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West Mokoan Solar Farm

892 Benalla-Yarrawonga Development Pty Ltd

10-Jun-2021

Project Amendment Addendum

Geotechnical Desktop Assessment

Project Amendment Addendum

Geotechnical Desktop Assessment

Client: 892 Benalla-Yarrawonga Development Pty Ltd

ABN: 628034300

Prepared by

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10-Jun-2021

Job No.: 60597809

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1.0 Introduction

1.1 Planning Permit Application

AECOM Australia Pty Ltd (AECOM) continues to act on behalf of the applicant, 892 Yarrawonga Development C/- South Energy, in relation to Planning Permit Application No. PA2000978 for the West Mokoan Solar Farm.

Planning Permit Application No. PA2000978 was submitted to Department of Environment, Water, Planning and Land (DELWP) on 07 October 2020. The Application is for the use and development of a Renewable Energy Facility and Utility Installation (solar farm and energy storage) and associated buildings and works, removal of native vegetation, display of business identification signage, removal and creation of easements and the creation or alteration of access to a Road Zone Category 1 (the Project).

This letter is an addendum to the West Mokoan Solar Farm Facility Geotechnical Desktop Assessment, dated 21 November 2019 (Geotechnical Desktop Assessment, Doc Ref: 60597809-RPT-GT-0001_Rev 2).

1.2 Requests for Further Information

Pursuant to Section 54 of the *Planning and Environment Act 1987 (P&E Act),* DELWP issued a Request for Further Information (RFI) dated 5 November 2020. A separate RFI was issued from DELWP – Hume Region, on 26 November 2020. There were no matters raised in either of the RFIs in relation to or concerning ground engineering.

1.3 Project Amendments

As a result of changes to the Project area and technical requirements, and in response to the RFI's, a formal amendment to the Planning Permit Application is being sought, pursuant to Section 50 of the *P&E Act.* The changes to the project are summarised below:

- ***Change to the substation location***

  Due to AusNet requirements, the substation has been relocated from 892 Benalla-Yarrawonga Road (Lot 1 PS625748), on the northern side of Lake Mokoan Road to the southern side of Lake Mokoan Road on land at Benalla-Yarrawonga Road (Lot 1 TP173518). As a result, the vehicle access gates along Lake Mokoan Road have been altered – with the northern access point to the (former) substation removed and a new access point for the new substation added. Furthermore, the location of solar panels and associated equipment has changed, with solar panels now located on the former substation site.

- ***Change to native vegetation retention and removal***

  In response to the RFI from DELWP – Hume Region (dated 26 November 2020), additional habitat assessments and native vegetation assessments have been undertaken, and the solar farm layout has been revised to optimise native vegetation retention. Previously, a total of 2.868 ha of native vegetation was proposed to be removed, which included 43 scattered trees (39 large trees and 4 small trees). The revised solar layout proposes a total of 1.891 ha of native vegetation to be removed which includes 28 scattered trees (26 large trees and 2 small trees). Refer to the Flora and Fauna Impact Assessment for full details.

- ***Reduction in Project area and capacity***

  Land at 81 Lake Mokoan (Lot 2 PS625748) is now excluded from the project. The dwelling at 81 Lake Mokoan Road (proposed to be used for construction purposes) is now excluded from the Project and maintains its current use as a dwelling on private land and a 'sensitive receptor'.

  As a result of the changes described above, the capacity (energy generation) of the solar farm has been slightly reduced, which is summarised in Table 1.

Table 1 Comparison of Solar Energy Facility Details

Item	Previous Concept Plan	Revised Concept Plan
Total Project Area (ha)	467.2	426.4
Direct Current Capacity (MW)	245.19	233.74
Number of PCUs	60	57
Total Modules	557,256	531,216

2.0 Assessment

A review of the revised Concept Plan (labelled 60597809-DWG-EL-0003_Rev11 and dated 3/6/2021), presented in Appendix A was undertaken to confirm any ground engineering impacts as a result of the changes to the project described above.

- ***Change to the substation location***

  The ground engineering considerations associated with; the relocation of the substation from 892 Benalla-Yarrawonga Road (Lot 1 PS625748) to Benalla-Yarrawonga Road (Lot 1 TP173518), and the relocation of vehicle access gates and solar panels, are suggested to remain consistent with the observations and preliminary and indicative recommendations made and documented within the original Geotechnical Desktop Assessment

- ***Change to native vegetation retention and removal***

  Ground engineering considerations made in response to the rearrangement of the solar farm layout to optimise native vegetation retention are consistent with the observations and preliminary and indicative recommendations made and documented within the original Geotechnical Desktop Assessment.

- ***Reduction in Project area and capacity***

  With the exclusion of the land at 81 Lake Mokoan (Lot 2 PS625748) from the project, it is anticipated the overall extent of earthworks and temporary and permanent construction effort would be reduced, potentially reducing the geotechnical design and construction risk.

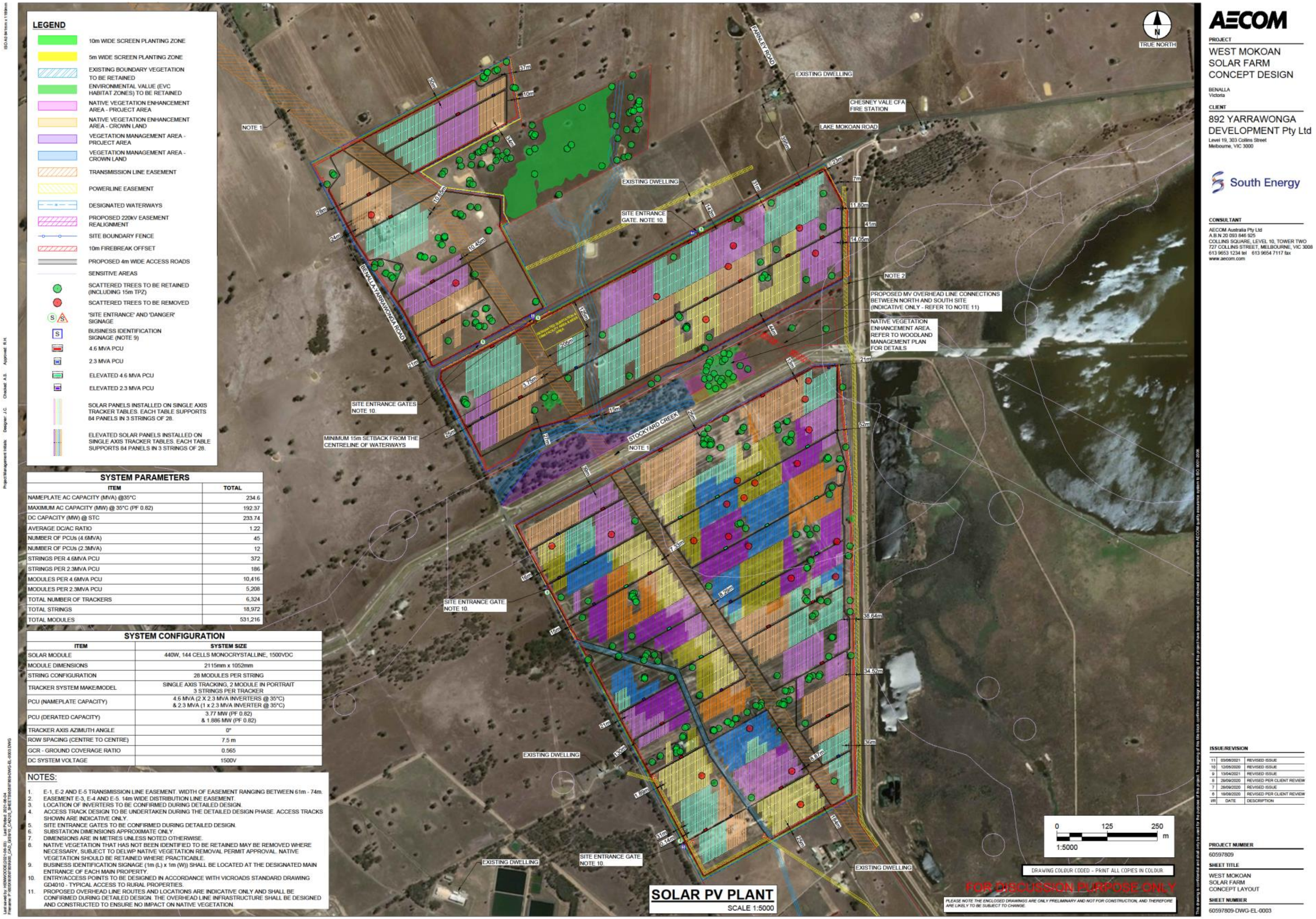
3.0 Conclusion

The proposed amendments to the changes to the Project area and technical requirements in response to the RFI's raised by DELWP, dated 5 November 2020, and DELWP – Hume Region, on 26 November 2020, have been reviewed against the high level preliminary ground engineering information acquired, and subsequently documented, as part of visual geotechnical inspection undertaken in October 2019.

