Agricultural Assessment

Proposed Solar Farm - 6 Meridian Road, Yelta

Victoria, via Merbein & Mildura

Green Gold Energy

Cadeema

DOCUMENT INFORMATION

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CONSULTANT INFORMATION

Cadeema - Soil, Water & Environmental Consulting

- A Victorian-based consultancy
- Specialise in soil, water and environmental management
- Fields of environmental, agricultural, geotechnical, archaeology
- Undertaking site investigations, pre-development assessments, trouble-shooting, on-going monitoring, development planning and implementation management

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1 INTRODUCTION

An Agricultural, Environmental, Soil and Water Scientist from Cadeema (Cliff Dillon) undertook a detailed Agricultural Land Utility Assessment of an approximately 15 ha area of land in north-western Victoria referred to herein as '*the site*'. The site is located on an approximately 120 ha property located at 6 Meridian Road, Yelta, in the Local Government Area of Mildura (Council Property No. 24474; Lot 2 PS504917; SPI 2\PS504917) and which is referred to herein as '*the property*' (*Image 1*) (*Appendix A - Locality Plan*). The property is located in north-western Victoria, approximately 20 km northwest of the city of Mildura, between Mildura (Victoria) and Wentworth (NSW), approximately 9 km northwest of the township of Merbein, in the rural district of Yelta (*Appendix B - Property Plan*). The site is located in the central western area of the property (*Appendix C - Site Plan*).

Mr Dillon is an appropriately qualified and experienced scientist with more than 20 years experience assessing agricultural sites. The site is proposed for development for an approximately 5 MW solar farm by Green Gold Energy (*Appendix D - Proposed Solar Farm*) who propose to lease the land off the current owners, Wendy and Gavin Gaiter.

The purpose of the Agricultural Assessment was to provide an independent assessment of the agricultural utility of the site. This includes assessment of the likely impacts of site development for the proposed solar farm on the farm and on district agricultural utility and viability, particularly pertaining to the reduction in land area available for agricultural use compared with agricultural land availability/viability in this district of north-western Victoria.

Image 1: *The site consists of flat open land with saltbush and few trees.*

2 METHODOLOGY

This detailed Agricultural Land Utility Assessment included a desktop assessment of relevant publicly available information pertaining to the site including environmental features on and surrounding the site (*Appendix B - Property Plan*). A site visit and inspection were undertaken on Monday 25th October 2021 (*Appendix C - Site Plan*) and this included an interview with the current landholders (Wendy and Gavin Gaiter) who have owned the property for the last 10 years. The site inspection included subsurface investigations to verify soil types and an inspection of infrastructure on and surrounding the site.

This agricultural assessment included assessment of the soils existing vegetation, agricultural utility, farming enterprise layout, water features, water supply, drainage, access, fencing, topography and landscape context along with general pertinent features relating to agricultural use on and adjoining the site. The site inspection included a site walk to examine agricultural, environmental and physical features along with detailed soil profile examinations (utilizing a 100 mm diameter hand augur and a shovel) (*Image 2*).

Image 2: *The inspection included detailed soil profile examinations (utilizing a 100 mm diameter hand augur and a shovel) to assess soil layers (horizons) down to depths of 40 cm.*

Information on the site was collected, documented, interpreted and assessed to address strategies outlined under Clause 14.01-1S for the Protection of Agricultural Land within Victorian planning schemes. Aspects addressed included:

- Identify areas of productive agricultural land, including land for primary production and intensive agriculture.
- Consider state, regional and local issues and characteristics when assessing agricultural quality and productivity.
- Avoid permanent removal of productive agricultural land from the states agricultural base without consideration of the economic importance of the land for the agricultural production and processing sectors.
- Protect productive farmland that is of strategic significance in the local or regional context.
- Protect productive agricultural land from unplanned loss due to permanent changes in land use
- Protect strategically important agricultural and primary production land from incompatible uses.

