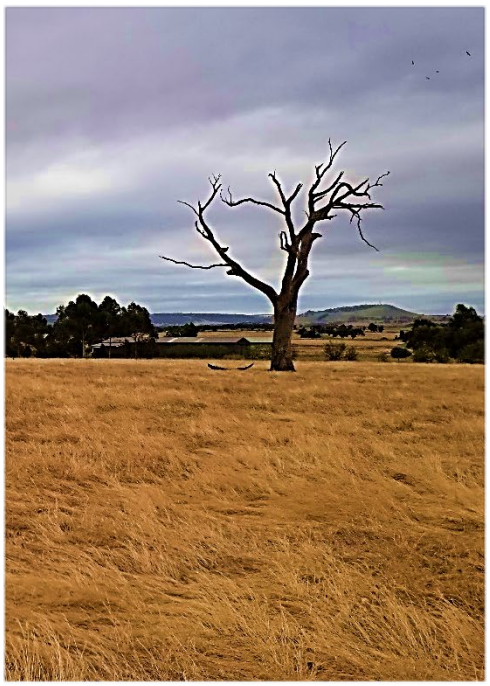
Planning Report

Anakie Solar Farm –1435-1475 Ballan Road Anakie

November 2022

Project Number: 21-425

ADVERTISED PLAN



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Acronyms and abbreviations

AHD/elevation	Australian height datum/ground height above sea level
BESS	Battery Energy Storage System
BPA	Bushfire Prone Area
CFA	Country Fire Authority
DELWP	Department of Environment, Land, Water and Planning (VIC)
EMP	environmental management plan
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Cwth)
ESO4	Environmental Significance Overlay Schedule 4 (of the scheme)
FZ	Farming Zone
ha	hectares
km	kilometres
LGA	Local government area
m	metres
MWh	megawatt hour
P&E Act	*Planning and Environment Act 1987* (VIC)
PP	Planning Permit
PR	this Planning Report
PV	photovoltaic
proponent	BNRG Renewables Ltd
subject land	1435-1475 Ballan Road, Anakie 3213
the proposal	Anakie Solar Farm
the proposal site	The development footprint within the subject land
the scheme	The Greater Geelong Planning Scheme
TIA	traffic impact assessment
TRZ2	Transport Zone 2 (of the scheme) (as applying to Ballan Road)
VIA	visual impact assessment

Executive summary

The Anakie Solar Farm (the proposal) is located south of the town of Anakie, Victoria (Figure 2-1). The subject land address is 1435-1475 Ballan Road, Anakie 3213. The land is formally identified as Lot 6 TP434281. Works are also proposed within the road reserve of Ballan Road adjacent to the subject land. The land is 22km north of the Geelong CBD and 6km south of the rural town of Anakie, Victoria, within the City of Greater Geelong Local Government Area.

This Planning Report (PR) is seeking a planning permit for the use and development of the proposed Anakie Solar Farm including:

- A maximum 4.99 Megawatt (<5MW) solar energy facility within the Farming Zone (FZ):
  - Up to 12ha of fenced solar array on tilt trackers would be installed within the array with a maximum tilt of 60 degrees (east to west) and resting angle of 0 degrees.
  - Inverters and substation.

And additional works including:

- Utility installation:
  - Powerline connection to the 22kV distribution system located within the Geelong-Ballan Road reserve.
  - And exempt minor utility installation, battery energy storage system (BESS) with a proposed capacity of up to 23 MWh.
- Road works:
  - Proposed site entry off the Geelong-Ballan Road (Transport Zone, TRZ2).
- Native vegetation removal:
  - Including all vegetation within the development footprint and for proposed road works.

The proposal, see Figure 2-8, has been designed with an iterative approach and:

- Is consistent with the provisions of the Greater Geelong Planning Scheme, specifically but not limited to clauses:
  - 53.13 renewable energy facilities – The proposal has been designed to address site constraints and opportunities and avoids and minimises impacts.
  - 52.17 native vegetation – The proposal avoids and minimises impacts to the higher value native vegetation located in the subject land as much as practicably possible.
  - 13.02 bushfire planning – The site is considered low risk and bushfire impacts have been designed for and the site would be managed in accordance with relevant Australian Standards, and the CFA's *Design Guidelines and Model Requirements: Renewable Energy Facilities* (CFA, 2022).
  - 14.01-1S and 21.05 – The proposal addresses the potential for state, regional and local agricultural impacts, land capability, continuation of farming on the subject land, and compatibility of the proposal considering surrounding agricultural land uses.

The proposal addresses relevant site factors. Necessary specialist reports have been prepared to inform the layout, and the findings are summarised below:

- Ecology – The Ecological Assessment (NGH, 2022) shows the proposal has avoided and minimised impacts to native vegetation by designing the proposed layout with an iterative

approach. Areas of higher value vegetation identified on the subject land have been avoided. The proposal would need to remove 0.071ha of native vegetation including one large tree (stag) within the proposal site. The required offsets have been determined for the proposal.

- Traffic – A Traffic Impact Assessment (AMBER, 2022) has assessed the traffic impacts of the proposal. Access to the site would be provided via a new access to Ballan Road. The site would generate up to 108 vehicle movements per day during peak construction times, including up to 38 truck movements. The road network is able to accommodate the traffic generated and vehicle types (roads are designated for B-double vehicles) by the development during the construction, operation, and decommissioning stages. A small number of oversize and overmass vehicles would be required to deliver larger plant to the site such as the sub-station transformer and earthmoving equipment. To mitigate the impacts of the development during construction a Traffic Management Plan would be prepared.
- Noise – An Acoustic Report (Renzo Tonin & Associates, 2022) was completed and considered a worst-case scenario demonstrates compliance can be achieved with relevant EPA guidelines and standards and would be low risk with respect to operational and construction noise and vibration and can operate without adverse acoustic impact on residential amenity. The report found that there would be no likely noise exceedances of the relevant noise criteria:
    - EPA 1826 noise limits.
    - Construction noise and vibration criteria.