Based on the planning amendments outlined herein, it is proposed the observations documented, and preliminary and indicative recommendations stated, within the Geotechnical Desktop Assessment (Doc Ref: 60597809-RPTGT-0001 Rev2) remain aligned with the original document.

Appendix A

Revised Concept Plan



SYSTEM PARAMETERS

ITEM	TOTAL
NAMEPLATE AC CAPACITY (MVA) @35°C	234.6
MAXIMUM AC CAPACITY (MW) @ 35°C (PF 0.82)	192.37
DC CAPACITY (MW) @ STC	233.74
AVERAGE DC/AC RATIO	1.22
NUMBER OF PCUs (4.6MVA)	45
NUMBER OF PCUs (2.3MVA)	12
STRINGS PER 4.6MVA PCU	372
STRINGS PER 2.3MVA PCU	186
MODULES PER 4.6MVA PCU	10,416
MODULES PER 2.3MVA PCU	5,208
TOTAL NUMBER OF TRACKERS	6,324
TOTAL STRINGS	18,972
TOTAL MODULES	531,216

SYSTEM CONFIGURATION

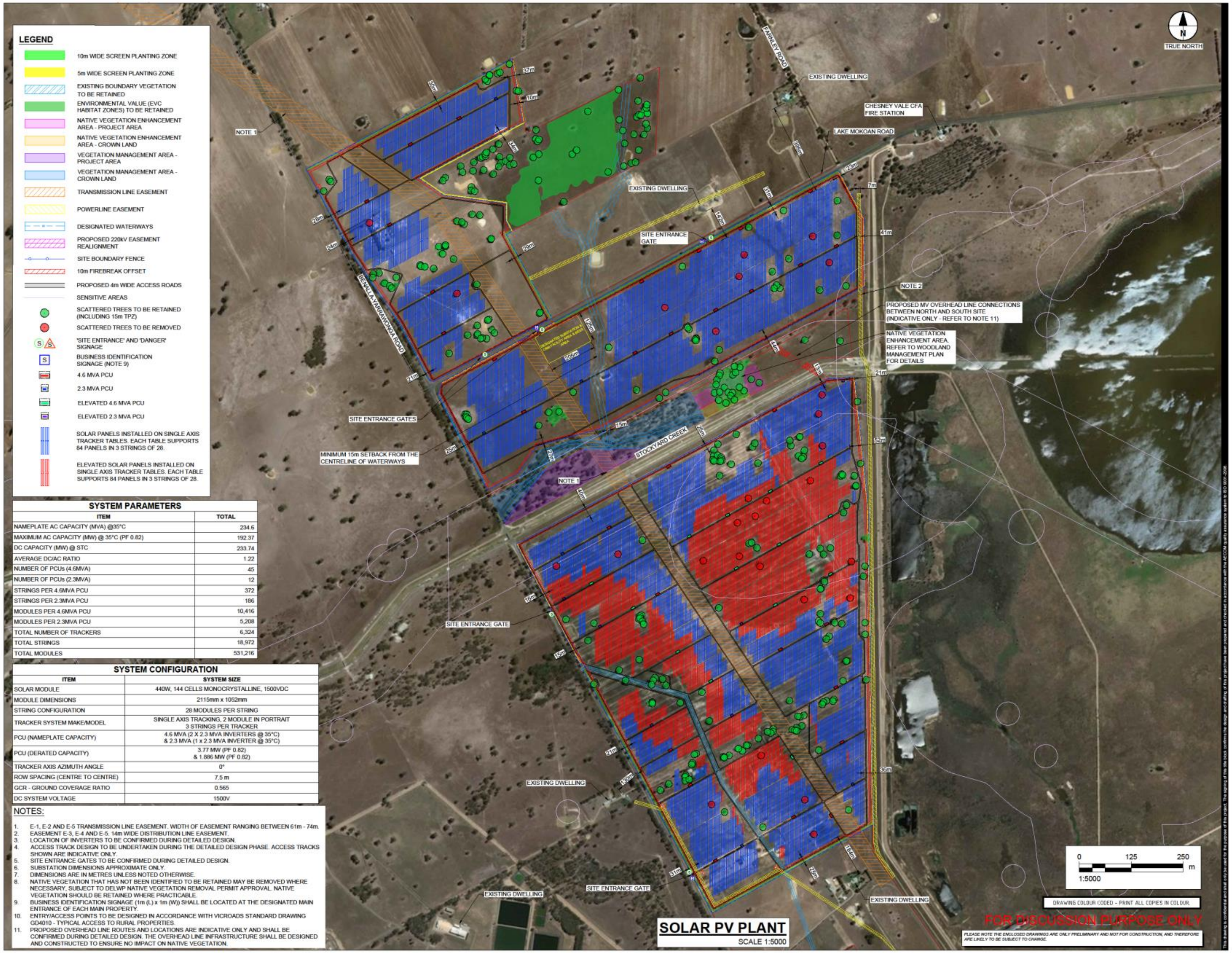
ITEM	SYSTEM SIZE
SOLAR MODULE	440W, 144 CELLS MONOCRYSTALLINE, 1500VDC
MODULE DIMENSIONS	2115mm x 1052mm
STRING CONFIGURATION	28 MODULES PER STRING
TRACKER SYSTEM MAKE/MODEL	SINGLE AXIS TRACKING, 2 MODULE IN PORTRAIT 3 STRINGS PER TRACKER
PCU (NAMEPLATE CAPACITY)	4.6 MVA (2 X 2.3 MVA INVERTERS @ 35°C) & 2.3 MVA (1 x 2.3 MVA INVERTER @ 35°C)
PCU (DERATED CAPACITY)	3.77 MW (PF 0.82) & 1.886 MW (PF 0.82)
TRACKER AXIS AZIMUTH ANGLE	0°
ROW SPACING (CENTRE TO CENTRE)	7.5 m
GCR - GROUND COVERAGE RATIO	0.565
DC SYSTEM VOLTAGE	1500V

NOTES:

1. E-1, E-2 AND E-5 TRANSMISSION LINE EASEMENT. WIDTH OF EASEMENT RANGING BETWEEN 61m - 74m.
2. EASEMENT E-3, E-4 AND E-5. 14m WIDE DISTRIBUTION LINE EASEMENT.
3. LOCATION OF INVERTERS TO BE CONFIRMED DURING DETAILED DESIGN.
4. ACCESS TRACK DESIGN TO BE UNDERTAKEN DURING THE DETAILED DESIGN PHASE. ACCESS TRACKS SHOWN ARE INDICATIVE ONLY.
5. SITE ENTRANCE GATES TO BE CONFIRMED DURING DETAILED DESIGN.
6. SUBSTATION DIMENSIONS APPROXIMATE ONLY.
7. DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
8. NATIVE VEGETATION THAT HAS NOT BEEN IDENTIFIED TO BE RETAINED MAY BE REMOVED WHERE NECESSARY, SUBJECT TO DELWP NATIVE VEGETATION REMOVAL PERMIT APPROVAL. NATIVE VEGETATION SHOULD BE RETAINED WHERE PRACTICABLE.
9. BUSINESS IDENTIFICATION SIGNAGE (1m (L) x 1m (W)) SHALL BE LOCATED AT THE DESIGNATED MAIN ENTRANCE OF EACH MAIN PROPERTY.
10. ENTRY/ACCESS POINTS TO BE DESIGNED IN ACCORDANCE WITH VICROADS STANDARD DRAWING GD4010 - TYPICAL ACCESS TO RURAL PROPERTIES.
11. PROPOSED OVERHEAD LINE ROUTES AND LOCATIONS ARE INDICATIVE ONLY AND SHALL BE CONFIRMED DURING DETAILED DESIGN. THE OVERHEAD LINE INFRASTRUCTURE SHALL BE DESIGNED AND CONSTRUCTED TO ENSURE NO IMPACT ON NATIVE VEGETATION.