This agricultural assessment concentrated on site physical characteristics including geology, landform, geomorphology, vegetation (including remnant vegetation), hydrology (natural surface water occurrence and movement), drainage (soil profile and surface), topography and groundwater. Consideration was given to site agricultural characteristics including current land use, evidence of historical land use, general agricultural utility, fencing, vermin, and vegetation (including weeds and crop growth/performance). The detailed assessment of soil physical characteristics facilitated determination of soil crop suitability and soil productivity potential. This information was combined to ascertain site utility for commercial agricultural production, site context and compatibility with existing property farming operations and with district agriculture.

Please note that no laboratory soil chemistry analysis was undertaken as part of this assessment. Soil physical characteristics are a more important determinant of land use potential by comparison with soil chemical characteristics.

Collaboration of this information facilitated comparison of land within the site with that on the remaining areas of the property and with other agricultural land surrounding the site and in the district.

Collaboration of this information facilitated formulation of conclusions on likely impacts of site development for the proposed solar farm on the property and on district agricultural utility and viability, particularly pertaining to the reduction in land area available for agricultural use compared with agricultural land availability/viability in this north-western district of Victoria.

This report outlines the results of the Agricultural Assessment of the site.

3 SITE FEATURES

3.1 The Site & Its Context

As detailed in the Introduction, the proposed approximately 15 ha solar farm site is located on an approximately 120 ha property near Mildura and Merbein in north-western Victoria near where the Calder Highway and the Abbotsford Bridge span the Murray River linking Victoria with New South Wales (*Appendix A - Locality Plan; Appendix B - Property Plan*). In this district, land consists of 3 distinct landscapes including the incised Murray River Corridor, the topographically low Murray River Floodplain, and the more elevated Mallee Landscape. The land on and surrounding the property consists of the natural Murray River Floodplain and as such is covered by the Land Subject to Inundation Overlay. Whilst historically the property would have been periodically (typically seasonally) naturally flooded by the Murray River, due to water control infrastructure in the River, this now rarely occurs. There are distinct differences between the low-lying, poorly drained, flat, grey clay landscape of the Murray River Floodplain, and the adjoining topographically higher, well drained, undulating, red calcareous sands of the Malley Landscape.

The landscape across the majority of the property is similar and consists predominantly of flat open country. Scattered remnant Black Box (*Eucalyptus largiflorens*) trees occur in the northern section of the property (*Image 3*), and the house, along with garden and agricultural shedding, are located in the far north of the property. Access to the property is gained adjacent to the house off Meridian Road in the far north of the property.

The property (*Appendix B - Property Plan*) is zoned Farming Zone and is bordered to the east by Meridian Road, a tarmac double lane rural road, and beyond this by Farming Zone rural holdings. A grain receival and storage facility is located to the southeast of the property. Land to the north, west and south of the property consists of the Wargan-Mallee Bushland Area which is public conservation land covered by the Public Conservation and Resource Zone.

A small earthen public road, Hoyle Road, is located approximately 75 m to the north of the property, and this provides access to several Farming Zone rural holdings located on slightly topographically higher land. Land between the property and Hoyle Road Land forms part of the aforementioned Wargan-Mallee Bushland Area. Land on the property and on surrounding rural holdings is utilised for low intensity grazing of unimproved, natural vegetation and weeds. There is a distinct difference between land use on the Murray River Floodplain which is utilised for low intensity grazing and public conservation, by comparison with the adjoining Mallee Landscape which is typically utilised for high intensity, high value, irrigated horticulture. It is predominantly soil type which facilitates this difference due to the sand dominant, well drained, high productivity potential soils of the Mallee Landscape which can be compared to the clay dominant, poorly drained, low productivity potential soils of the Murray River Floodplain.

The proposed solar farm site on the property consists of flat, open land utilised by the current property owner for low intensity grazing by cattle and sheep. Historically (assumed in the 1970's or 1980's), land forming earthworks to facilitate flood (border check) irrigation were undertaken on the property and on the site however, this irrigation system is now defunct. It is assumed irrigation water was accessed from the Murray River and was pumped and piped approximately 700 m to this irrigation area. Water for the property is currently accessed from the Murray River however, distribution is limited to the house area. Approximately four (assumed remnant) Black Box eucalypt trees occur along the central western boundary of the property and area of the site.