  A Noise Management Plan would be prepared and include recommendations from the Acoustic Report with respect to noise and vibration during the construction phase.

- Visual – The Visual Impact Assessment (NGH, 2022) found that existing vegetation and topography prevent the majority of views into the proposal site, however views would be possible from the property to the north (shed and cropping land), Ballan Road (mostly glance views due to a 100km road speed) and is likely from the dwelling located approximately 300m to the south of the proposal site, however existing trees and boundary fence vegetation would limit views (identified as R1). The impacts, post mitigation, are assessed as Low. Potential views from R1 would be further screened by improved existing tree line plantings. The mitigation measures committed to by the proponent in this PR relating to management of traffic, control of light spill, dust minimisation, and design (materials and colours) would avoid and minimise associated impacts to near residents and road users.
- Glint and Glare – The Glint and Glare Assessment (MOIR L.A., 2022) includes a technical modelling analysis of potential impacts. The assessment concluded that there would be no glare impacts to dwellings, other than the associated dwelling and very limited impacts to road receptors. Existing vegetation provides appropriate mitigation, no further mitigation would be required.
- Agriculture – The Agricultural Assessment (Meridian Agriculture, 2022) confirms the proposal:
    - Would not be located on high quality agricultural land.
    - Would have no effect on the ability of surrounding property owners, nor would it impact on the agricultural sector in the wider region.

- Would be a medium-term loss of part of the agricultural land of the site, but this would not prohibit grazing of cattle or cropping on the remainder of the subject land during operation of the proposal.
- When the proposal is decommissioned, there would be no residual detrimental impact on the productivity of the site. Soil fertility would decline over time, but this can be easily corrected.

The avoidance, minimisation and mitigation measures set out in this PR, and supporting documents and proposal plans, have been committed to by the proponent. Prior to commencement of relevant stages, relevant Environment Management Plan (EMP) documents would be prepared. Impacts would be effectively managed through implementation of the EMP for the site. The proponent would submit the EMP to the DELWP prior to commencement of relevant stages. Sub plans would include:

- Risk, Fire and Emergency Management Plan.
- Landscape Plan.
- Landscape (Flora, Fauna, Weeds, Pest) Management Plan.
- Noise Management Plan.
- Traffic Management Plan.
- Soil and Water Management Plan.
- Waste Minimisation and Management Plan.

The proposal:

- Has been designed in consideration of the Greater Geelong Planning Scheme and the Solar Energy Facilities Design and Development Guidelines (DELWP, 2019).
- Would contribute to the achievement of the Victorian Government's renewable energy policies. The proposal is estimated to generate 12,000MWh in the first year, the equivalent to supplying over 1,500 households with renewable electricity. The BESS would also assist in delivery of power during peak times to the network.
- Provides for diversification of economy, directly strengthening the resilience of the current agricultural business (existing farm) and the region generally.

1. Introduction

1.1 Overview

This Planning Report (PR) has been prepared to support a Ministerial Planning Permit seeking the Ministers approval of a proposed <5MW AC solar energy facility and up to a 23MWh Battery Energy Storage System (BESS) at 1435-1475 Ballan Road Anakie (the proposal). This PR identifies and assesses the potential environmental and planning issues associated with the construction, operation, and decommissioning of the proposal. This PR has been prepared by NGH on behalf of the proponent BNRG Leeson (acting for BL Anakie Solar Nominees Pty Ltd as trustee for BL Anakie Solar Trust).

The proposal includes the installation of energy generating solar infrastructure including 11.7 hectares (ha) of single axis (tracking) solar array, inverters, substation, transmission line connection, site entries (construction/operation and emergency), traversable fire break and BESS.

The land is subject to the planning provisions of the Greater Geelong Planning Scheme (the Scheme) and is located on land zoned Farming Zone (FZ). As outlined by the Decision Guidelines of the Planning Scheme, this PR considers potential impacts of the proposal and specifically addresses construction and operational aspects such as social impacts (visual effect, glint and glare, noise, air quality and land use compatibility), and environmental impacts (native vegetation, water, bushfire, traffic). These matters have been addressed in Section 5 of this PR and accompanying specialist studies and reports as listed in Table 2-2.

This PR should be read in conjunction with the accompanying plans and documentation as listed below.

Table 1-1 Accompanying plans and documentation

Appendix	Description	Prepared by
A	Development Plans	BNRG
B	Certificates of Title	BNRG
C	Ecology Report	NGH Pty Ltd
D	Traffic Impact Assessment	Amber
E	Visual Impact Assessment	NGH Pty Ltd
F	Glint and Glare Assessment	MOIR Landscape Architects
G	Noise (acoustic) Assessment	Renzo Tonin & Associates
H	Agricultural Assessment	Meridian Agriculture

The structure and content of the PR addresses the Planning Scheme relevant to the proposal site and the Solar Energy Facilities Design and Development Guideline (DELWP, 2019).

2. The proposal and location

2.1 Locality and subject land

The Anakie Solar Farm (the proposal) is located on the Ballan Road 22km north of the Geelong CBD and 6km south of the rural town of Anakie, Victoria, see Figure 2-1.

The Greater Geelong Planning Scheme states that Anakie is considered the gateway to a number of tourist destinations and facilities such as the Brisbane Ranges, Anakie Gorge, small art/craft outlets, Fairy Park, and a number of wineries. The Geelong-Ballan Road is used as the throughfare to Anakie and these destinations. Geelong is the closest city to the proposal site has a population of 252,217 and is Victoria's largest provincial city (GGCC, 2022).

The closest renewable energy project under consideration in the Immediate area is:

- Inverleigh Wind and Solar Farm (solar part). Located west of Geelong and approximately 5.7km to the southwest of the proposal site.

The subject land is identified as 1435-1475 Ballan Road, Anakie and is within the City of Greater Geelong Local Government Area (Greater Geelong LGA), formally identified as Lot 6 TP434281, see Figure 2-2. The total area of the subject land is approximately 44ha, with up to a maximum of 12ha of the land forms the proposal site (proposed lease area). Certificates of Title for the property are included at Appendix B.