Appendix B

Elevated Panels Plan



LEGEND

- 10m WIDE SCREEN PLANTING ZONE
- 5m WIDE SCREEN PLANTING ZONE
- EXISTING BOUNDARY VEGETATION TO BE RETAINED
- ENVIRONMENTAL VALUE (EVC HABITAT ZONES) TO BE RETAINED
- NATIVE VEGETATION ENHANCEMENT AREA - PROJECT AREA
- NATIVE VEGETATION ENHANCEMENT AREA - CROWN LAND
- VEGETATION MANAGEMENT AREA - PROJECT AREA
- VEGETATION MANAGEMENT AREA - CROWN LAND
- TRANSMISSION LINE EASEMENT
- POWERLINE EASEMENT
- DESIGNATED WATERWAYS
- PROPOSED 220kV EASEMENT REALIGNMENT
- SITE BOUNDARY FENCE
- 10m FIREBREAK OFFSET
- PROPOSED 4m WIDE ACCESS ROADS
- SENSITIVE AREAS
- SCATTERED TREES TO BE RETAINED (INCLUDING 15m TPZ)
- SCATTERED TREES TO BE REMOVED
- 'SITE ENTRANCE' AND 'DANGER' SIGNAGE
- BUSINESS IDENTIFICATION SIGNAGE (NOTE 9)
- 4.6 MVA PCU
- 2.3 MVA PCU
- ELEVATED 4.6 MVA PCU
- ELEVATED 2.3 MVA PCU
- SOLAR PANELS INSTALLED ON SINGLE AXIS TRACKER TABLES. EACH TABLE SUPPORTS 84 PANELS IN 3 STRINGS OF 28.
- ELEVATED SOLAR PANELS INSTALLED ON SINGLE AXIS TRACKER TABLES. EACH TABLE SUPPORTS 84 PANELS IN 3 STRINGS OF 28.

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SOLAR PV PLANT

SCALE 1:5000

DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR.

FOR DISCUSSION PURPOSE ONLY

PLEASE NOTE THE ENCLOSED DRAWINGS ARE ONLY PRELIMINARY AND NOT FOR CONSTRUCTION, AND THEREFORE ARE LIKELY TO BE SUBJECT TO CHANGE.

AECOM

PROJECT

WEST MOKOAN
SOLAR FARM
CONCEPT DESIGN

BENALLA
Victoria

CLIENT

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South Energy

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
3	07/06/2021	REVISED ISSUE
2	14/05/2021	REVISED ISSUE
1	13/04/2021	FOR ISSUE

PROJECT NUMBER

60597809

SHEET TITLE

WEST MOKOAN
SOLAR FARM
ELEVATED VS NON-ELEVATED

SHEET NUMBER

60597809-DWG-EL-0005

892 Yarrawonga Development Pty Ltd

21-Nov-2019

Doc No. 60597809-RPTGT-0001

West Mokoan Solar Farm Facility

Geotechnical Desktop Assessment

West Mokoan Solar Farm Facility

Geotechnical Visual Assessment

Client: 892 Yarrawonga Development Pty Ltd

ABN: 63 628 034 300

Prepared by

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21-Nov-2019

Job No.: 60597809

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Table of Contents

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) was initially engaged in early 2019 by South Energy Pty Ltd, on behalf of 892 Yarrawonga Development Pty Ltd, to provide a geotechnical desktop assessment for the proposed West Mokoan Solar Farm facility located on current private land on Benalla-Yarrawonga Road, in Benalla Shire in central northern Victoria. This site is located approximately 10 km north-east of Benalla town centre and shown in Figure 1.

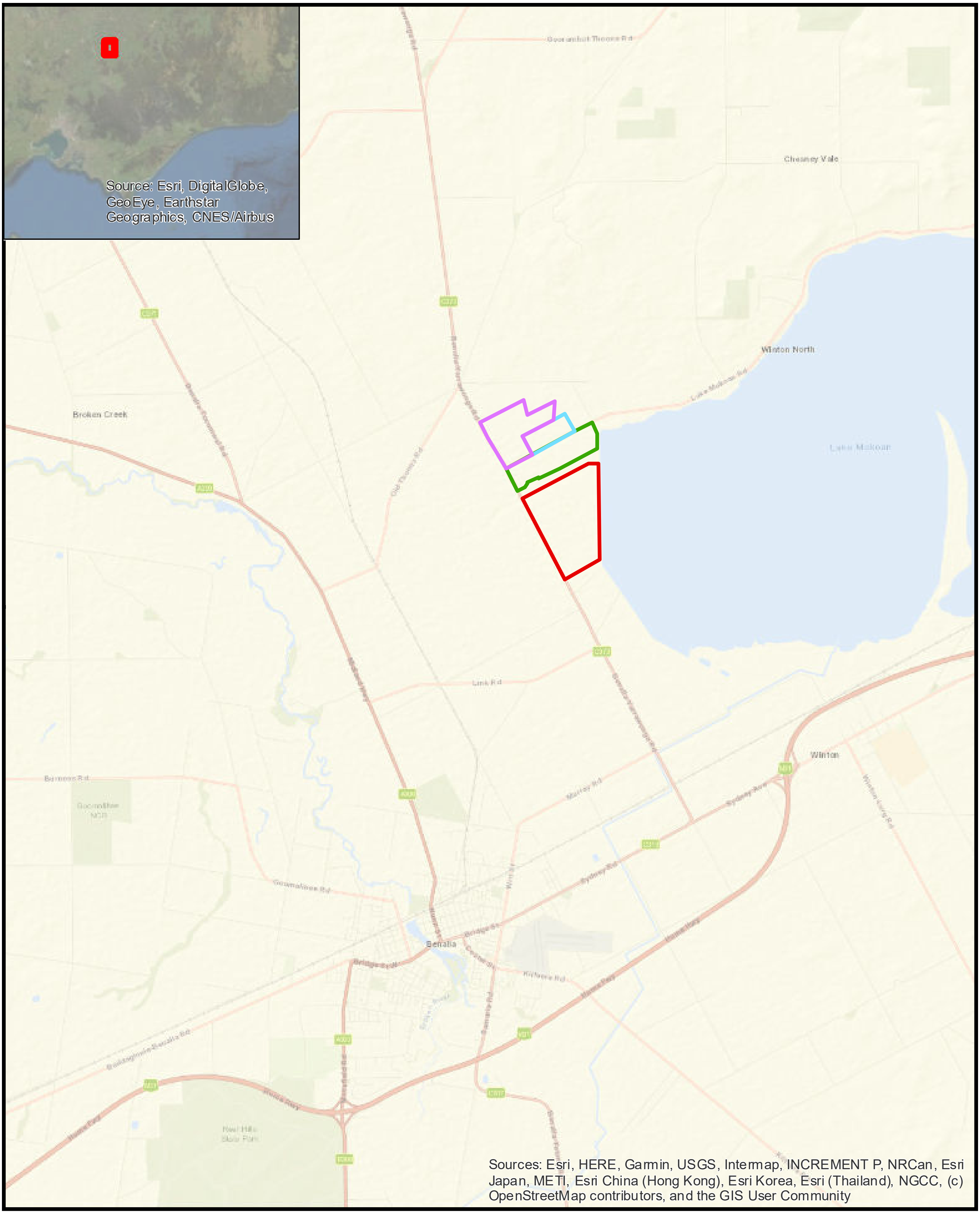
Subsequent to the early 2019 initial assessment which assessed land parcels to the north of the Winton Wetlands Outlet Channel, further parcels of land to the south (Lots 1-5; LP206524) have been added into the potential site. As a whole, the properties assessed have been herein referred to as 'West Mokoan Solar Farm'.

The site assessed in October 2019, is located at 616 Benalla-Yarrawonga Road, Benalla, highlighted overleaf in Figure 1.