Image 3: *Scattered remnant Black Box (Eucalyptus largiflorens) trees occur in the north of the property adjacent to the proposed solar farm site.*

3.2 Topography & Drainage

The site is flat and, due to lack of surface slope and poorly drained, clay dominant soils, is poorly drained. As detailed earlier, historical earthworks to facilitate flood (border check) irrigation were implemented on the site and while this system is now defunct, remnants of these earthworks remain. It is understood that this irrigation system has not been utilised for the past at least 20 years and it appears the system has not been maintained over this time. Remaining remnants of the irrigation system include an earthen irrigation water supply channel along the western boundary of the site (*Images 4 & 5*), small earthen check banks and shallow earthen spoon drains (*Image 6*). Whilst it is difficult to ascertain due to the very flat landscape, it is assumed that excess if and when excess surface water occurred across the site and property, this would drain in a south easterly direction from the site.

Image 4: *An unmaintained and now-defunct earthen irrigation water supply channel and outlet in the southwest of the site.*

Image 5: *An unmaintained and now-defunct earthen irrigation water supply channel is located along the western boundary of the site.*

Image 6: *A small earthen check bank, which is a remnant of the now-defunct flood (border check) irrigation system, is one of the few remaining remnants of irrigation on the site.*

3.3 Soils

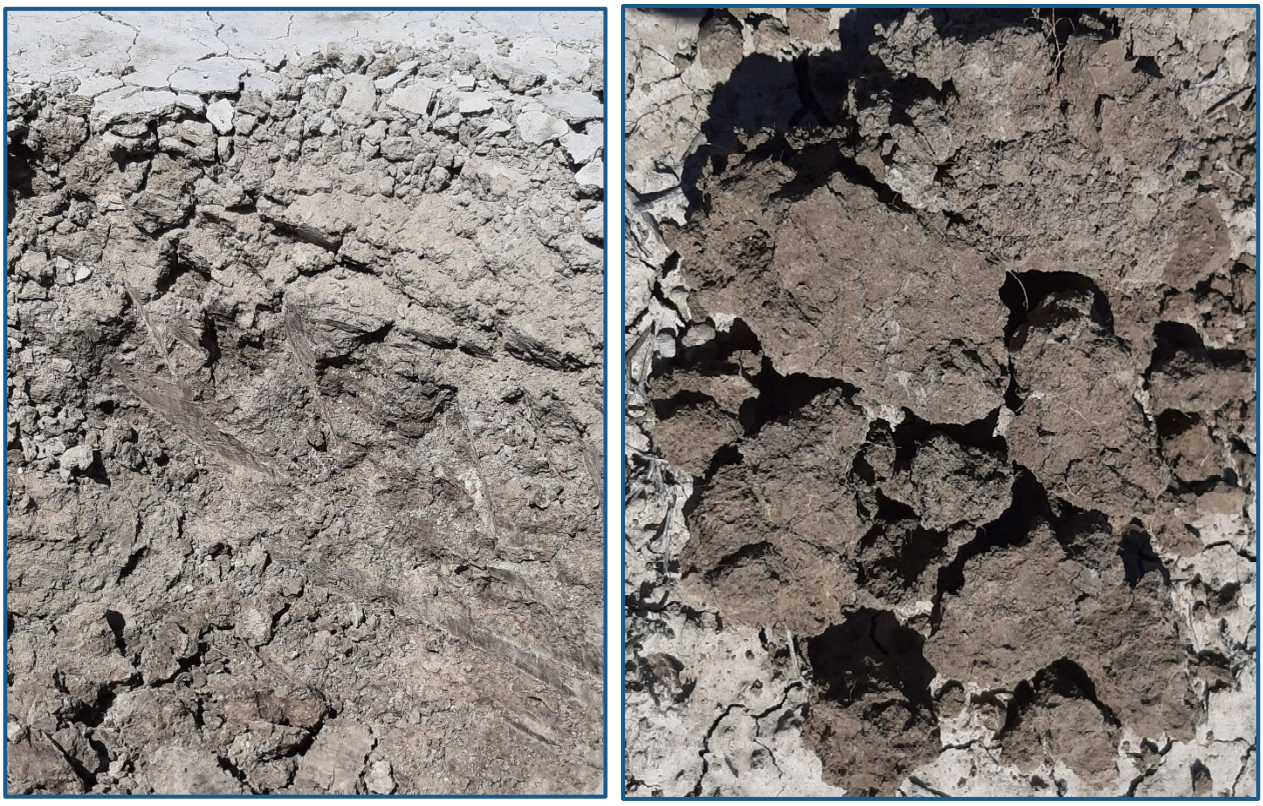
Soil Assessment – Soils on the site were assessed by an experienced Soil Scientist using a shovel and a 100 mm diameter hand soil augur (*Image 2*). This facilitated assessment of soil physical characteristics, soil mapping and soil classification, the latter facilitating determination of soil productivity potential and soil crop suitability.