The subject land is agricultural land and is zoned Farming Zone (FZ). The land is currently used for grazing and has historically been used for cropping. The site is rectangular in shape with an east west long orientation. The land is in a gently undulating/sloping landscape with hills in the distance roughly 5km from the proposal site up to a level of approximately 160m AHD to the west and 230m AHD to the northwest. The proposal site has an elevation of approximately 106m to 100m AHD falling to the rear (west) of the site.

The subject land has existing tree lines within the property and along the front boundary (Ballan Road frontage). There is a dwelling located in the southern half of the lot with trees forming part of the garden around the dwelling. Agricultural parcels of a similar scale directly surround the lot, with dwellings located immediately to the west and south and further to the north and southeast. There are 12 rural dwellings within 2km of the proposal site.

The surrounding area is mostly cropping and grazing land with some intensive agricultural activities including a number of poultry farms and a feedlot. These sites have significant commercial scale infrastructure including large scale sheds, that can be seen from Ballan Road.

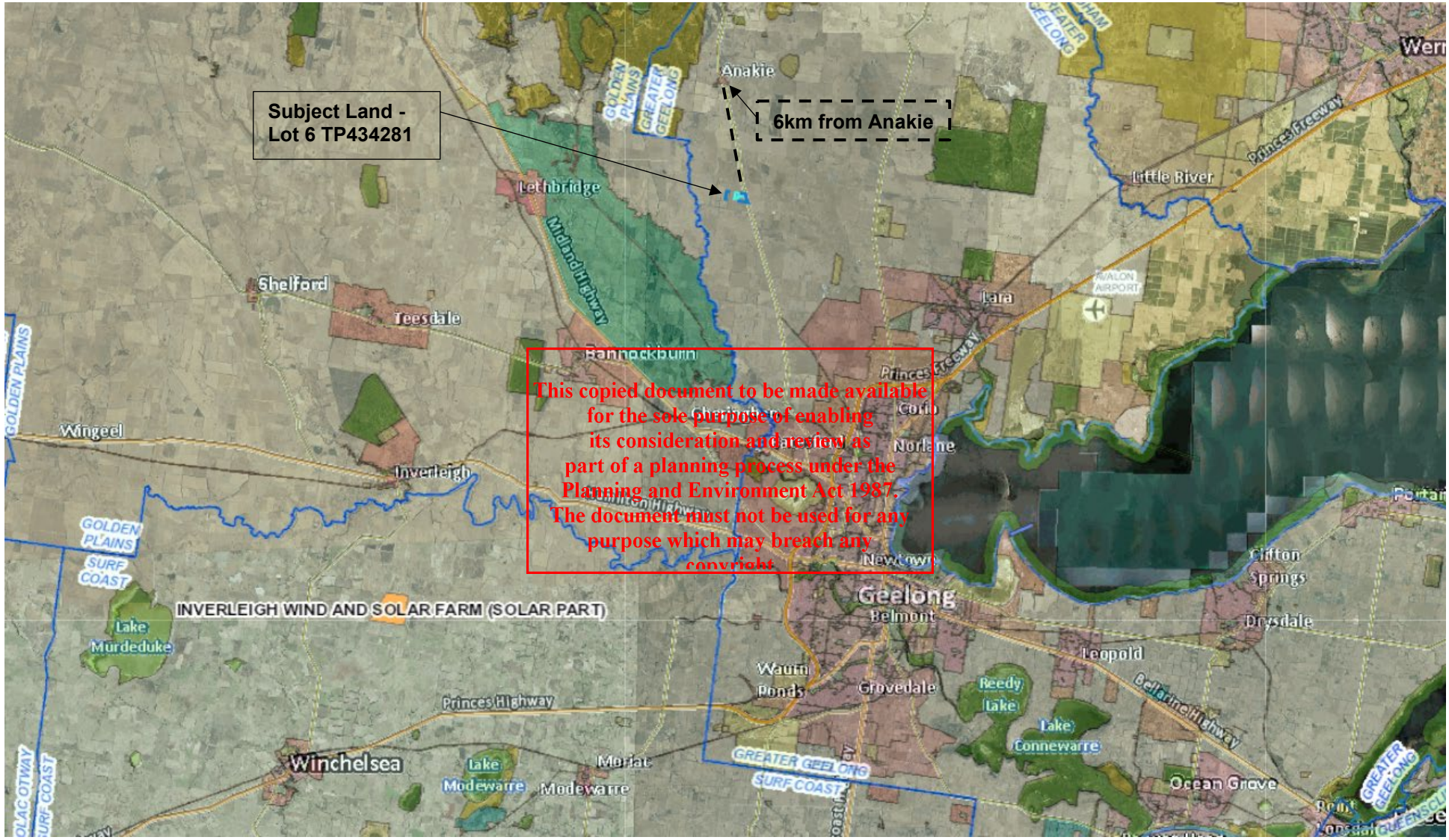


Figure 2-1 Location map showing the subject land and proximity of the proposal to Anakie and Geelong and solar farm under construction and LGA boundaries (Source: Vic Plan, 2022)