1.1 Proposed Development

Based on the current Concept Design the development will consist of:

- Photovoltaic (PV) solar panel arrays, mounted on fixed tilt structures and supported on driven; helical; or screw piles, concrete 'ballast' blocks, or shallow pad footings;
- Containerised power converter units (PCUs) supported on shallow pad footings;
- Substation, O&M facility and Battery Energy Storage System (BESS);
- Lightweight buildings and associated infrastructure;
- Fencing and gates;
- Access roads and drainage works; and
- Service trenching, cables and transmission line connecting to the existing electricity network.



PROJECT ID	60338515
CREATED BY	ullahi
LAST MODIFIED	ullahi 29 OCT 2019

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Coordinate System: GDA 1994 MGA Zone 55

0 900 1,800 3,600

metres

1:100,000 (when printed at A4)

LEGEND

- Site 1 - 892 Benalla-Yarrawonga Road, Goorambat
- Site 2 - 81 Lake Mokoan Road, Goorambat
- Site 3 - Benalla-Yarrawonga Road, Benalla
- Site 4 - 616 Benalla-Yarrawonga Road, Benalla

Lake Mokoan Solar Farm Location Plan

892 Yarrawonga Development Pty Ltd

Lake Mokoan Solar Farm

Yarrawonga-Benalla Road, Benalla, Victoria

Figure

1

Map Document: (C:\Users\ullahi\Desktop\60597829_West Mokoan SF\60597809 Geotech.mxd)

1.2 Site Description

At the time of preparation of this report, the site was made up of four adjoining parcels of land as identified below, and located on Figure 2:

- Site 1 - 892 Benalla-Yarrawonga Road, Goorambat
- Site 2 - 81 Lake Mokoan Road, Goorambat
- Site 3 - Benalla-Yarrawonga Road, Benalla
- Site 4 - 616 Benalla-Yarrawonga Road, Benalla

The solar farm site is irregular in shape and forms a combined area of approximately 475 hectares over numerous large paddocks, which are currently used for broadacre farming (livestock grazing and cropping). Lake Mokoan Road is a sealed road which runs east from Benalla-Yarrawonga Road, and parallel to the Winton Wetlands Overflow Channel through the central portion of the site.

The four parcels of land which make up the subject site, shown in Figure 1, are identified as Site 1 to Site 4 for reference in this report.

The predominantly undeveloped land is relatively flat and includes a few scattered trees, several farm dams and various unsealed farm tracks. There are single-storey dwellings and associated farm buildings present on Sites 1 and 2 and 4, with no dwellings on Site 3. The dwellings are set back approximately 150 and 200 m from Benalla-Yarrawonga Road at Site 1 and Site 4 respectively, and 115 m from Lake Mokoan Road for Site 2.

The farm dams vary in size and shape, and are spread out across the site, with connecting drainage paths, which flow downslope. Historically landholders have constructed farm dams to store run-off generated from rainfall events to provide long-term storage for periods of below average rainfall and to act as sediment control devices. Farm dams are typically constructed by creating an excavation in the ground and using the removed soil to construct an earth embankment around the perimeter to increase storage capacity and provide freeboard.

Anecdotal discussions with the current Site 4 land owner have indicated that following significant rainfall events, the north-eastern portion of Site 4 can remain waterlogged for a period of around 24hours.

1.3 Site Setting and Adjoining Land Use

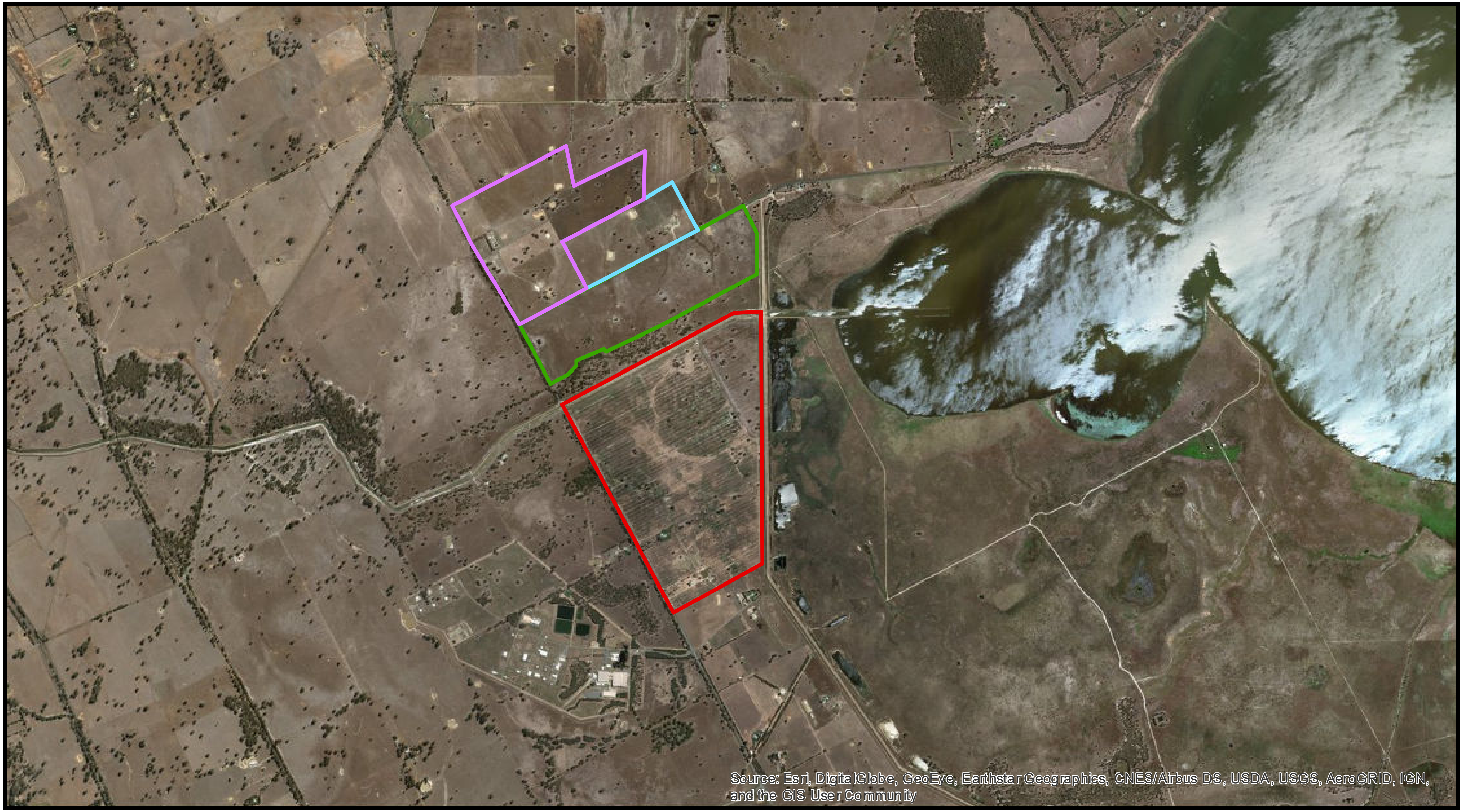
The neighbouring properties to the north, west and south of the sites are mainly agricultural land used for broadacre farming, with the Winton Wetlands being located to the east.

Planned flooding of the former Winton Swamp in 1971 inundated around 7,000 Ha of agricultural land and forests to create Lake Mokoan reservoir. The storage was subsequently decommissioned and drained in 2010 and is currently being restored as the Winton Wetlands. The large 3-4 m tall, earthen dam wall extends along the eastern boundary of the sites. Adjacent to the northern boundary of Site 4 is the Winton Wetlands Overflow Channel, known as Stockyard Creek, which flows in a westerly direction from the wetlands towards Broken River.

1.4 Purpose of Assessment

The geotechnical visual assessment was conducted to develop an understanding of the existing geological conditions at the sites and identify potential geotechnical hazards, which may present a constraint to construction and development of the proposed solar farm facility.

It should be noted that this assessment does not provide sufficient site-specific information to inform design. Information relating to planning, heritage, ecology, drainage and hydrology and other potential constraints are reported separately.