Geology – The geology across the site is recent Quaternary alluvium of the Coonambidgel Formation which was formed as part of the floodplain of the nearby Murray River.

Soil Type – The soils across the site are all Grey Clay Vertisols (Ug Soils).

Grey Clay Vertisols – The soil surface is slaked and on drying consists of fine cracking (*Image 7*). The soil profile consists of a shallow (0-6 cm), grey (or light grey), light to medium clay surface soil layer (A Horizon) which grades into a poorly structured, poorly drained, dark grey to dark grey-brown heavy clay subsoil (B Horizon) which extends to depth (50+ cm) (*Images 8 & 9*). Surface soil structure is granular to subangular blocky and subsoil structure is columnar to subangular blocky. Soil structure throughout the soil profile is dense, tough and intractable, and is hard when dry and plastic when wet. Whilst no natural lime (soil carbonates) were identified on the site, it is likely that these occur at depth in sporadic (5-10%) fine powdery and modulated deposits as is typical of Vertisol soils in this landscape. Because of the topographically low-lying nature of this soil type, combined with the flat landscape, limited surface drainage, high water holding capacity and low soil profile permeability, the soils across the site are susceptible to waterlogging, salting and sodicity.

Image 7: *The soil surface is slaked and consists of fine cracks when dry; the grain receival/storage facility to the southeast of the property can be discerned in the background of this image.*



Images 8 & 9: *The soils consist of a shallow (0-6 cm), grey (or light grey), light to medium clay surface soil layer (A Horizon) which grades into a poorly structured, poorly drained, dark grey to dark grey-brown heavy clay subsoil (B Horizon) which extends to depth (50+ cm).*

Soil Productivity Potential – The soils on the site have a low agricultural productivity potential because of the shallow depth of surface soil, high clay content, tough and intractable soil structure, poor drainage and susceptibility to waterlogging, salting and sodicity. In combination, these features provide unfavourable conditions for root growth and function, and limit the soil volume available for plant root exploitation. The soils are not amendable to tillage due to unfavourable conditions at slightly wet or slightly dry soil moisture contents. Where tillage improves soil structure, poor soil structure rapidly returns. The soils are not suitable for agriculture or horticulture. The soils are not suitable for higher value horticultural fruit or vegetable crops. The soils are also not suitable for lower value, broad acre, row crops, cereal/grain/oilseed crops and perennial or annual pastures. At best, the soils are suitable for low value, low intensity, grazing of native pastures however, little if any native pastures grow in this landscape on this site as plants predominantly consist of weeds, halophytes and saltbush (*Image 10*).

Image 10: *Plant growth on the site consists of weeds, halophytes and saltbush.*

Soil Chemistry – Whilst the soils were not analysed in the laboratory for soil chemical characteristics, the soil chemical status is likely to evince low soil nutrition for agricultural production as no nutrients or soil ameliorants have been applied for at least the past 10 years. Soil pH levels are likely to be moderately alkaline as is typical of these soil types in this landscape. Salinity and sodicity, which are described further hereunder, are likely to be elevated contributing to low soil chemical stability. The assumed but likely low soil nutrition and stability are not conducive to achieving satisfactory agricultural yields for crops or pastures.

Salinity – The climate, topography, landscape and soil types on this site are conducive to adverse impacts from salinity which are likely to be exacerbated by the adjoining horticultural irrigation areas and the historical removal of remnant vegetation. It is likely that the soils on the site contain elevated salinity levels, particularly sodium chloride (NaCl) levels, as was evidenced by the presence of halophytes and efflorescence (*Image 11*).

