development: solar arrays to 4m height The low nature of the development reduces effective visibility within flat locales Dense vegetation in places, mitigating views from township 	Negligible

Figure 25: Typical view along Mulwala-Savernake Road at industrial area



4.2.7 Viewpoint 7: Views east towards proposal from west of site

Viewpoint Description

Viewpoint 6 is located about 3.0km north west of the Mulwala Township and represents potential visual receivers within the broader vicinity, including those motorists and pedestrians using Mulwala-Barooga Road, and rural properties.

The principle land zoning within this areas is RU1 Primary Production directly west of the proposal site, and SP1 Infrastructure to the south west, directly over the Murray Darling canal. The overarching land zoning has resulted in very little in the way of development; the landscape character is generally open grasslands with a significant quantity of native trees and vegetation within adjacent lots and lining the Mulwala-Barooga Road, largely mitigating views into the large rural lots.

Viewpoint	Sensitivity	Magnitude	Impact
Views east towards proposal from west of site	Impacts: <ul style="list-style-type: none">The solar arrays & associated infrastructure such as buildings, power lines etc may be visible from properties within the area and may result in a change to the existing visual environmentThe solar arrays will be visible from the roads in areas; motorists and other road users may be exposed to indirect glare from the solar farm		
	Moderate <ul style="list-style-type: none">Large industrial properties with/ mostly closed landscape characterLarge rural properties with/ mostly closed landscape characterTall clumps of native trees & vegetation to boundaries & roadsLocale is flat resulting in a higher visual exposure due to lack of topography & vegetationAs the solar farm represents a moderate departure from existing environment the sensitivity is moderate	Negligible <ul style="list-style-type: none">Relatively low development: solar arrays to 4m heightThe low nature of the development reduces effective visibility within flat localesDense vegetation in many places, mitigating views from townshipDistance between existing visual receivers resulting in low visual impactLittle or no sensitive receivers	Negligible

Figure 26: Typical view east along Mulwala-Barooga Road



Table 4: Visual Impact Assessment - Viewpoint Summary

Viewpoint	Viewpoint 1	Viewpoint 2	Viewpoint 3	Viewpoint 4	Viewpoint 5	Viewpoint 6	Viewpoint 7
Viewpoint	Views south-west towards site along Mulwala-Savernake Rd	Views from within property of 290 Savernake Road, Mulwala	Views westerly towards site along Mulwala Savernake Rd	Views north-west towards proposal at southeast corner of site	Views north towards proposal from Mulwala Township	Views north towards proposal from industrial area	Views east towards proposal from west of site
Description	Mulwala-Savernake Road is a 26km arterial road linking Mulwala to Savernake. The road is aligned north-south, and eventually links-up to the Riverina Highway in Savernake NSW. The single-carriageway rural road is utilised as one of the major links to regions directly north of Mulwala. Views from the Mulwala-Savernake Road towards the project site are dominated by rural affects, which typically have an agricultural utilisation of grazing and cropping. These rural properties are characterised by large, level expanses separated by unsealed roads. Generally, there is minimal vegetation within the property with any tree of noticeable scale concentrated to the property boundaries. In most cases the vegetation consists of medium to large size native trees and an understorey of grasses, resulting is mostly clear unobstructed views.	Number 290 Savernake Road, Mulwala is a rural property about 1.4km north of the Tocumwal Street and Mulwala-Savernake Road intersection. The property is within close proximity to the proposal site, approximately 223m east. Internally the site features a range of rural infrastructure including sheds, water tanks and hard-stands. The landscape character of the site is typical of this region, and includes scattered native trees surrounded by open grasslands, and there are a number of exotic trees planted within the property. There is a single dwelling, the primary sensitive receiver, which looks directly towards the proposal site. Between the proposal site and the property, there are a number of existing mature native trees and low shrubs which contribute to visual mitigation. However, due to the intermittent nature of this vegetation, the proposal would be visible from the dwelling.	This viewpoint is positioned along Mulwala-Savernake Road, about 2.7km north of the Mulwala Central Business District zone, and represents views possible from a cluster of 4 rural properties east of the proposal, which would be within moderate proximity to the proposal / solar arrays. Views from this vicinity are characterised by the rural nature of the area, typically grazing and cropping, with open expanses of land. On the eastern side of Mulwala-Savernake Road is a landscape buffer comprising of mostly native trees, which are sparse in some areas and visually impenetrable in others. The most densely planted buffers are generally positioned within a closer proximity to residence / dwellings, which cannot be seen from the Mulwala-Savernake Road as a result. The western side of the Mulwala-Savernake Road is much less vegetated.	Viewpoint 3 is located at the intersection of Mulwala-Savernake Rd - Tocumwal Rd, about 1.2km north of the Mulwala CBD. This viewpoint represents a range of visual receivers circumventing the proposal site with the vicinity, including new residential dwellings about 450m east of the proposal site, and existing and future industrial properties directly across Tocumwal Road. Views within this area are characterised by a range of different land uses, including residential dwellings on large 5000m2 lots, and industrial/commercial properties consisting of large warehouses. To the south-east of the proposal is a number of undeveloped lots on R1 - General Residential zoned land.	This viewpoint is located about 1.5km south of the proposal site. This position represents a number of different visual receivers within the Mulwala township, including residential dwellings, motorists and pedestrians, and commercial properties. Views within this area are characterised by a range of different land uses, principally residential properties, commercial and land within the public realm such as parks and foreshore areas. The Mulwala township is positioned on the banks of Lake Mulwala and is aligned northeast - southwest in a distinct grid pattern. The township is highly urbanised, the urban form of the township generally consists of detached dwellings on medium to large size lots. The streets and private garden areas contain mature trees and vegetation which limit views past the dwelling.	This viewpoint is located at the Barooga Rd - Tocumwal Rd intersection, about 1.4km north-west of the Mulwala Township. This position represents two primary receivers - industrial properties directly south of the proposal, and motorists and pedestrians utilising Tocumwal Road. Pastoral views within this area result from the prior and existing primary production land usage, with trees to property boundaries and open grasslands. Buffer landscaping has been planted to boundaries resulting in a number of tall tree clusters. Between the Mulwala Township and the proposal is the industrial area, which consists of large warehouses situated on large lots.	Viewpoint 6 is located about 3.0km north west of the proposal site, and represents potential visual receivers within the broader vicinity, including those motorists and pedestrians using Mulwala-Barooga Road, and rural properties. The principle land zoning within this areas is RU1 Primary Production directly west of the proposal site, and SP1 Infrastructure to the south west, directly over the Murray Darling canal. The overarching land zoning has resulted in very little in the way of development; the landscape character is generally open grasslands with a significant quantity of native trees and vegetation within adjacent lots and lining the Mulwala-Barooga Road, largely mitigating views into the large rural lots.
Sensitivity	High	High	High	High	High	Negligible	Moderate
Magnitude	Low	Low	Low	Low	Negligible	Negligible	Negligible
Impact	Moderate	Moderate	Moderate	Moderate	Negligible	Negligible	Negligible