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LAST MODIFIED ullahi 29 OCT 2019

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0 462.5 925 1,850
metres
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LEGEND

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- Site 3 - Benalla-Yarrawonga Road, Benalla
- Site 4 - 616 Benalla-Yarrawonga Road, Benalla

Site Locations & Extents of Geotechnical Site Inspection

892 Yarrawonga Development Pty Ltd

Lake Mokoan Solar Farm

Yarraewonga-Benalla Road, Benalla, Victoria

Figure

2

Map Document: (C:\Users\ullahi\Desktop\60597829_West Mokoan SF\60597809 Geotech.mxd)

1.5 Scope of Work

The geotechnical assessment comprised a desktop study supplemented with a site walkover/drive-over to confirm existing surface conditions and identify any key geotechnical features if present.

The desktop study included a review of publicly available information and publications such as geological, soil, landscape, topographical and hydrogeological maps and aerial photography.

General geological considerations, broad geotechnical recommendations and potential geotechnical risks associated with construction of the solar farm development are included. It is to be noted no intrusive investigation was requested or undertaken to date.

2.0 Desktop Review

A desktop review of available information was undertaken as part of the investigation. The findings are discussed in the following sections.

2.1 Topography

The overall topography of the site is characterised by the low relief Shepparton Formation alluvial landform. The site exhibits a slight overall gradient fall with the Winton Wetland Overflow Channel representing the local low point.

Based on the Tomkinson Group Features and Levels Survey Plan (Drawing No. W1183-001) site elevations range between approximately 172 mAHD (metres Australian Height Datum) in the north of the sites and approximately 160 mAHD in the vicinity of the Overflow Channel.

There is a slight mounding centred on the dwelling at 892 Benalla-Yarrawonga Road, with a maximum surveyed elevation of 173 mAHD, which broadly correlates with the geological inlier described in Section 2.3.

2.2 Drainage

There are a number of unnamed shallow, low relief ephemeral drainage lines on the site, which generally flow towards the Overflow Channel. Other than Stockyard Creek and the Winton Wetlands there are no major water bodies in the vicinity of the site.

2.3 Geological Setting

The Geological Survey of Victoria 1:250,000 series ‘Wangaratta’ map sheet indicates the site is located in an area comprising Quaternary age (<2.6 Million years) fluvial and lacustrine sediments of the Shepparton Formation, generally associated with extensive prior stream networks, floodplains and colluvium.

The heterogeneous Shepparton Formation sedimentary unit typically comprises flood plain clays, silts, channel sands and minor gravel. The deposits are also known to contain quartz, mica, feldspar and ironstone and cemented sands. The sedimentary deposits generally constitute a relatively thin veneer over older stratigraphical units.

The Geological Survey of Victoria 1:100,000 series ‘Dookie’ map sheet was also reviewed, although the extent of the map sheet only covers a small area along the western side of the subject site, to provide greater clarity on the geological boundaries[1].

The map sheet shows a discrete area (geological inlier) to the north of the subject site comprising extensive quartz rich Pinnak Sandstone deposits, associated with Ordovician age Adaminaby Formation. The formation is indicated to comprise dark to pale grey and green, very thick to thin bedded, turbidic sandstone, siltstone, shale and occasional chert.

The Geological Survey of Victoria 1:250,000 series ‘Wangaratta’ map sheet indicates that to the northwest of Site 4, paludal sediments comprising silts and clays are to be anticipated, which on a local scale extend to the Winton Wetlands.

The geological map sheets do not indicate any faulting, geological structures or mining activities on, or in close proximity to the site.

[1] There is no published 1:100,000 scale geological map sheet adjoining the eastern side of the 1:100,000 Dookie map sheet

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Coordinate System: GDA 1994 MGA Zone 55

0 195 390 780
metres
1:20,000 (when printed at A4)

LEGEND

- Pinnak Sandstone(Oap): generic
- Shepparton Formation (Nws): generic
- incised colluvium (Nc1): generic
- swamp and lake deposits (Qm1): generic
- Site 1 - 892 Benalla-Yarrawonga Road, Goorambat
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- Site 4 - 616 Benalla-Yarrawonga Road, Benalla

Geological Setting

892 Yarrawonga Development Pty Ltd

Lake Mokoan Solar Farm

Yarrawonga-Benalla Road, Benalla, Victoria

Figure

3

Map Document: (C:\Users\ullahi\Desktop\60597829_West Mokoan SF\60597809 Geotech.mxd)

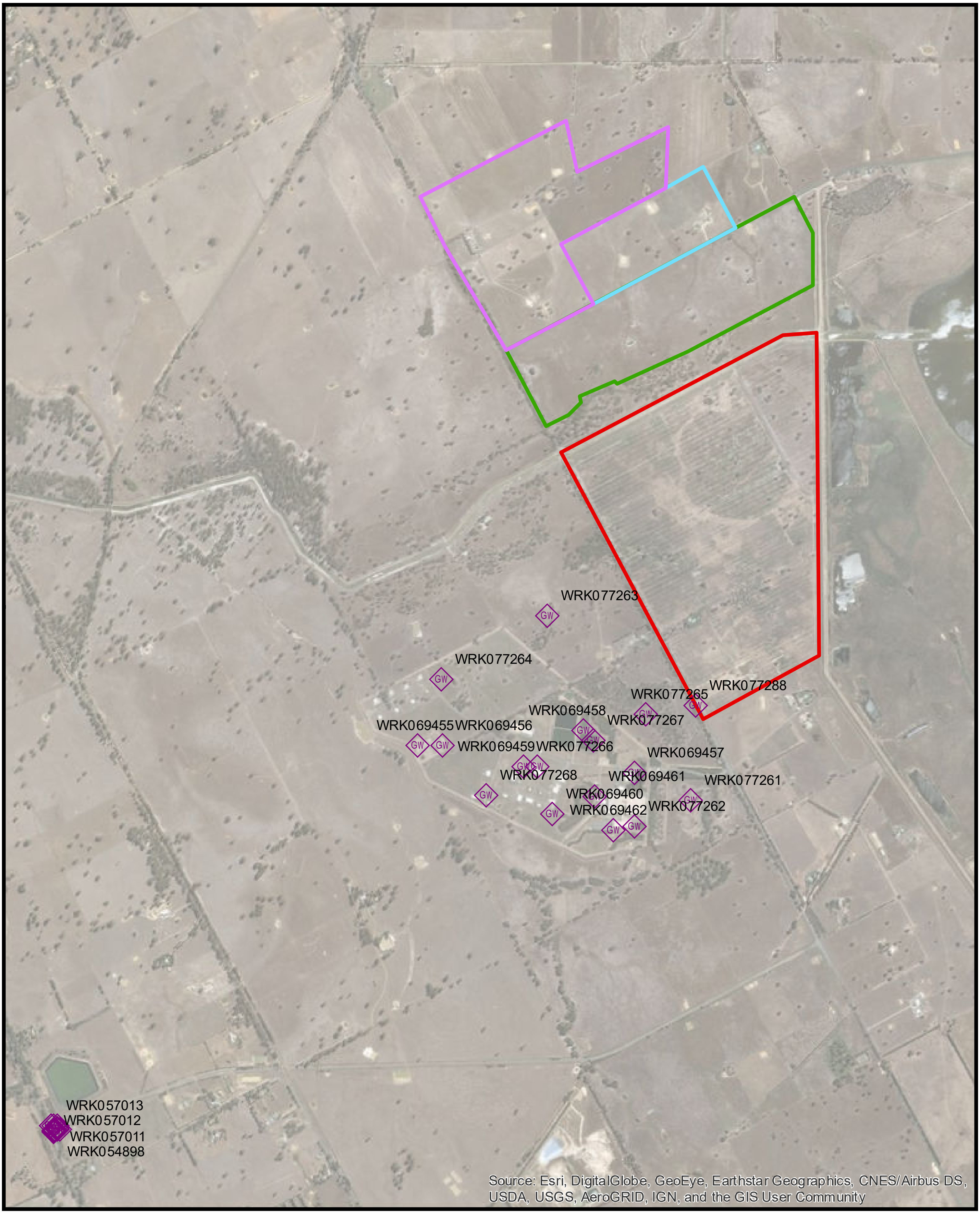
2.4 Regional Hydrogeology

The Department of Environment, Land, Water and Planning web-based groundwater reporting tool 'Visualising Victoria's Groundwater' (VVG) indicates depth to groundwater is expected to be around 5 - 10 m from the existing ground surface.