Sodicity – Elevated subsoil sodicity can naturally and inherently occur in these soil types in this district. Sodicity on this site is likely to have been exacerbated by land clearing and historical land use practices. The subsoil is on this site are likely to be adversely impacted from sodicity as was evinced by sodic soil physical characteristics such as poor structure (*Image 11*). This soil sodicity adversely impacts soil structure which can limit plant root proliferation and soil profile penetration, and also reduces soil profile permeability exacerbating waterlogging. It is likely that soil sodicity and salinity are limiting the agricultural viability of the site. Whilst salinity and sodicity can be improved with practices such as the application of gypsum, significant benefits from gypsum and improvements in salinity and sodicity are not likely due to the poor drainage and permeability of the soils.

Image 11: *Poorly structured subsoil peds displaying white efflorescence indicating the presence of salts.*

3.4 Surface Water & Groundwater

Groundwater – Whilst no information on groundwater on the site is available, it is likely that shallow (in the upper 5 metres of the soil profile) saline groundwater exists in the vicinity of the property as is typical of lower lying land fringing an irrigated Mallee Landscape. Periodic waterlogging could also occur on the site resulting in shallow perched watertables. It is likely that this shallow groundwater has salinity levels in excess of 6,000 µS/cm.

Surface Water – At the time of the site investigation, there was no surface water on the site. Whilst surface water is likely to collect on the site during wet climatic conditions due to the crusted soil surface, high clay content and low soil profile permeability, volumes are not likely to be significant given the dry climate and landscape. Overland surface water flow would be limited due to the flat nature of the landscape. A small incised earthen farm dam is located approximately 100 m to the north of the site. It is understood this dam is periodically filled with river water for stock watering (*Image 12*). At the time of the site investigation this dam contained water which was assessed with a handheld salinity/pH metre indicating a field salinity level of 545 µS/cm and a pH of 9.2. This water salinity level is not excessive and is likely to be a combination of river water (estimated to approximate 300 µS/cm) and soil salts. The elevated pH confirms the alkaline calcareous nature of these soils.

Image 12: *A small incised earthen farm dam, located approximately 100 m north of the site, is utilised to supply stock drinking water on the property.*

3.5 Vegetation

Trees – Whilst the majority of the site has historically been cleared for agriculture, approximately 4 (assumed remnant) Black Box (*Eucalyptus largiflorens*) trees occur in the central western area of the site (*Image 13*).

Image 13: *Approximately 4 (assumed remnant) Black Box (Eucalyptus largiflorens) trees occur in the central western area of the site.*

Groundcover – At the time of the site inspection, groundcover across the site consisted of weeds, halophytes and saltbush (*Images 1, 5, 6, 10 & 13*). Much of the ground surface was bare.

Natural Vegetation – Historically, natural vegetation in this landscape would typically consist of Black Box (*Eucalyptus largiflorens*) trees (*Image 3*), Lignum (*Muehlenbeckia florulenta*), halophytes (*Image 14*) and saltbushes such as that which occurs to the north of the site and the north of the property (*Image 15*). The site investigation was not undertaken at a suitable seasonal time of year conducive to locating and/or identifying small native grasses and ground covers.

Image 14: *Salt indicator plant species such as halophytes occur naturally in this landscape and on the site.*

Image 15: *Historically, natural vegetation would typically consist of Black Box (Eucalyptus largiflorens) trees and associated understory such as that which occurs to the north of the site/property.*

3.6 Infrastructure & Other Site Features

Infrastructure – Agricultural improvements identified on the site at the time of the site investigation included the aforementioned and now-defunct irrigation infrastructure (*Images 4, 5, & 6*) and agricultural wire and treated pine and steel (star picket) post fencing and gates (*Image 16*). There was no other agricultural infrastructure or improvements on the site.