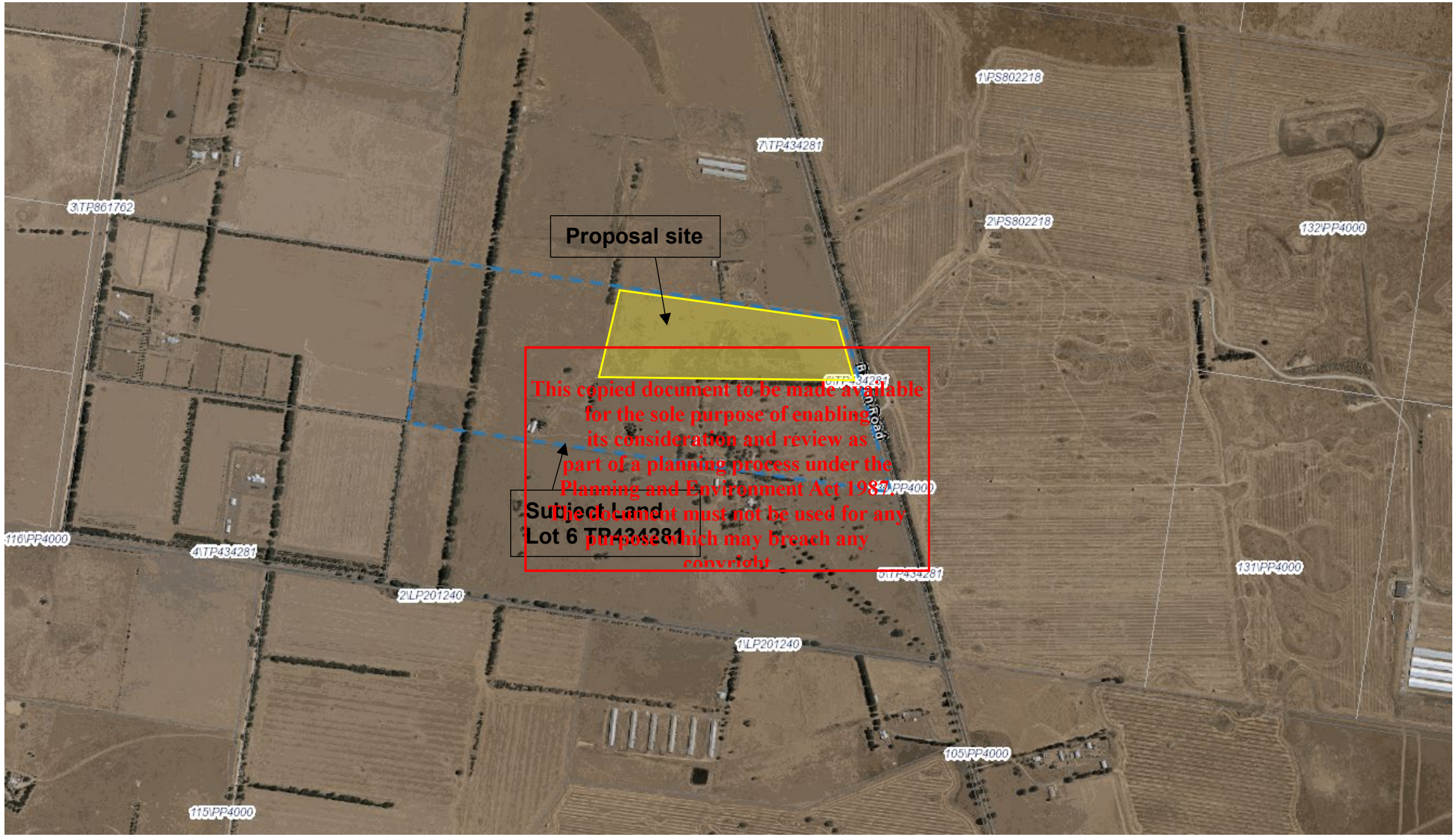


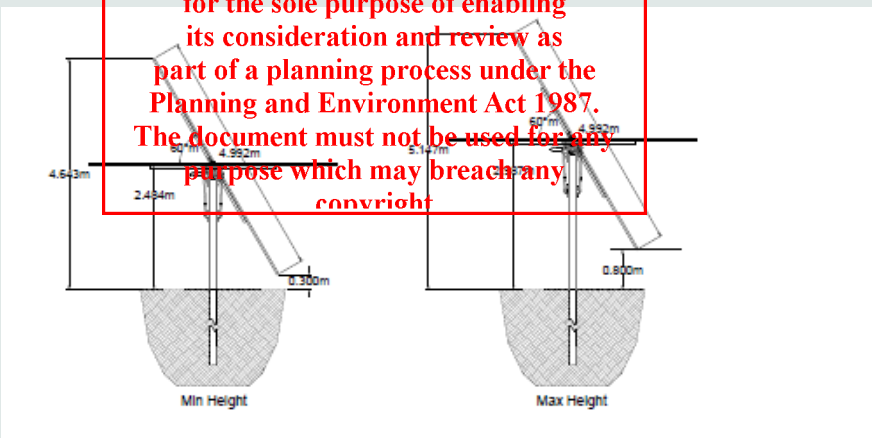
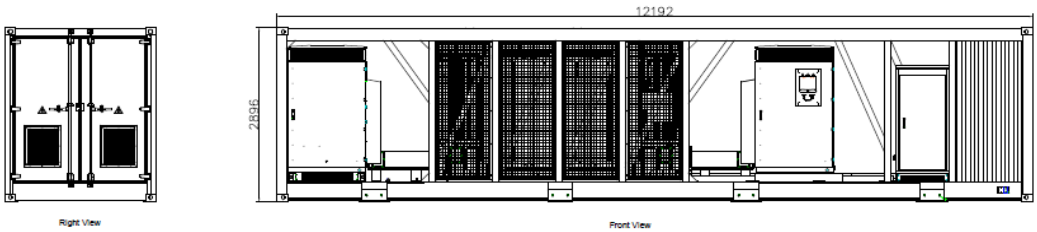
Figure 2-2 Proposal site and surrounding agricultural land, including rural dwellings and poultry farms and feedlots (Source: Vic Plan, 2022)

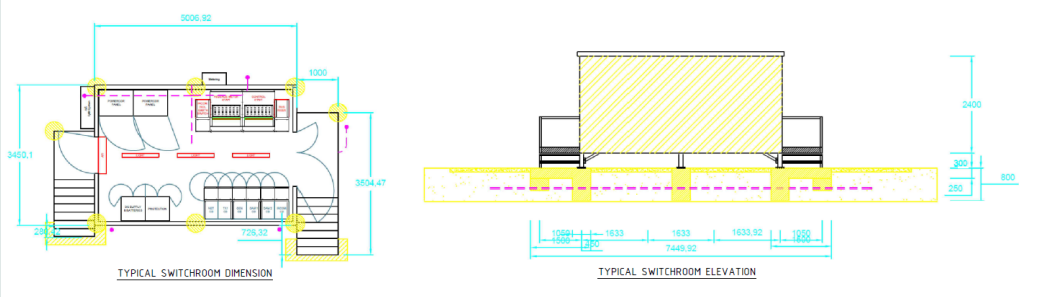
2.2 Proposal details

2.2.1 Solar infrastructure

The proposal involves the use and development of land for a solar energy facility, being the construction, operation, and decommissioning of a ground-mounted photovoltaic (PV) solar array energy generating system, generating direct current (DC) power that would be converted to alternating current (AC) power, then transferred to the electricity network or stored for later transfer. A summary of the key solar infrastructure and associated works is included in Table 2-1.