The VVG online map (www.vvg.org.au) indicates there are 28 observation bores within close proximity to the boundary of the site, summarised in Table 1 below and presented on Figure 4.

Table 1: Groundwater bore locations within close proximity of the sites

Bore ID	Easting (m)	Northing (m)	Depth (m)	Year Completed	Lithology Log
WRK054892	407570	5959257	5	2010	No
WRK054893	407560	5959258	5	2010	No
WRK054894	407568	5959263	5.2	2010	No
WRK054895	407586	5959271	5	2010	No
WRK054896	407581	5959287	6	2010	No
WRK054897	407597	5959264	6	2010	No
WRK054898	407564	5959244	5.9	2010	No
WRK054899	407550	5959283	6	2010	No
WRK057011	407584	5959259	6	2010	No
WRK057012	407543	5959285	6.5	2010	No
WRK057013	407559	5959288	6.2	2010	No
WRK069455	409786	5961608	18	2012	Yes
WRK069456	409940	5961608	17	2012	Yes
WRK069457	411111	5961444	16	2012	Yes
WRK069458	410801	5961703	18	2012	Yes
WRK069459	410523	5961482	17	2012	Yes
WRK069460	410614	5961190	18	2012	Yes
WRK069461	410872	5961295	18	2012	Yes
WRK069462	410982	5961089	18	2012	Yes
WRK077261	411461	5961276	17	2013	Yes
WRK077262	411116	5961115	17	2013	Yes
WRK077263	410584	5962401	17	2013	Yes
WRK077264	409933	5962014	9	2014	Yes
WRK077265	411181	5961800	17	2014	Yes
WRK077266	410433	5961480	17	2014	Yes
WRK077267	410863	5961643	17	2014	Yes
WRK077268	410209	5961309	17	2014	Yes
WRK077288	411488	5961851	3	2013	Yes



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LEGEND

GW Groundwater Monitoring Bore

Site 1 - 892 Benalla-Yarrawonga Road, Goorambat

Site 2 - 81 Lake Mokoan Road, Goorambat

Site 3 - Benalla-Yarrawonga Road, Benalla

Site 4 - 616 Benalla-Yarrawonga Road, Benalla

Groundwater Monitoring Bore Locations

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Lake Mokoan Solar Farm

Yarrawonga-Benalla Road, Benalla, Victoria

Figure

4

2.5 Previous Geotechnical Investigations

AECOM is not aware of any geotechnical investigations on or within close proximity to the site. It is possible that previous investigations or construction records may exist for transmission towers which are located within the site

2.6 Sodic Soils

The Victorian Resources Online (VRO) maps (formerly Department of Agriculture) have been compiled from previous soil and land surveys over the past 50 years, with the generalised maps issued at regional scale. These have been reviewed to provide a general indication of likely soil characteristics at the West Mokoan Solar Farm on a local level and provide basis for possible further investigation.

The maps indicate that sodic soils, a soil with exchangeable sodium greater than 6%, could be present onsite (Figure 5). Sodic soils typically occur on broad, flat landscapes with poor drainage, particularly in arid environments. The Bureau of Meteorology (BOM) indicates Benalla has a mean annual rainfall of approximately 670 mm. Sodic soils are susceptible to dispersion and waterlogging, and earthworks which contain dispersive soils are generally more erodible.

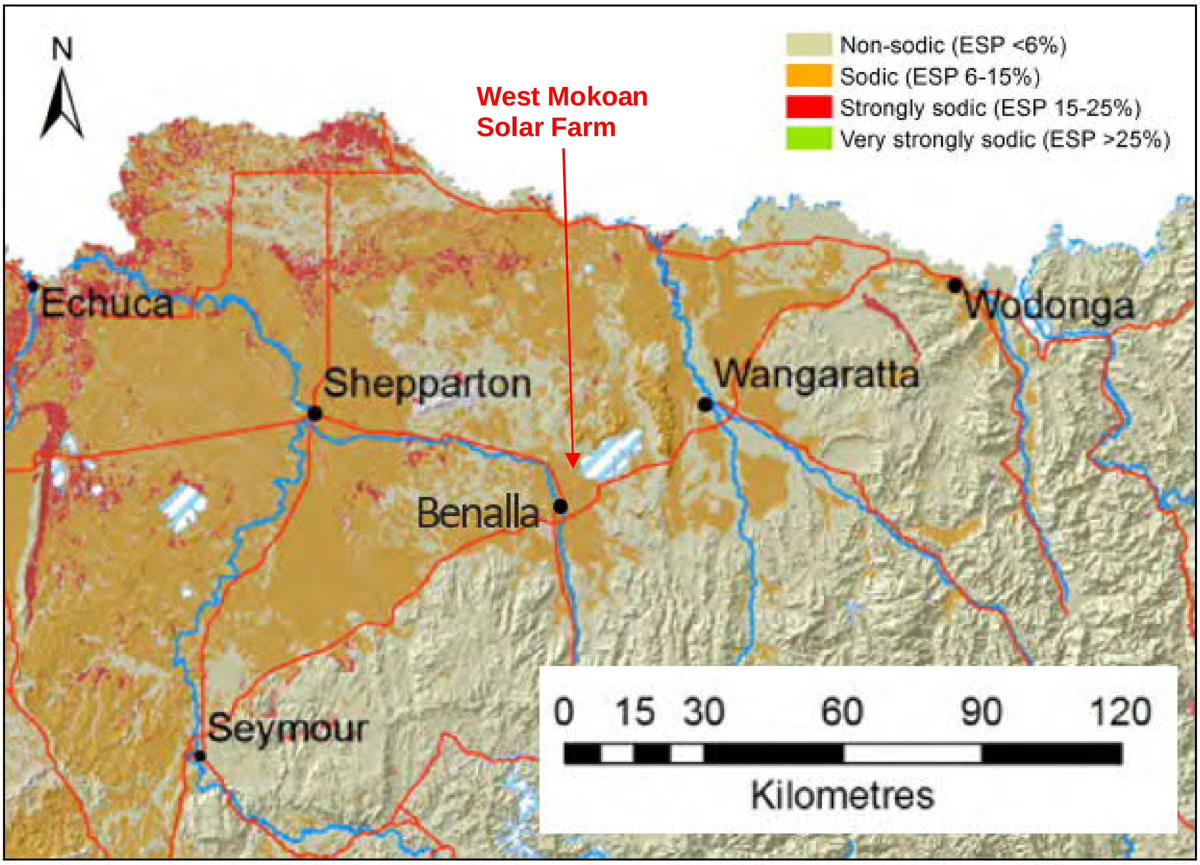

Figure 5: Generalised regional map of Victorian sodic soil distribution

2.7 Acid Sulphate Soils

Based on review of VRO maps and given the location and elevation of the site, it is considered that there is very low probability of occurrence for acid sulphate soils to be present on the site.

2.8 Easements and Existing Power Infrastructure

There are a number of electricity transmission, telecommunication and power line easements across the sites. The 220 kV Glenrowan to Shepparton overhead transmission line traverses the eastern portion of the site in a NNW-SSE orientation, in a 62 to 84 m wide corridor easement. The transmission lines are carried on a series of self-supporting, galvanized steel lattice towers constructed in the paddocks, Figure 6. There are also a number of narrower easements for the power poles servicing the various dwellings and outbuildings.

Figure 6: 220 kV Glenrowan to Shepparton transmission line and smaller local feeder line

3.0 Visual Site Inspections

A walkover and drive over survey was carried out for Sites 1,2 and 3 on 23 January 2019 and Site 4 on 25 October 2019 by an AECOM engineering geologist, to inspect the landform and identify surface features of interest.

At the time of the inspection of Sites 1,2 and 3, the weather conditions were dry and sunny, with Site 4 being inspected in overcast conditions, with all areas accessible using a 4WD vehicle. At the time of the inspection of Site 4, visual inspection of the site was restricted due to the density and maturity of the planted crops, as seen in Figure 7.

The site visits were supplemented by an anecdotal discussion with the local landowners (where available) for any relevant information on site features, conditions and behaviours.