Image 16: *The only agricultural infrastructure on the site is farm fencing.*

4 AGRICULTURAL ASSESSMENT

4.1 Current Land Use

According to the Landholder, the site has not been utilised for irrigation for the past approximately 20 + years. The Landholder anecdotally understands that flood (border check) irrigation was practised on the property however, the crops grown are unknown. It is likely that 'shoulder' irrigation of winter crops and pastures, or summer pasture/fodder crops were sustained with this irrigation. Production is not likely to have been high due to the low productivity potential of the soils. In several seasons over the past 10 years, the current Landholder has sown winter crops for fodder production (oats) however, due to low rainfall and poor soil conditions, these crops have failed. From an agricultural perspective, it is assumed that historically the property has been used predominantly utilised for low intensity grazing of native vegetation.

The current Landholder utilises the property for low intensity grazing by cattle and sheep. However, land on the property and on the site do not produce sufficient feed to sustain stock and therefore supplementary feeding is constantly required. The Landholder sources hay and fruit waste, the latter from local fruit juice processes, to sustain stock on the site (*Image 17*). It would not be possible to sustain stock on the site in its current form and condition without importation of stockfeed. No native or introduced pasture species exist on the site. Whilst it may be possible to establish some hardier pasture species on the site, pasture production is not likely to be high due to the low productivity potential of the land.

Image 17: *The Landholder sources fruit waste from a local juice processor to provide feed for sheep; without this it would not be possible to sustain stock on the site.*

4.2 Agricultural Utility

The site has low productivity potential and therefore low agricultural utility due to the low productivity potential of the soil. As detailed earlier, the soils have a low agricultural productivity potential because of the shallow depth of surface soil, surface crusting, high clay content, tough and intractable soil structure, poor drainage and susceptibility to waterlogging, salting and sodicity. The soils are not suitable for any types of mainstream agricultural crops or pastures and are not suitable for agriculture or horticulture. It is the author's opinion that the site should never have been cleared for agricultural use. Viable options for soil amelioration are limited, would be short lived and are not likely to be feasible.

The relatively dry climate limits water from rainfall. The site has been irrigated in the past and could, theoretically, still be irrigated with water from the nearby Murray River. However, no usable irrigation infrastructure is available on the site or on the property. Considerable investment would be required to facilitate efficient and effective irrigation on the site and the property and this is not likely to be viable. The yields and returns from crops which could be grown under irrigation on the site are unlikely to justify investment in irrigation on the site.

The limited productivity potential and agricultural utility of the site is confirmed by the current land use which is limited, low intensity grazing which can only be undertaken with the importation of supplementary feed.

4.3 Proposed Solar Farm Impacts on Agriculture

As detailed earlier, the proposed solar farm (*Appendix D - Proposed Solar Farm*) will cover 15 ha or approximately 12.5% of the property. Solar farm development on the site will not segregate surrounding agricultural land on the property or in the district in relation to access or drainage. Development will not adversely impact agricultural utilisation of the remaining areas of the property. Because existing agricultural production is very low/non-existent and the potential for agricultural production from the site is low, the reduction in agricultural output from the site by the establishment of the proposed solar farm will be negligible. It may be possible or advantageous to periodically graze the site after solar farm establishment.

Existing or potential agricultural production from the site is limited and therefore generates a low return on investment and a low economic input into the local community. Based on the limited agricultural utility of the site (detailed above), the site is not likely to realise a substantial increase in agricultural productivity and therefore financial return. The site owners envisage establishment of the proposed solar farm will improve their returns from this site and thereby increase the long-term security of the site and the property (income security) through diversification to an income source which is likely to be more secure by comparison with agriculture as the latter is low intensity/low income and is subject to the vagaries of climate and agricultural commodity prices.

The loss of agricultural production on the site will be minor by comparison with production from agricultural land in the district. It can therefore be concluded that the loss in agricultural production is not significant and is not likely to impact the economy of the district.