Table 2-1 Key infrastructure and associated works of the proposal

Key feature	Description
Solar array	The proposal is a <5MW (AC) solar facility (refer to Figure 2-8) comprising: • 11.1ha of fenced solar array, including a maximum of 12,000 photovoltaic (PV) modules (i.e., Talesun 580W) on tilt trackers would be installed within the array with a maximum tilt of 60 degrees (east to west) and resting angle of 0 degrees. • Solar panel technology utilises semiconductor material designed to absorb and convert sunlight into electricity. The panels provide energy in the form of DC, which must be converted to AC via a solar inverter.  Figure 2-3 Typical array detail (module and tracker) (Source: BNRG, 2022)
Invertors	MV inverter (i.e., Sungrow SG4950HV) would be installed, the inverter incorporates smart operation and maintenance (O&M). The solar panel arrays would be connected to the inverter. The inverter would be approximately 12.2m (length) x 2.9m (width) x 2.4m (height) and would weigh approximately 27 tonne.  Figure 2-4 Typical inverter MV detail (Source BNRG, 2022)

Key feature	Description
Substation	The substation (utility installation) components would be on a non-combustible finished surface as required. The substation components would include: • MV Inverter/transformer. • Switchroom.  Figure 2-5 Typical Switchroom detail (BNRG, 2022) Overhead powerlines (utility installation) would connect the substation to the 22kV distribution lines located within the road reserve (refer to Figure 2-8) for the Point of Interconnection (POI)). The powerline connections require a permit for the use of land for a utility installation. Locations, numbers and spacing of power poles to connect to the power line within the road reserve will be determined through detailed design post planning approval, however will be minimal, 1 or none. The existing timber poles typically have a maximum height of 12m. A distribution line will connect from the proposal switchroom to the existing distribution pole and line located within the road reserve. The height of any new pole required for interconnection would be a maximum of 12m and will be of wood, steel or spun concrete pole construction (not steel lattice) and located adjacent to the proposed switchroom.

2.2.2 Battery Energy Storage System (BESS) infrastructure details

The proposal includes the use of land for a minor utility installation being a Lithium-ion Battery Energy Storage System (BESS) with a capacity of approximately 5MW power output for 4 hours. *An exemption from a planning permit applies to the BESS as a land use listed in Clause 62.01 of the Scheme, being the use of land for a minor utility installation.*

The BESS includes battery storage units (8 x 30ft containers) and an inverter (1 x 40ft container). The BESS would be located directly adjacent to the substation inverter and MV switchgear.

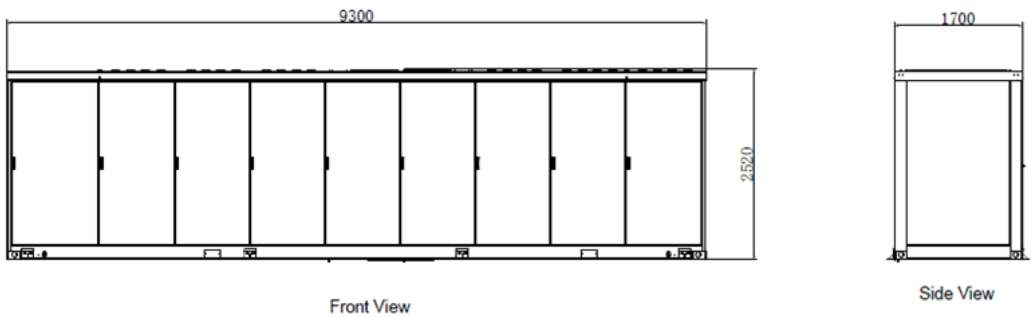


Figure 2-6 BESS typical unit (BNRG, 2022)

A BESS is a device that stores energy by accumulating energy through reversible electrochemical (lithium) reactions. The energy is stored/extracted in DC and converted/inverted into AC by an accompanying bi-directional inverter sized to the storage capacity. The medium voltage switch gear and auxiliaries would control the delivery of electricity to and from the substation and offsite power transmission infrastructure.

The BESS would store power to enable potential distribution to the network outside of sunlight hours, during the evening and morning peak times.

The BESS would operate for the life of the proposal (a minimum of 30 years). Maintenance and/or upgrades would not be expected to be needed until after a period of approximately 10-15 years.

Construction would involve:

- Construction of non-combustible surfaces such as concrete hardstands.
- Delivery of infrastructure components to the site.
- Assembly of the BESS containerised units (shipping container style) and associated infrastructure (substation connection, fencing, etc.).
    - Battery container units of either:
        - Lithium iron phosphate ('LFP').
        - Lithium Nickel Manganese Cobalt Oxide ('NMC').
        - Lithium Manganese Oxide ('LMO').

Each battery unit would be fully modular and self-contained. Each unit would also include:

- Battery storage cells.
- A range of battery, temperature, electrical and fire monitoring systems. These monitoring systems are integrated with automated and manual safety protection systems, and may include:
    - Internal temperature controls, Heating Ventilation and Air Conditioning (HVAC).
    - Fire detection systems such as smoke detectors and heat sensors.
    - A range of electrical monitoring and alarm systems.
    - Telemetric reporting of sensor data to the onsite control room.
    - Telemetric reporting to offsite operations and maintenance facility.
    - Internal fire suppression agent.
    - Power shut down and disconnection.