3.1 Surface Conditions

The site visits generally confirmed the findings of the desktop study, with the land observed to be used primarily for grazing and cropping. At the time of the inspection of Sites 1,2 and 3, the vegetation mainly consisted of sparse, short grass and interspersed with barren areas. As previously indicated, the visual inspection of Site 4 was restricted due to the density and maturity of the cropping.

Figure 7: Crop Maturity at the time of the Site 4 inspection

A number of medium to large sized trees were interspersed around the perimeter of the internal post and wire fence lines, or as a copse around the farm dams.

The shallow farm dams described in Section 1.2 are generally oval or rectangular in plan and between 30 and 75 m in length. Most of the dams were constructed with the earth embankment completely enclosing the storage. However, some of the dams only had the earth embankment constructed around three sides, with the northern upslope side open facilitating catchment. In general, the embankments of the farm dams were less than 1 m in height, with very gentle internal and external side slopes. It is likely the farm dams had been in use for many years and the embankments worn down to a varying degree due to effects of weathering and long-term trafficking by cattle.

The materials exposed along the farm dam embankments were observed to be a dry, friable silty/sandy clay. In some sections of the dam embankments, a covering of fine to medium grained, red-brown ferruginous gravel was observed as shown in Figure 8. The dam sides also showed minor signs of erosion, with shallow rilling observed in isolated areas as shown in Figure 9.

Figure 8: Gravel exposed on farm dam embankment

Figure 9: Surface desiccation feature

3.2 Site Features

Photographs taken of the key features observed during the site visit are included in Appendix B and labelled LM01, LM02 etc. for reference. A brief description of each feature is provided in Table 2 below, and the corresponding location presented in Appendix A.

Table 2: Key site features

ID	Description
LM01	5Ml dam, recently deepened
LM02	Dry drainage line meander, looking south
LM03	Dry drainage line meander, looking north

ID	Description
LM04	Rectangular shaped dam
LM05	Lake Mokoan Road, looking east
LM06	From Lake Mokoan Road looking south
LM07	From Lake Mokoan Road looking north
LM08	5 Ml irregular shaped dam
LM09	5 Ml irregular shaped dam
LM10	3 Ml square shaped dam
LM11	Medium sized square shaped dam
LM12	Line of trees
LM13	Medium oval shaped dam
LM14	Small sized oval shaped dam
LM15	Quasi square shaped dam
LM16	From top of Winton Wetlands dam wall looking west
LM17	Eastern end of Site 3 showing Lake Mokoan Road and Site 2 dwelling on right of photo
LM18	From Lake Mokoan Road looking south
LM19	Winton Wetlands Outfall Channel
LM20	Agricultural dam embankment
LM21	Site 4 viewed from Winton Wetlands Embankment (South)
LM22	Site 4 viewed from Winton Wetlands Embankment (Northwest)
LM23	Evidence of farm machinery track depressions suggesting soft ground
LM24	Perimeter access track
LM25	Agricultural dam
LM26	Ephemeral drainage channel (South)
LM27	Exposed ground
LM28	Ephemeral drainage channel (North)
LM29	Ephemeral drainage channel (North)
LM30	Agricultural dam embankment
LM31	Excavation spoil from dam construction
LM32	Farm operation access track and exposed ground

No groundwater monitoring or operational water bores suitable for groundwater level measurement were observed on site.

Site 4 was noted to have a number of ephemeral drainage channels traversing the site, generally draining the site to the perimeter. The drainage channels were up to 1m in depth and typically approximately 1m in width. The nominal alignment of the drainage channels is presented in Figure 10.

During periods of rainfall, it is suggested the channels will be susceptible to localised ground saturation and softening, which may be required to be addressed as part of ongoing concept design development. Refer to ‘Surface Water Assessment’ prepared by AECOM for further details.

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LEGEND

SymbolID

- Observed Ephemeral Drainage Channels
- Site 4 - 616 Benalla-Yarrawonga Road, Benalla

Observed Ephemeral Drainage Channels - Site 4

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Yarrawonga-Benalla Road, Benalla, Victoria

Figure

10

Map Document: (C:\Users\ullahi\Desktop\60597829_West Mokoan SF\60597809 Geotech.mxd)

4.0 Geotechnical Considerations

4.1 General

The geotechnical assessment indicates the geological conditions across the site are relatively uniform, and the area generally suitable for construction of the proposed solar farm facility, subject to the following considerations. The assessment also indicates there is reduced potential for flooding, landslides or subsidence, however small-scale surface erosion may occur.

The general preliminary advice and recommendations provided in the following sections should be supported by a detailed geotechnical investigation, including borehole drilling and/or test pit excavations, to confirm the findings of this assessment and provide design parameters and reduce geotechnical uncertainty. The following sections relate to key considerations only, and are not intended to be exhaustive, and other geotechnical risks may be identified during design development and construction phases.

4.2 Anticipated Ground Conditions

Based on visual and tactile assessment, the near surface soils at the site appear to generally comprise a relatively thin layer of clayey silt (topsoil) overlying generally silty/sandy clay. At the time of the site visit, the near surface site clays observed in the dams were assessed to be medium to high plasticity, dry of the plastic limit, and of very stiff to hard consistency. However, significant softening of the soil can occur when wet, as evident from the farm machinery tyre depressions observed in the October inspection of Site 4 as shown in Figure 11 and 12.

Figure 11: Evidence of depression of soil soils induced by farm machinery traffic (October 2019)

Figure 12: Evidence of depression of soil soils induced by farm machinery traffic (October 2019)

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The clays are likely to be reactive and hence prone to shrink and swell movements upon wetting and drying. Cracking of the exposed ground surfaces was observed, indicating potential for shrink-swell activity due to seasonal moisture variations.

The surface soils are potentially dispersive and erodible under the action of running water. Erosion of the exposed surfaces and turbid dam tends to confirm the potential for dispersivity of the site soils.

No rock was observed during the site visit and is not expected to be encountered during construction works, with the exception of the slightly elevated area adjacent to Benalla-Yarrawonga Road described in Section 2.3, where shallow rock may be present. Further investigation would be required to confirm the presence, depth, weathering and extent of the rock.

4.3 Anticipated Site Classification to AS2870-2011

Site classification for foundation soil reactivity provides an indication of the amount of ground surface movement which has potential to occur with seasonal variation in moisture. Although not strictly applicable to the proposed solar farm development, Australian Standard AS2870-1996 'Residential Slabs and Footings' has been referenced to provide an overall site classification for preliminary foundation design purposes.

Based on the findings of the assessment, a site classification of H1-D to H2-D (for deep seated moisture range) is anticipated for the existing site conditions, with a corresponding characteristic surface movement (y_s) of between 40 and 75 mm. It is recommended a design suction change (H_s) of 3 m be adopted.

It should be noted that any cut or fill earthworks may alter the characteristic surface movement and modify the site classification, hence these areas of the site will need to be re-assessed giving consideration to final design levels.

4.4 Site Trafficability

During dry weather the near surface soils are expected to provide a suitable surface on which to run construction plant. However, appreciable softening of the clays and subsequent trafficability problems may be encountered during wet weather. Should trafficability difficulties be encountered, consideration should be given to the placement of a granular working platform.

4.5 Site Preparation and General Earthworks

The site won materials may be considered suitable for construction of engineered fill but will require appropriate moisture conditioning. Stripping of surficial siltier soils may be necessary, prior to the fill placement, but this is to be confirmed by geotechnical investigations. Particular care is needed in the backfilling of farm dams, to ensure all wet and softened soil is removed, prior to filling.

4.6 Excavation Conditions

As the site is relatively flat, it is anticipated that that further earthworks will be required to establish access tracks and foundation preparation. Based on the findings of the desktop assessment, the near surface soil at the site is likely to comprise clay generally of very stiff to hard consistency. These soils are expected to be readily excavated by conventional mechanical excavation equipment. For the area in the north west of the site, targeted investigation will be required to assess the depth, extent and weathering of the rock near the dwelling (if present) and whether localised rock breaking or ripping will be required.

4.7 Groundwater

Based on publicly available data and site observations, it is likely that groundwater will generally be between 5-10 m below the existing ground surface. In the vicinity of the Overflow Channel, this level may be less than 5 m below existing surface.