Table 5: Visual Impact Assessment - Receptor Summary

Recep- tor	Address	Proximity to Pro- ject (approx.)	Sensitivity	Magnitude	Impact	Visual Screening	Residual impact
1	511 Tocumwal Road Mulwala 2647 (A)	1000 metres	High	Negligible	Negligible	None	Negligible
2	511 Tocumwal Road Mulwala 2647 (B)	750 metres	High	Negligible	Negligible	None	Negligible
3	279 Tocumwal Road Mulwala 2647	250 metres	Moderate	Low	Low	Buffer 1	Low
4	93 Barooga Road Mulwala 2647	500 metres	Moderate	Low	Low	Buffer 1	Low
5	290 Savernake Road Mulwala 2647	250 metres	High	Low	Moderate	Buffer 5	Low
6	96 Cypress Way Mulwala 2647	365 metres	High	Low	Moderate	Buffer 4	Low
7	Residential Subdivision (A)	420 metres	High	Low	Moderate	Buffer 3	Low
8	139 Little Bull Plain Road Mulwala 2647	1120 metres	High	Low	Moderate	Buffer 5	Low
9	223 Little Bull Plain Road Mulwala 2647	1500 metres	High	Negligible	Negligible	None	Negligible
10	124 Little Bull Plain Road Mulwala 2647	1800 metres	High	Negligible	Negligible	None	Negligible
11	Residential Subdivision (B)	1400 metres	High	Negligible	Negligible	Buffer 3	Negligible
12	Mulwala Township (A)	1000 metres	High	Negligible	Negligible	Buffer 3	Negligible
13	Mulwala Township (B)	1120 metres	High	Negligible	Negligible	Buffer 2	Negligible
14	Industrial Zone	50 metres	Negligible	Negligible	Negligible	Buffer 2	Negligible

5.0 Conclusion & Safeguards

5.1 Conclusion

Whilst the degree a project the scale of the proposal is visible from certain vantage points can be quantified, the degree to which the viewers will be impacted is influenced by an individual's perceptions of what change will bring. The residents and users of the landscape surrounding the site will reflect a range of sensitivities. The degree to which the changes to the landscape are perceived negatively will depend on the actual users / residents.

As stated earlier in the introduction, this report considers views from habitable room windows, outdoor areas / home yard dwelling as sensitive receptors. Views from residual land beyond the home yard area (such as cropping/grazing land, recreational land etc) are treated as less sensitive receivers. This report also adopts the standard methodology of sensitivity relating to proximity, in that the greater the distance between the visual receptor and the proposal, the lesser the visual sensitivity. In consideration of the above methodology relative to the visual receptors assessed herein, in most cases the proposal will have a negligible visual influence.