BESS technology is established in the marketplace and is already required to comply with a range of Australian and international standards. The hazards associated with each type of battery chemistry technologies available are similar as they are all Li-ion-based technology.

2.2.3 Amenities and services

Temporary amenities would be located near the substation. The site is not proposed to be connected to Council sewerage mains. It is expected to be serviced by porta-loos, managed by the site operator.

There is reticulated water available to the subject land, possible connection to the solar farm may be possible. The static (water tank) or reticulated water access for firefighting purposes would be located near the site entrance.

2.2.4 Associated infrastructure (security cameras, lighting, and fencing)

The whole site would be secured with appropriate fencing and lockable gates would be placed at the main entrance, providing restricted access. The fence would be maximum height of 2m, and a non-reflective colour and material that complements/blends with the vegetation on site and recedes into the background. Security lighting would be installed at the substation (BESS and inverter/transformer area) and would be directed away from dwellings and the road. CCTV would be installed on the site.

2.2.5 Site entry, parking and perimeter traversable fire break

The proposed site entry is off Geelong Ballan Road, using a *AGRD Part 4 – Typical Design to Rural Properties* intersection. The intersection would be designed to the B-Double standard, see Figure 2-7.

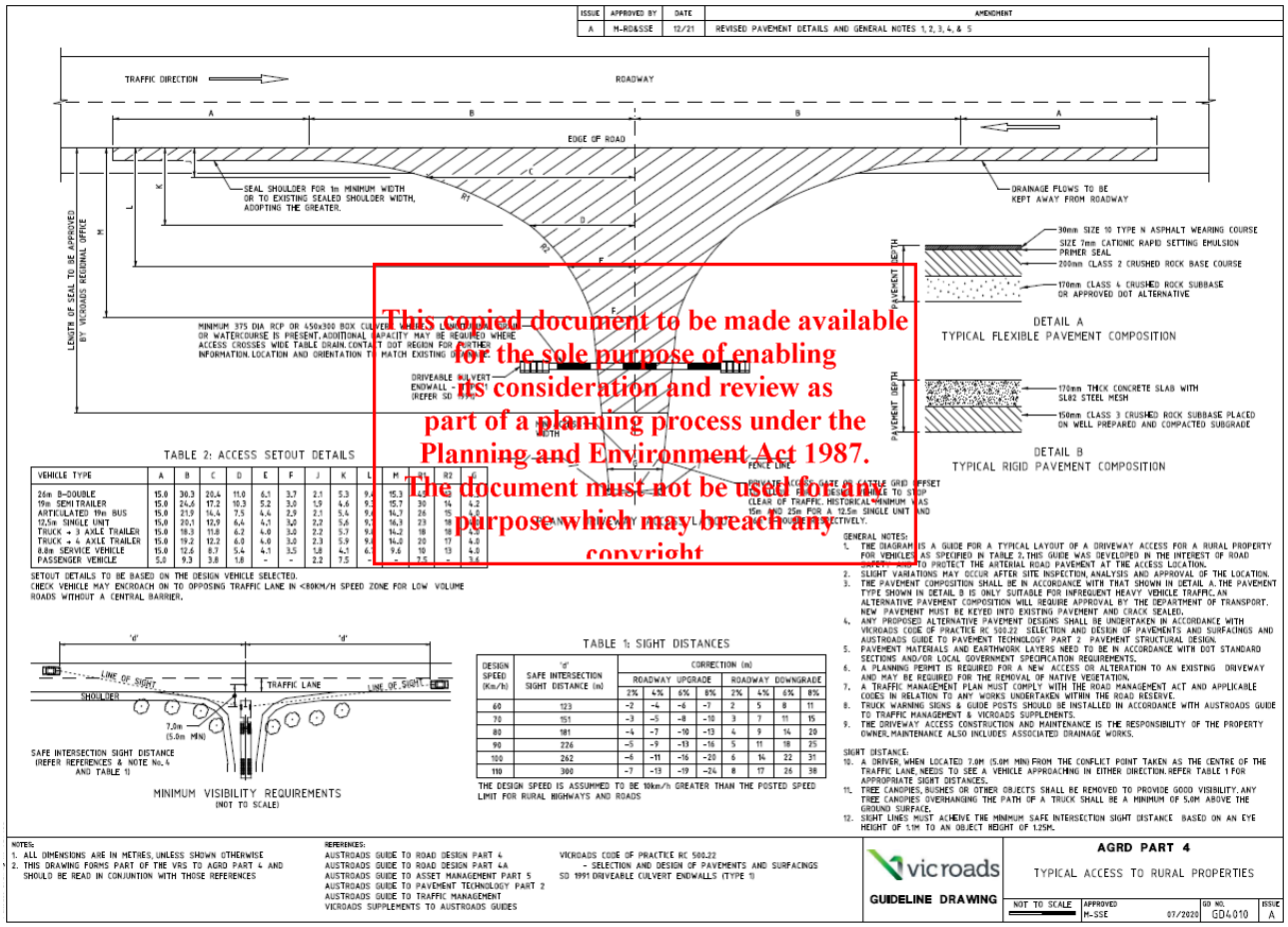


TABLE 2: ACCESS SETOUT DETAILS

VEHICLE TYPE	A	B	C	D	E	F	J	K	L	M	R1	R2	G
26m B-DOUBLE	15.0	30.3	20.4	11.0	6.1	3.7	2.1	5.3	9.4	15.3	45	13	4.3

Figure 2-7 Access (intersection) details and dimensions (AMBER (VicRoads), 2022)

Parking for operational staff would be informal parking within the fenced proposal site.

The site entry would connect with the proposed 10m wide traversable fire break that would be provided within the proposal site fenced area. The traversable area will provide access around the perimeter of the proposal site and would be suitable for emergency and maintenance access.