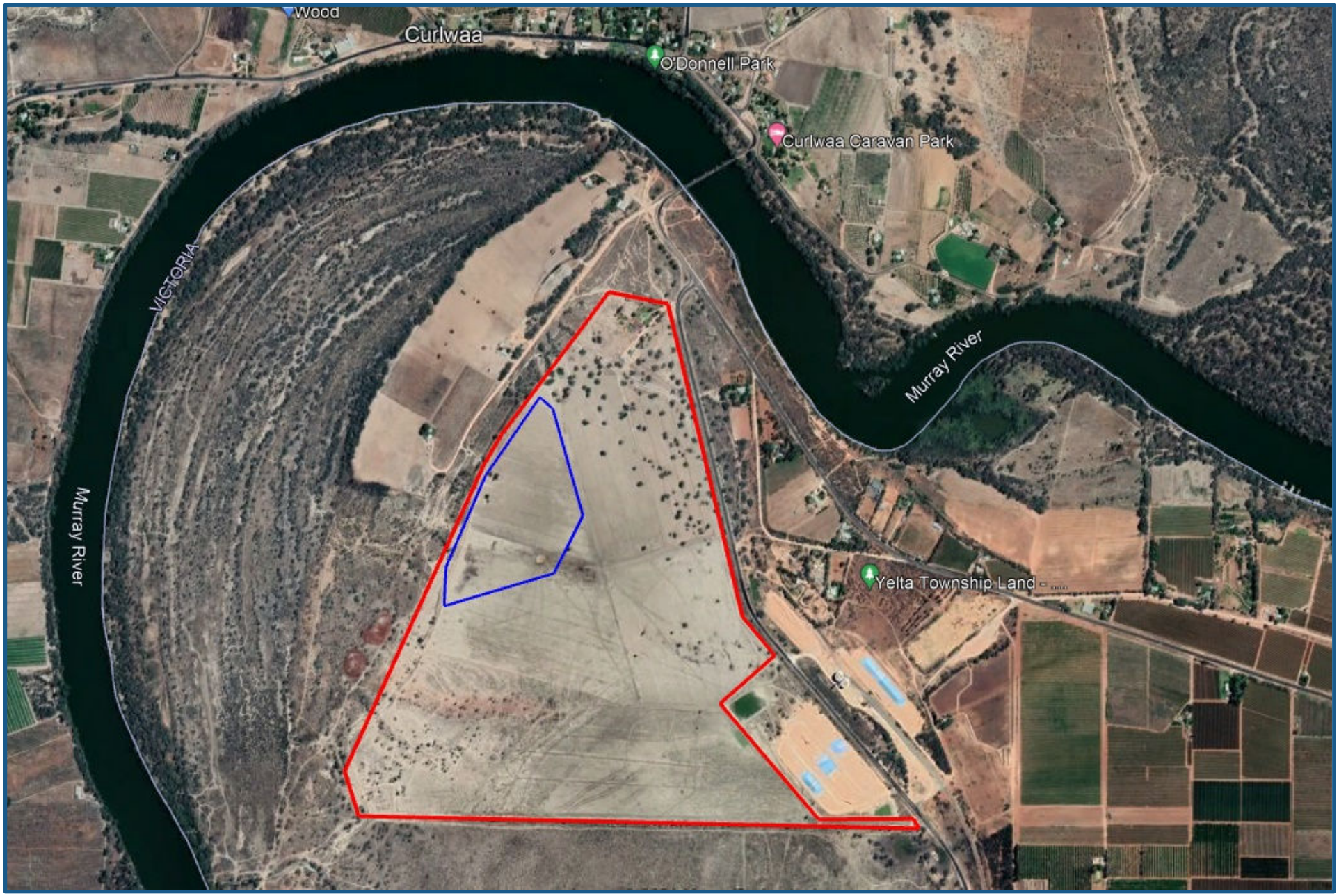
5 CONCLUSIONS

This comprehensive Agricultural Land Utility Assessment of the 15 ha site by an appropriately qualified and experienced scientist considered existing and historical land use combined with agricultural, environmental and physical features on and adjoining the site. The site should never have been cleared and utilised for agriculture or irrigation because the location of the site in the landscape combined with the low productivity potential soil type render the site unsuitable for agriculture. The soils on the site severely limit the agricultural production potential of the site. Because historical, existing and potential agriculture on the site is limited and low return, the loss of agricultural production from the proposed solar farm development on the site will be minor and will not be significant by comparison with production on remaining areas of the property or with production on agricultural land in the district. From an agricultural production perspective, establishment of the proposed solar farm will not adversely impact and is likely to improve economic returns for the site, for the Landholders and for the economy of the district.