The proposal will change the landscape character of the setting in a very site-specific manner. Beyond this it will have an overall negligible impact on the localised area. As mentioned in the assessment process previously, the landscape character of the setting is generally rural in aesthetic - much of the vegetation that lines the properties adjacent to the roads can provide a visual barrier to the locally positioned receivers. Moreover, the largely flat nature of the locality and region generally, assists greatly in mitigating views to the proposal due to the lack of prospect from the visual receivers.

Of 7 viewsheds were assessed, some were identified as having the potential for a visual impact from the proposed development. The degree of importance placed on these viewpoints varied according to a combination of considerations of visual prominence and visual exposure. It is concluded that the majority of views to the proposal area are of negligible to moderate impact. **Table 4: Visual Impact Assessment - Viewpoint Summary** summarises the results of the analysis.

The report assessed 14 different visual receptors including the Mulwala Township, residential dwellings and industrial areas. This resulted in a range of Negligable to Moderate visual impact ratings. The proposed mitigation measures will assist in reducing the visual impact from a Moderate to a Low rating as per **Table 5: Visual Impact Assessment - Receptor Summary**. These measures include landscape documentation, presented in **Figure 28-30 Preliminary Landscape Documentation**. The buffer planting design has also been represented in **Figure 31 & 32: Preliminary Landscape Design Intent - Artist Impression of Buffers**.

5.2 Safeguards

The visual impact assessment identified mitigation measures to manage and minimise the potential visual impacts. Mitigation measures are proposed in response to the Moderate assessment ratings in order to help reduce the visual impacts of the Proposal to a Low Impact, for the construction and operational stages. Design recommendations relate to the findings of the urban design issues discussed in this report with the aim of meeting the following key urban design objective. The measures may assist in reducing the Moderate assessment ratings if successfully implemented. This may include landscaping to the proposal site.

5.2.1 Environmental Safeguards

Table 6: Mitigation Measures

Impact	Environmental Safeguard	Responsibility	Timing
Landscape character & visual impact	Apply urban design principles and objectives during detailed design phase.	Applicant	Detailed design
Landscape character & visual impact	Landscape documentation developed to reinstate vegetation where required.	Applicant	Detailed design
Landscape character & visual impact	Where road reserve vege. Has been removed, consider new/additional planting in private properties.	Applicant	Detailed design
Landscape character & visual impact	Investigate colour combinations / colour-ways for infrastructure items to ensure visual obscurity.	Applicant	Detailed design
Landscape character & visual impact	Use trees or other screening vegetation to assist in reducing the visual prominence or proposal.	Applicant	Detailed design
Landscape character & visual impact	Ancillary structures: minimise reflective surfaces by using muted colours.	Applicant	Detailed design
Landscape character & visual impact	Visual receivers such as residential properties: implement landscape screening to boundary and/or within private property.	Applicant	Detailed design
Landscape character & visual impact	Identify and retain key vistas where possible.	Applicant	Detailed design
Landscape character & visual impact	Localised construction site influence reduced in accordance with a plan.	Contractor	Construction
Landscape character & visual impact	Light spill from construction sites into adjacent properties will be minimised.	Contractor	Construction
Landscape character & visual impact	Construction site assets such as equipment, temporary holdings, barriers, traffic management & signage will be removed on completion.	Contractor	Construction
Landscape character & visual impact	Where construction works require removal of vegetation on private land, re-vegetation would be undertaken in consultation with property owners.	Contractor	Construction
Landscape character & visual impact	Damage to vegetation by construction activity will be avoided by protecting trees prior to construction via root & trunk protection measures, & trimming vegetation to avoid total removal.	Contractor	Construction

5.2.2 Construction Safeguards

The following measures should be implemented during the construction phase(s) to minimise visual impacts:

- Continue consultation with landholders to develop mutually beneficial visual mitigation strategies, including the type and location of potential landscaping and associated mounding.
- Avoid unnecessary loss or damage to vegetation adjacent to the site and the site by protecting trees prior to construction and/or trimming vegetation to avoid total removal. This includes vegetation that makes a substantial and positive contribution to landscape character and/or provides screening to view sheds nominated as receiving potentially high visual impact.
- Minimise light spill from the development into adjacent visually sensitive properties by directing construction lighting into the construction areas and ensuring the site is not over-lit. This includes the sensitive placement and specification of lighting to minimise any potential increase in light pollution.
- Temporary hoardings, barriers, traffic management and signage would be removed when no longer required.
- Measures such as the provision of visual screening/retention of existing vegetation would be considered for visually sensitive areas.
- Ensure minimal disturbance to root zones of vegetation that lines property boundaries and may not necessarily be part of the work but which root zones could encroach on the work area and should be protected.
- The site to be kept tidy and well maintained, including removal of all rubbish at regular intervals. There should be no storage of materials beyond the construction boundaries
- Locate site sheds away from residences to avoid disturbance.
- Graffiti to be removed during construction in accordance with standard requirements.
- Work/site compounds should be screened, with shade cloth or similar material (where necessary) to minimise visual impacts on key viewing locations
- Restore any areas that are impacted by construction with appropriate landscape treatments.