The 10m traversable fire break would be maintained throughout the construction and operation of the proposal. If required, water trucks would be used to suppress dust during construction, operation, and decommissioning. Additional stabilising techniques and/or environmentally acceptable dust control would also be applied where required to suppress dust.

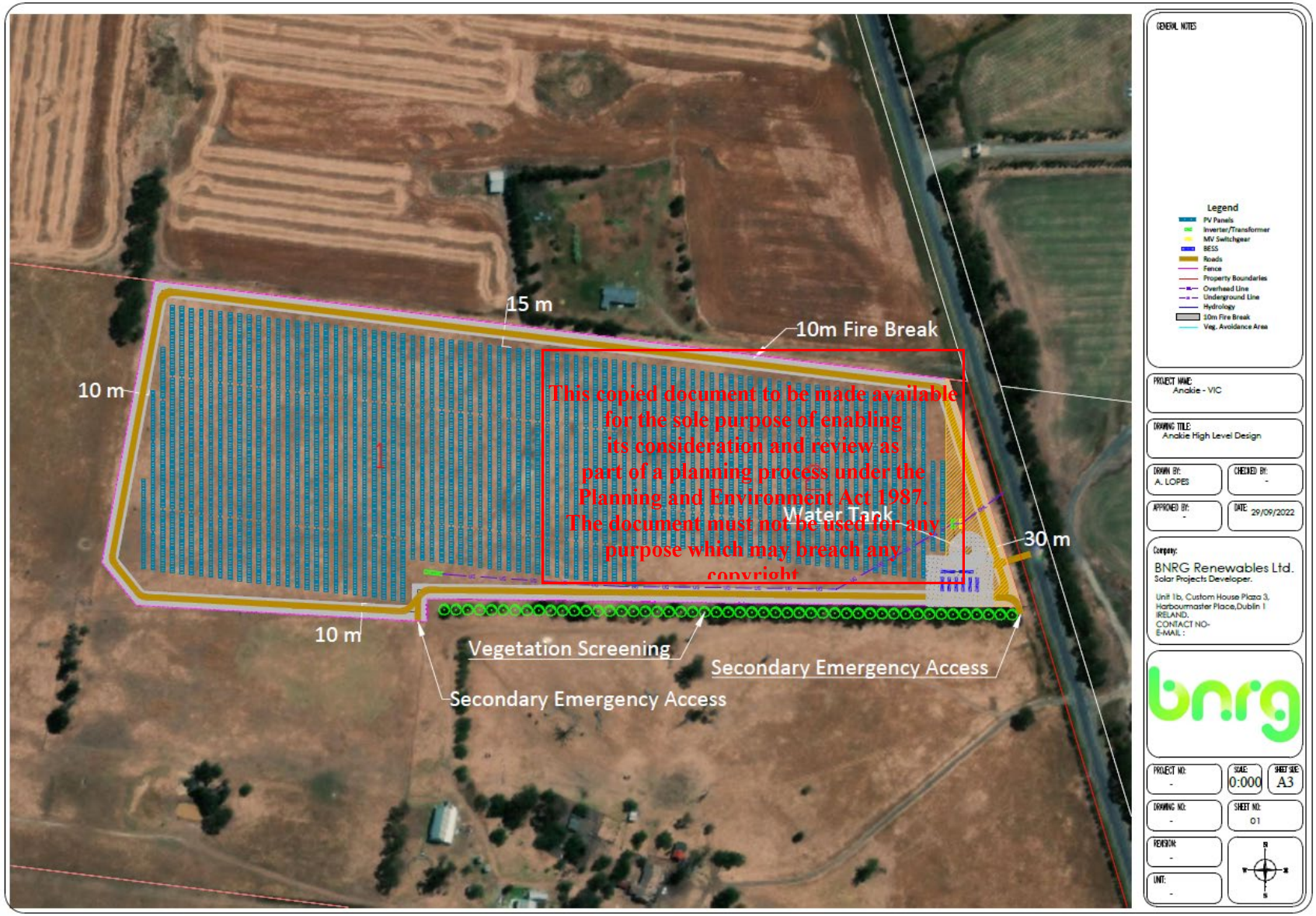


Figure 2-8 The proposal (Source: BNRG, 2022)

2.2.6 Proposal summary table

The primary characteristics of the proposal and subject land are summarised in Table 2-2.

Table 2-2 Breakdown of proposal elements (site features and construction, operation and decommissioning matters)

Proposal elements	Description
The proposal	Anakie Solar Farm.
Proponent	BNRG Leeson.
Capacity	4.99MW (<5MW) (AC) solar facility.
Subject land	1435-1475 Ballan Road, Anakie 3213. Lot 6 TP434281.
Proposal site area and maximum development footprint	Approximately 11ha of the subject land would form the proposal site (within the larger leased area). The proposal site is generally rectangular in shape and is located in the northeast portion of the subject land.
Land zone	The subject land is zoned as Farming Zone (FZ). Connection to existing transmission lines and site entry would require works in the road reserve zoned Transport Zone 2 (TRZ2).
Local government	City of Greater Geelong Local Government Area.
Solar infrastructure	Approximately 12,000PV modules (i.e., Talesun 580W) on tilt trackers. Inverter: MV inverter (i.e., Sungrow SG4950HV) would be installed including transformer/s and associated infrastructure. Switchroom, measuring approximately 5m (l) by 3.4m (w) by 2.6m (h).
Energy storage (exemption applies)	Electricity storage capacity of up to a maximum 23MWh (i.e., 5MW power output for 4 hours) and comprising of lithium-ion batteries with 1 transformer. Estimated battery size – 8 x 30ft containers. Each single battery container is approximately 26.4 tonnes.
Electricity Connection	The proposal would connect via overhead line to the existing powerlines located to the east of the site within the road reserve.
Site access	The site access for construction and operation would be off Ballan Road using a new entry point. Any required additional emergency access would be through the subject land.
Perimeter road	Internal access would be provided within the 10m wide traversable fire break around the perimeter of the site, consistent with bushfire protection and maintenance needs.
Construction hours	Standard daytime construction hours would be 7.00am to 6.00pm Monday to Friday and 9.00am to 1.00pm on Saturdays.