4.8 Suitable Foundation Types

The surface materials expected over the extent of the site are not anticipated to provide a significant challenge with respect to foundation design and construction. Shallow spread footings, driven steel piles (channel of CHS) and /or screw piles may be considered suitable options. The design of the foundation will need to take the effects of the 'shrink-swell' effects into account. Consideration may need to be given to founding of the piles below the design suction depth H_s (see Section 4.3). The soil swelling around the pile shaft could also lead to tension forces in the pile and therefore full-length reinforcement should be used if concrete piles are used.

For lightweight buildings, it is expected stiffened raft or strip and pad footings may be appropriate.

4.9 Site Seismicity

Based on Australian Standard AS1170.4-2007 '*Structural Design Actions Part: 4, Earthquake actions in Australia*', Section 3, the hazard factor (Z) for the site is 0.09g (0.09g in 500 years probability of exceedance).

Based on the anticipated subsurface conditions at the site, the sub-soil classification considered appropriate at this preliminary stage: would be Class C (Deep Soil Site).

4.10 Access Track Pavement Design

For preliminary purposes a design CBR of 3.0% is considered appropriate.

5.0 Further Geotechnical Site Investigation

The currently available geotechnical information is insufficient to facilitate design of the civil elements and foundations expected for the proposed solar farm development and therefore intrusive geotechnical investigation will be required. It is recommended the geotechnical investigation(s) incorporate the following key elements.

- Drilling of boreholes and/or excavation of test pits to characterise the soils;
- Collection of disturbed and undisturbed soil samples, and rock core where present;
- In-situ testing such as:
  - Dynamic Cone Penetrometer (DCP) tests adjacent to test pits and boreholes
  - Standard Penetration Tests (SPT) at regular depths in the boreholes.
  - Shear vane tests in boreholes / test pits and on undisturbed samples.
- Geotechnical testing at soil and rock testing laboratories for both soil classification and assessment of engineering parameters of soil and rock such as:
  - Particle size distribution tests (PSD) grading and hydrometer;
  - Atterberg Limit tests
  - Shrink-swell tests
  - Soil compaction tests
  - 4-day soaked CBR tests
  - Unconsolidated Undrained (UU) triaxial compression tests
  - Soil dispersivity (pinhole dispersion test and/or Emerson Class test)
  - Point Load Index tests on samples of rock
  - Uniaxial Compressive Strength (UCS) on samples of rock
- Soil aggressiveness against concrete or steel (durability testing) comprising pH, chloride (Cl), sulphate (SO_4) and electrical conductivity (EC)
- Thermal resistivity testing to assess the soils capacity to conduct or dissipate heat; and
- Electrical resistivity testing of the soil, to determine the conductivity for electrical grounding design.
- Testing for soil contamination potential may also be required.

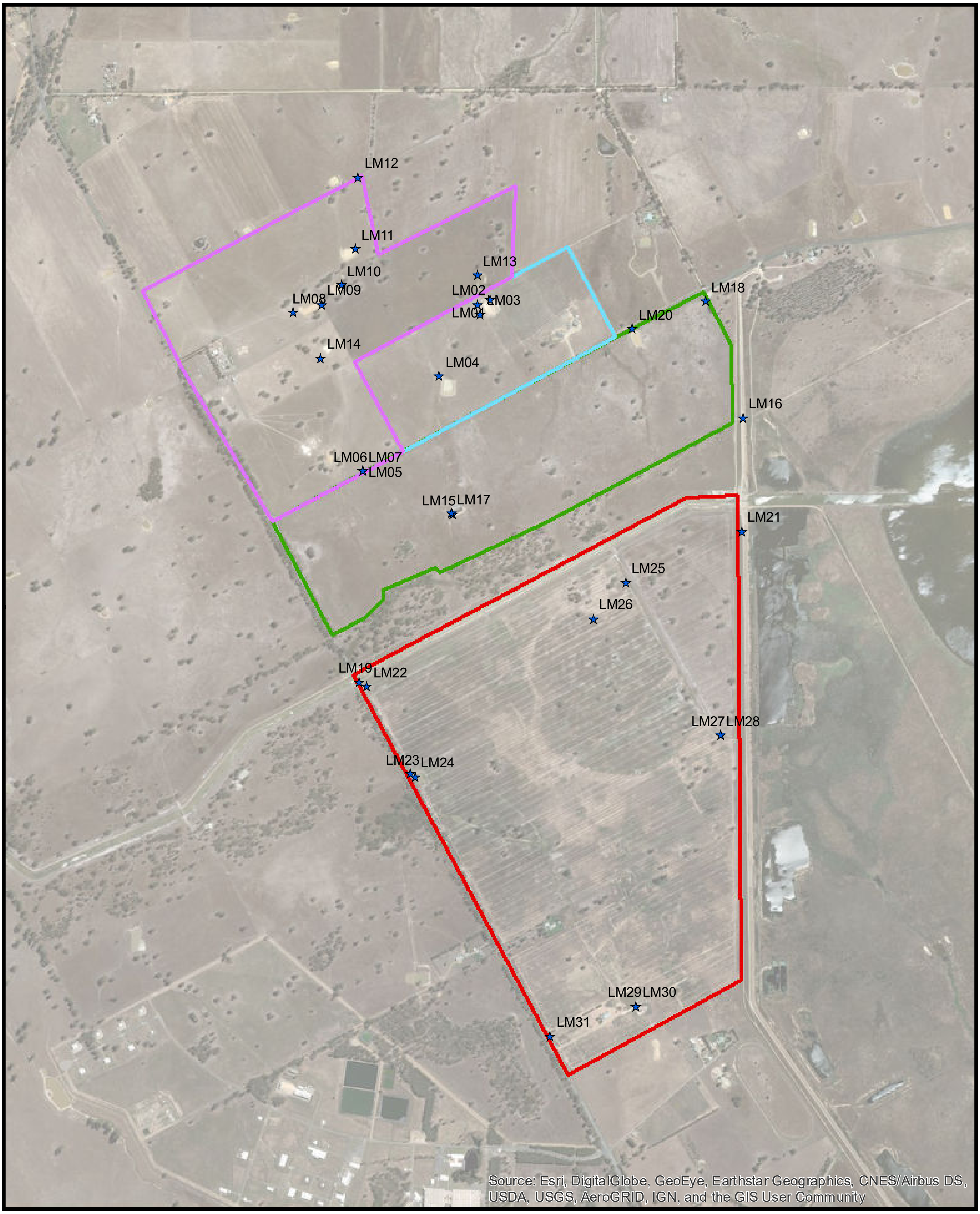
6.0 References

1. Geological Survey of Victoria '*Wangaratta'* 1:250,000 series map sheet.
2. Geological Survey of Victoria '*Dookie'* 1:100,000 series map sheet.
3. Australian Standard AS1170.4-2007 – '*Minimum Design Loads on Structures, part 4: Earthquake Loads*'
4. Australian Standard AS2870-1996 '*Residential Slabs and Footings.*'
5. Visualising Victoria's Groundwater, 2016 (*http://maps.cerdi.com.au/vvg.php*)

Appendix A

Figures

Appendix A Figures



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- Site 2 - 81 Lake Mokoan Road, Goorambat
- Site 3 - Benalla-Yarrawonga Road, Benalla
- Site 4 - 616 Benalla-Yarrawonga Road, Benalla

Photograph Location Plan

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Lake Mokoan Solar Farm

Yarrawonga-Benalla Road, Benalla, Victoria

Figure

A1

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Appendix B

Site Photographs

Photograph LM 1

Photograph LM 2

Photograph LM 3

Photograph LM 4

Photograph LM 5

Photograph LM 6

Photograph LM 7

Photograph LM 8

Photograph LM 9

Photograph LM 10

Photograph LM 11

Photograph LM 12

Photograph LM 13

Photograph LM 14

Photograph LM 15

Photograph LM 16

Photograph LM 17

Photograph LM 18

Photograph LM 19

Photograph LM 20

Photograph LM 21

Photograph LM 22

Photograph LM 23

Photograph LM 24

Photograph LM 25

Photograph LM 26

Photograph LM 27

Photograph LM 28

Photograph LM 29

Photograph LM 30

Photograph LM 31

Photograph LM 32

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