5.2.3 Operational Safeguards

The following operational measures should be taken to minimise the short and long term visual impacts:

- Undertake rehabilitation planting as early as possible to replace vegetation that provided screening to adjacent residential properties and sensitive visual receivers. In instances where this is not feasible, it may be possible to initiate screening and tree planting to the boundaries of, and/or within private lands. This approach may be feasible particularly to the site corner areas, where internal plantings would largely mitigate the influence of the proposal on residential properties.
- Landscape detail documentation highlighting screening planting and street-scape design should be prepared in alignment of the civil design, with the intent to provide some integration between the new proposal and the existing / planned landscape character
- Undertake regular landscape maintenance works to maximise the health and effectiveness of existing planting to help buffer the removal of existing landscape character items
- Where unplanned removal of visually significant vegetation will take place, prepare localised landscape plan as soon as possible to mitigate and reduce visual influence.
- Design landscaping to specific sections of the perimeter of the proposal to mitigate views

from houses located within a sensitive proximity.

- Explore the potential for landscaping to the lot or home yard area of affected visual receivers to mitigate visual impacts of the proposal.
- Where appropriate an individual landscaping plan should be prepared in consultation with the landowner and with consent from local government.

5.2.3 Visual Mitigation through Buffer Landscaping

The location of sensitive receivers, largely focussed on residential dwellings and rural properties which contain dwellings, has dictated the location and type of landscape buffer required to mitigate any visual impact resulting from the proposal. Buffers have been proposed within the property boundary of the proposal site, and have been designed to mitigate views to the proposal from ground level, to approximately 4m height. This would mitigate views from taller, and more distant receivers. proposed bufferlandscaping has been represented within Figure 27: Preliminary Landscape Design Intent - Site Plan. Subsequent pages highlight the difference between the three buffer types.

As discussed previously in 'Chapter 4 Visual Impact Assessment', the visual impact rating is calculated by assessing the Sensitivity and Magnitude of the proposal on a given receptor type. These ratings have been utilised in the development of three different styles of buffer landscaping / screening to mitigate views towards the proposal depending on the sensitivity of the receiver:

- Buffer Type 1: Mitigative buffers which entirely block views to the proposal, for sensitive receivers such as residential dwellings.
- Buffer Type 2: Intermittent buffers which partially block views to the proposal, for moderately sensitive receivers, such as industrial areas.
- Buffer Type 3: Densify Existing Vegetation: Used to strengthen the visual mitigation of existing vegetation, used to retain the rural landscape character of the region.

Considering the presence and location of existing vegetation within a close proximity to the proposal, including vegetation to boundaries and to private lots, the proposed buffer landscaping would have an overall negligible residual visual impact and in many cases would improve the visual character of the region through an increase in the presence of mature vegetation, further supporting the regions landscape character. Moreover, the proposed buffer landscaping will vary; although views from dwellings would be mitigated, views into and through the proposal site from other positions would be preserved.

Figure 27: Preliminary Landscape Design Intent - Site Plan



ESCO Pacific

Sheet Plan 1:100000



Drawing Schedule

SHEET NO.	SHEET NAME	REVISION
L0.00	Cover Sheet	v01
L1.00	Buffer Location Plan	v01
L2.00	Buffer Plans & Details	v01

Preliminary Plant Species List

CODE	SPECIES	COMMON NAME	POT SIZE	STAKE	HTxSPRD
TREES					
ACA mel	Acacia melanoxylon	Australian Blackwood	5L	Y	4000x4000mm
EUC pol	Eucalyptus polyanthemos	Red Box	5L	Y	4000x4000mm
LEP pet	Leptospermum petersonii	Lemon-Scented Teatree	5L	Y	4000x4000mm
SHRUBS					
ACA pod	Acacia podalyriifolia	Queensland Silver Wattle	150mm	-	2000x2000mm
CAL pal	Callistemon pallidus	Lemon Bottlebrush	150mm	-	2000x2000mm
MEL bra	Melaleuca bracteata	Melaleuca Revolution Green	150mm	-	2000x2000mm

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v01	Preliminary	23/05/2018	B.E.	M.D.
rev. no	description	date	drawn	appr

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client

ESCO Pacific

project name

Mulwala Solar Farm

project location	

Savernake Road, Mulwala NSW

Savemore Road, Midwala NSW

the	

Cover Page	
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scale

AS SHOWN

project number	northpoint
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drawing number		rev	

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01	Preliminary	23/05/2018	B.E.	M.D.
rev. no.	description	date	drawn	appr