6 APPENDICES

6.1 Appendix A - Locality Plan

6.2 Appendix B - Property Plan

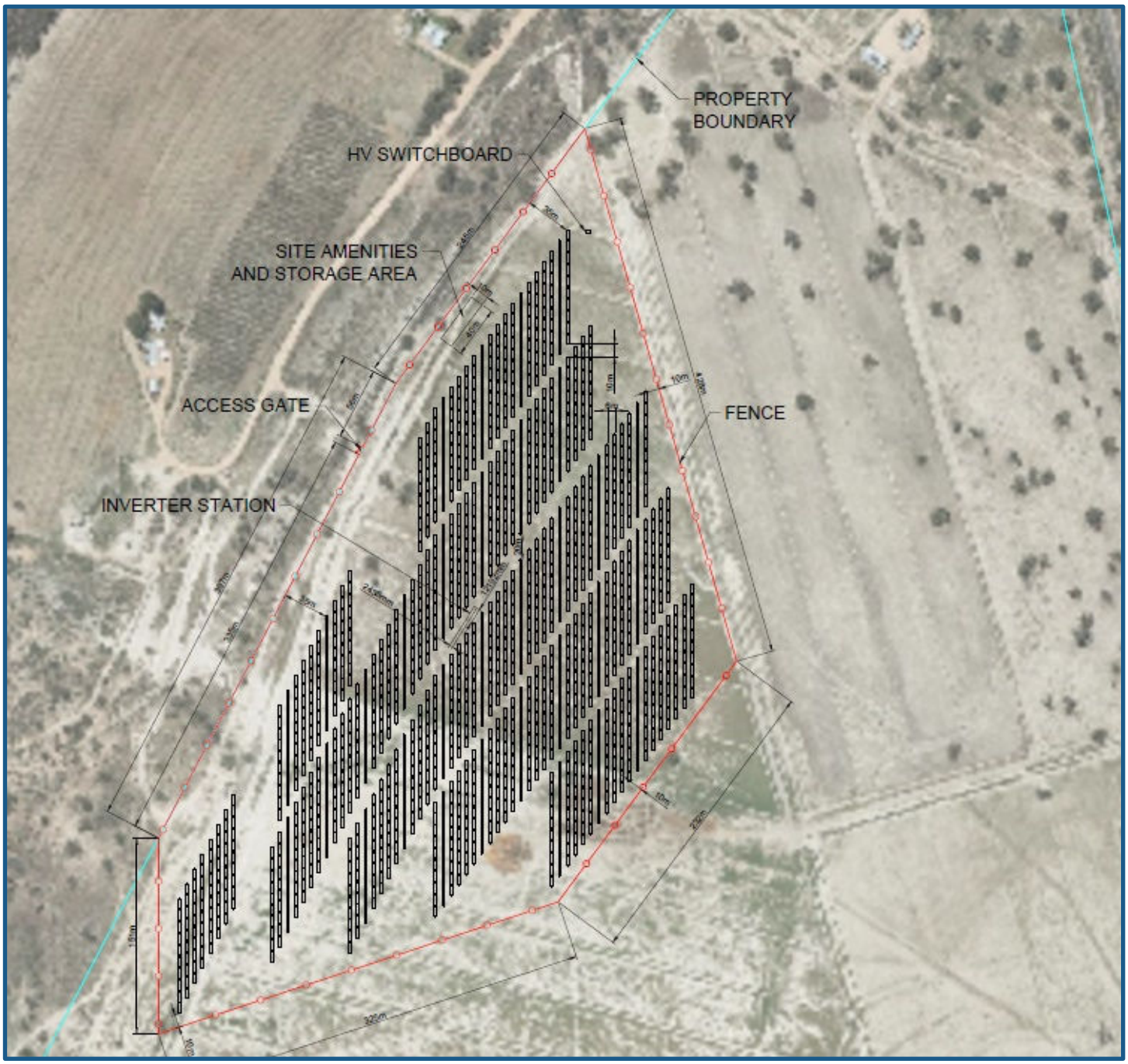


Property boundary in red and solar farm site in blue.

6.3 Appendix C - Site Plan

Property boundary in red and solar farm site in blue.

6.4 Appendix D - Proposed Solar Farm



Solar farm fence in red and property boundary in blue (aqua).