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client
ESCO Pacific

project name
Mulwala Solar Farm

project location
Savernake Road, Mulwala NSW

title
Buffer Location Plan

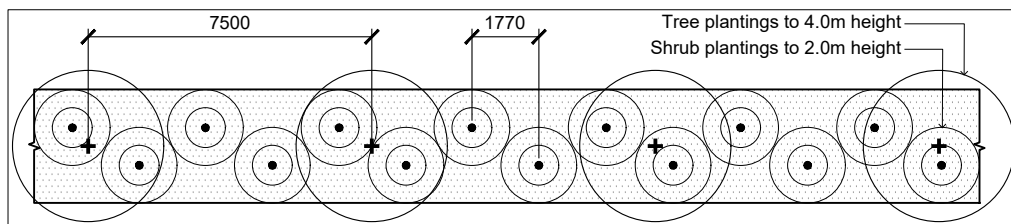
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project number
PR139828

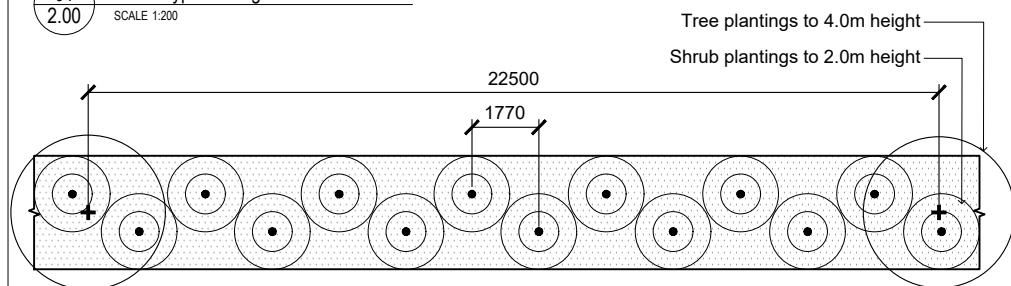
drawing number
L1.00

rev
v01

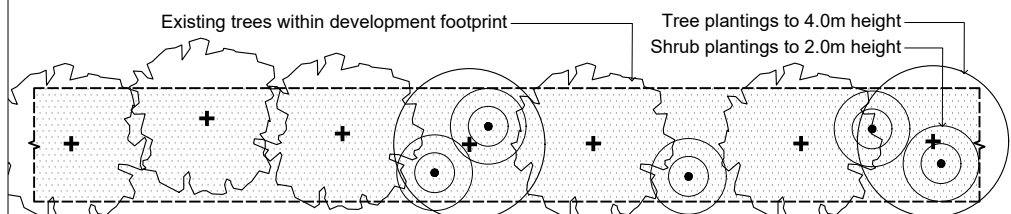




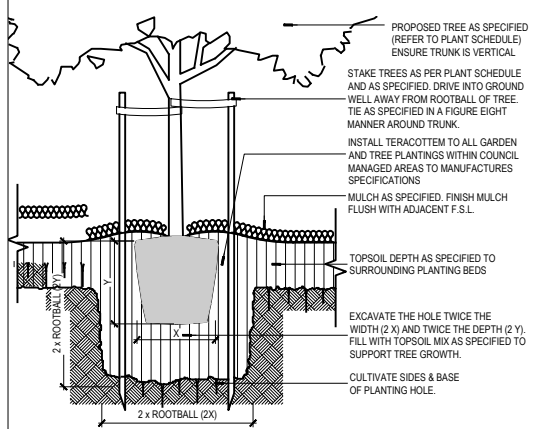
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2.00 SCALE 1:200



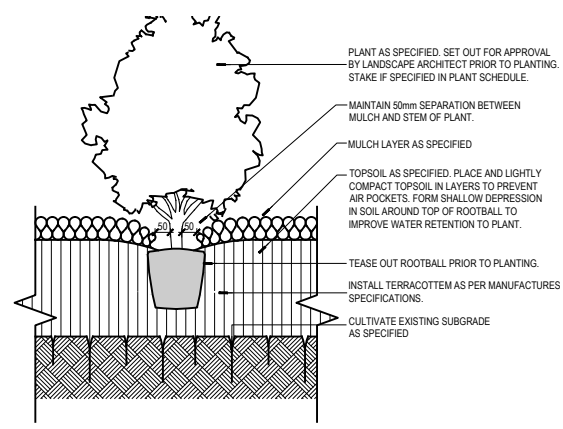
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2.00 SCALE 1:200



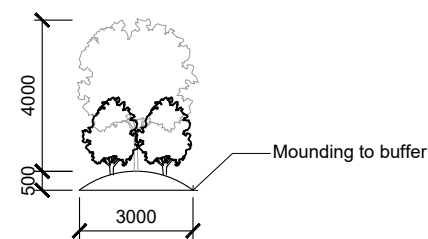
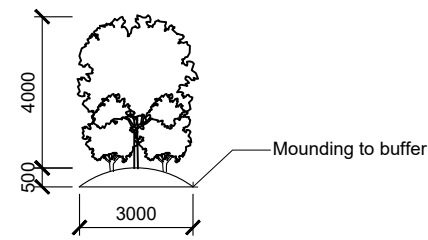
03 Buffer Type 3: Densify Existing Vegetation
2.00 SCALE 1:200



04 TREE PLANTING - IN GARDEN BEDS
2.00 SCALE 1:20




05 TYPICAL PLANTING
2.00 SCALE 1:10



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client		ESCO Pacific	
project name		Mulwala Solar Farm	
project location		Savernake Road, Mulwala NSW	
title		Buffer Plans & Details	
scale		AS SHOWN	
project number		PR139828	
drawing number		rev	
L2.00		v01	

Figure 31: Preliminary Landscape Design Intent - Artist Impression of Buffer Type 1

Buffer 1. Mitigative - Trees & Shrubs

150 to 300m length native tree & shrub buffer atop 500mm high mounding, placed to mitigate views from visually sensitive receptors such as residential dwellings.



Figure 32: Preliminary Landscape Design Intent - Artist Impression of Buffer Type 2

Buffer 2. Intermittent - Tree & Shrub

150m length native tree & shrub landscape buffer atop 500mm high mounding, placed to mitigate views from visually sensitive receptors such as industrial-zoned facing proposal development.



6.0 Reflectivity Assessment

6.1 Glare & Reflectivity of Photovoltaic Solar Panels

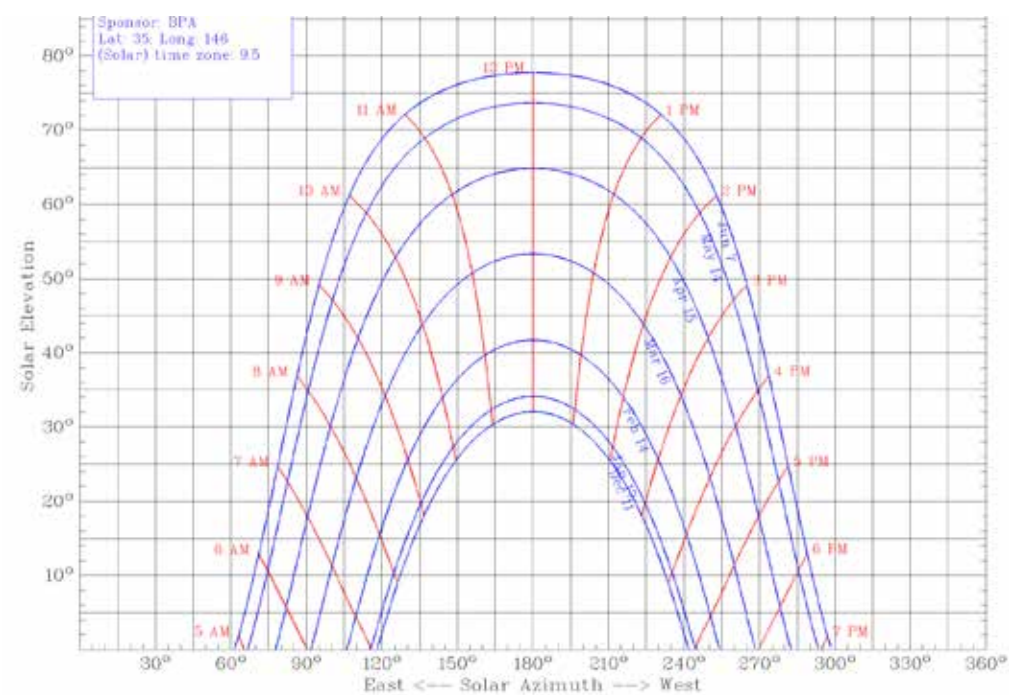
There are a number of factors which contribute to the occurrence of reflective visual nuisance, such as the frequency of the reflection, the type of reflection (specular versus diffuse), other localised environmental impacts and the location of visual receivers such as residences and commuters. This Reflectivity Assessment will consider the following two qualities to ascertain the proposals degree of reflective nuisance:

1. Design & the mechanical behaviour of the proposal.
2. The proposal within the existing environment.

6.2 Design & Mechanical Behaviour

Glare-based visual nuisance associated with the proposal will be largely influenced by the location & position of the solar panels relative to sensitive visual receptors within a closer proximity to the proposal, exposed to more direct specular reflection. The solar panels are designed to follow the sun along a single axis to maximise energy absorption. As presented in **Figure 24: Mulwala Sun Path** (University of Oregon, 2017), the diagram represents the average angle & path of the sun from June to December in the region.

Figure 33: Mulwala Sun Path (University of Oregon, 2018)

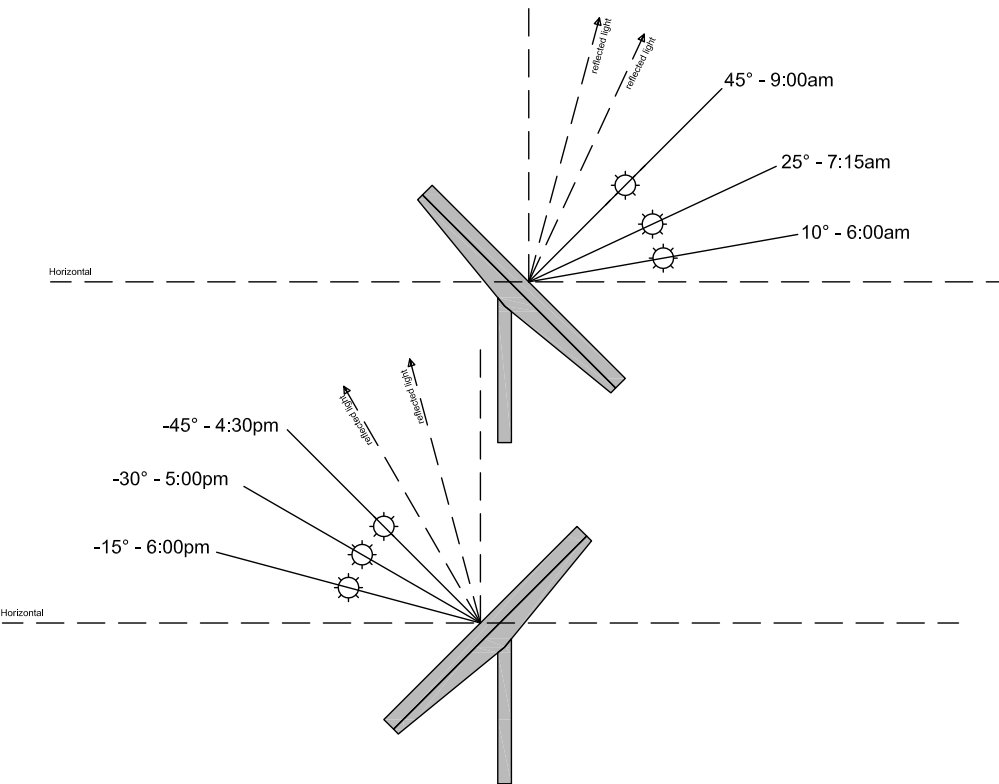


This data has been utilised to develop **Figure 25: Mechanical Behaviour of the Proposal**, which highlights the angle of the solar panels with respect to the time of day. The solar panels would remain at a stationary and constant 45 degree angle from sunrise (first light) at approximately 6:00am, until about 9:00am when the solar panels will begin to move and follow the path of the sun. Likewise, from approximately 4:30pm until sunset (last light) the solar panels will remain at a constant -45 degree angle.

Considering that the solar panels will remain at a static 45 degree angle in the mornings and afternoons, the resulting specular glare is likely to have a negligible influence on sensitive receivers, and any glare would reflect in an opposing direction away from the receptor.

The potential for glare associated with non-concentrating photovoltaic systems which do not involve mirrors or lenses is relatively limited. Photovoltaic solar panels are designed to absorb the highest amount of solar energy possible to generate the maximum amount of electricity. This results in negligible glare, reflecting as little as 2% of the sunlight received (Spaven Consulting 2011).

Figure 34: Mechanical Behaviour of the Proposal



There are additional, necessary solar farm infrastructure that may cause glare or reflections depending on the sun angle. These include:

- Steel array mounting structures - array mounting would be steel or aluminium.
- Temporary site offices, sheds, containerised inverter stations.
- The on-site substation.
- Perimeter fencing.
- Permanent staff amenities.

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

6.3 The Existing Environment

In this section we will briefly assess the proposals potential glare value resulting from its photovoltaic solar panels and compare this to the existing rural environment, to attain a baseline understanding.

Generally, photovoltaic solar panels will not create noticeable or nuisance glare compared with other commonly existing surfaces, such as building roofs (NSW Department of Planning, 2010). Likewise, photovoltaic solar panels are less reflective than other naturally occurring elements as represented in **Table 6: Reflectivity of Different Materials** (Avery & Berlin, 1992). Photovoltaic solar panels reflect approximately 3-20% of the light received depending on the angle of incidence.

Within the pastoral context of the proposal, grazing landscapes, crops and water share a similar or higher reflective value than photovoltaic solar panels, thus from a glare perspective the proposal would not represent a significant departure from the existing visual environment.

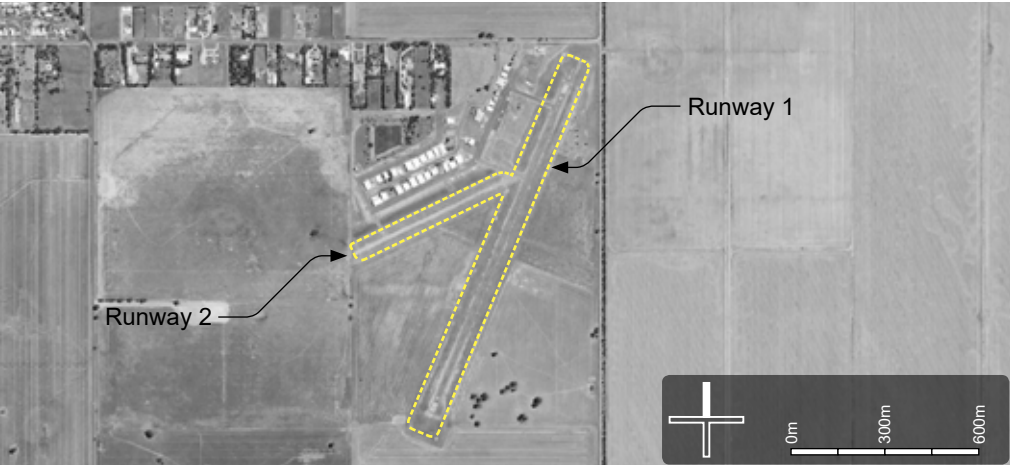
As stated previously the landscape character is largely flat and there are not many opportunities to view the site from a higher position. Within a context whereby there is a much greater degree of prospect, when seen from above from aircraft or tall building for example, photovoltaic solar panels appear dark grey and do not cause a glare or reflectivity hazard.

6.4 Air Traffic

There are a number of airports within the region including Tocumwal (40km from the proposal), Corowa Airport (30km from the proposal), Finley Airport (52km from the proposal) and Yarrawonga Airport (6.6km from the proposal).

Yarrawonga Airport is a 48 hanger, 2 runway facility located 2.8km southeast of the Yarrawonga CBD, as represented in **Figure 3: Regional Context**. The airport caters to the needs of light aircraft, including training and maintenance (Moirā Shire, 2010). The facility operates 24 hours per day, 7 days per week. Given the relative close proximity to the proposal, its possible that aircraft utilising the Yarrawonga Airport may be impacted by the solar farm. However, the northeast - southwest alignment of the runways, depicted in **Figure 33: Yarrawonga Airport**, would result in aircraft taking-off and landing in opposite directions from the proposal. Moreover, based on the average reflectivity of the proposal, the operation of the solar farm is not expected to result in visual nuisance for localised air traffic.

Figure 35: Yarrawonga Airport



6.4 Conclusion

Considering the relatively minimal glare reflecting off the photovoltaic solar panels, and their mechanical nature as they follow the sun, the level of visual nuisance or glare resulting from the proposal would have a minimal influence on locally positioned visual receptors.

Table 7: Reflectivity of Different Materials (Avery & Berlin, 1992).

Material	Percentage Reflected	
Fresh Snow	80-95	
Thick Cloud	70-80	
Water (sun near horizon)	50-80	
Old Snow	50-60	
Light Soil	50-60	
Thin Cloud	20-30	
Dry Soil	20-25	
Wet Soil	15-25	
Deciduous Forest	15-20	
Dark Soil	5-15	
Asphalt	5-10	
Crops	10-25	
Grazing / grass	10-20	
Coniferous Forest	10-15	
Solar Panels	3-20	
Water (sun near zenith)	3-5	

7.0 References

1. ESCO Pacific, 2018, Mulwala Solar Farm - Project Layout.
2. Google Earth Pro, 2018, Map of the Mulwala local and greater region - Lat 35°57'26.56"S, Long 146° 0'0.79"E, accessed 24/04/2017.
3. NSW Globe, 2017, NSW Property Data & Cadastral Information, accessed 24/04/2017.
4. Roads and Maritime Services, 2013, EIAN04 Environmental Impact Assessment Practice Note, Guideline for Landscape Character and Visual Impact Assessment, accessed 24/04/2017.
5. Roads and Maritime Services, 2014, Beyond The Pavement: Urban Design Policy Procedures And Design Principles, accessed 24/04/2017.
6. Avery & Berlin, 1992, '*Reflectivity of Different Materials*', Fundamentals of Remote Sensing & Airphoto Interpretation.
7. University of Oregon, 2018, Solar Radiation Monitoring Laboratory, *Mulwala Sun Path (Mulwala Latitude & Longitude)*, accessed 24/04/2018.
8. Planning and Environment, 2018, Oaklands Basin, <https://www.resourcesandenergy.nsw.gov.au/miners-and-explorers/geoscience-information/nsw-geology-overview/sedimentary-basins/oaklands-basin>, accessed 02/05/2018.
9. Moira Shire, 2010, Yarrowonga Aerodrome, http://www.moiravic.gov.au/Community_Health/Transport_Services/Yarrowonga_Aerodrome, accessed 21/05/2018.