Proposal elements	Description
	Any construction outside of these standard construction hours, if required, would only be undertaken with prior approval from relevant authorities, or unless in emergency circumstances e.g., to make work or the site safe.
Construction timing	Once the approval is received the project would take up to 3 months to develop and a further 6 months to be constructed.
Workforce	Construction –up to 50 staff on site at any time during construction (peak times). Operation – up to 5 full time equivalent (FTE) staff.
Operation period	Anticipated to be a minimum of 30 years.
Decommissioning	When decommissioning occurs, all above ground infrastructure would be removed to a depth of up to 1m. The site would be rehabilitated consistent with land use requirements.

3. Construction, operation, decommissioning, and management plans

3.1 Construction Plan

The proposal would take an estimated 6 months to construct. Key stages of construction are listed below:

3.1.1 Stage 1 – Premobilisation/early works

Stage 1: up to 2 months – Site work

- Pre-construction approvals with EMP.
- Order equipment.
- Land clearing (where possible to only the minimum extent necessary).
- Site preparation and services connection (if any, i.e., telecommunications).
- Fencing (boundary and construction as appropriate) including main gates and fire access gates.
- Planting of landscape zone (and establishment of relevant construction exclusion zones).
- Temporary site office and porta-loo facilities.
- Temporary car park.
- Temporary laydown area.

The Location Plan, Site Layout, High Level Design Plan, Elevations and Details Plans prepared by BNRG, show the site context, labelling of structures, location and details of the proposed infrastructure. The Laydown area is denoted by yellow hatching on the High Level Design plan, this area provides for any temporary site construction office, delivery and storage of materials during construction. A landscape plan would be prepared and submitted to DELWP for approval prior to commencement of Stage 1 works, a preliminary landscape plan has been provided with the plans set (refer to Appendix A). The detailed landscaping plan may include the following:

- Clearing areas and weed management.
- Location of fencing around the perimeter (security fencing, up to 2m high in a colour or other finish to blend with or recede into the background), and any associated lighting and CCTV.
- Planting of screening areas. The plan would include a planting list (pot size and type) including use of fast-growing native species for the locality resulting in earliest possible establishment of screening. A management plan would be developed to enable a planting success rate over the initial ~1–2 years of 60–80% and replanting as necessary.
- Additional temporary fencing installation as required to protect landscaped areas.

Construction and site operations would include regular maintenance and watering of the landscaped areas. Water for this purpose would be carted to site from a licenced operator or by another method approved the relevant determining authority.

3.1.2 Stage 2 – Construction

Stage 2: up to 4 months – Construction

- Delivery of PV modules, frames, electrical conduits, and balance of equipment.
- Footings.
- Fixing of modules.
- Positioning of junction boxes.
- Connecting of required cabling.
- Construction of substation (inverter/transformer, switchgear, and BESS).
- Construction of distribution line.
- Installation of associated works such as lighting and CCTV.

3.1.3 Grid connection and commissioning (pre-operation)

Grid connection/commissioning would occur 2–3 months after construction, and would include the following:

- Grid connection and commissioning of plant.
- Completion certificate.

3.1.4 Hours of construction and staff numbers

Construction activities would take place during normal working daylight hours (7am to 6pm) Monday to Friday and 7am to 1pm on Saturday. Work outside of these hours would only occur in instances where:

- There is no noise disturbance to nearby neighbours/buildings.
- Delivery of materials is required outside of normal hours for safety reasons as requested by police or other authorities.
- There is a need for emergency work to avoid loss of lives and/or equipment.

It is anticipated that there would be up to 50 staff on site at any time during construction (peak times). Workers would be housed off-site, as needed in the Geelong area. Buses would be arranged when needed to reduce traffic and minimise the need for temporary onsite parking.

Construction site access for the proposal from Ballan Road with the construction and operation (main) entry located in the northeast corner of the lot and emergency use access located south of the main entry connecting to the perimeter track proposed (as shown in Figure 2-8). The main entry would be used during construction and operation and would be suitable for all vehicles including heavy and oversized vehicles.

The proposed haulage route (proposed traffic movements), and site entries are described in the Traffic Impact Assessment (AMBER, 2022) provided in Appendix D and summarised in Section 5.7 Traffic.

3.1.5 Water requirements

Non-potable water requirements (generally to be used for dust suppression) are anticipated to be needed (based on visual cues) for the construction phase. Detailed water requirements would be determined by the construction contractors.

Reticulated water is available to the subject land and connections for the proposal may be possible if needed, or water would be sourced from commercial water suppliers and trucked to site in water

carts. Water sources for carting to site would be subject to determination by the proposal construction contractors.

There are no major earthworks anticipated for the proposal and as a result there would be no significant changes to the drainage regime of the site during construction and operation. The soil and stormwater management for the proposal would be designed and maintained in accordance with the Victorian Environment Protection Authority guidelines including:

- Publication 1894, Manage soil disturbance (EPA, 2020).
- Publication 1893, Use a treatment train (multiple control) approach (EPA, 2020).
- Publication 1895, Manage stockpiles (EPA, 2020).
- Publication 1897, Manage truck and other vehicle movement (EPA, 2020).
- publication 1896, Manage how you work within or adjacent to waterways (EPA, 2020).

A Soil and Water Management Plan would be included in the EMP for the proposal. The management plan would specifically address overland flow and sediment and erosion control.

Materials from construction would be refurbished, recycled, or disposed of offsite in accordance with Victorian environment protection waste management requirements.

Solid waste and putrescible waste disposal would be by the regular service of a licensed waste management contractor. Site storage of waste would be in approved waste containers provided by the contractor.

3.2 Operational Plan

The proposal is expected to operate for a minimum of 30 years. Solar farms generally require minimal regular maintenance. The majority of operations would be automated.

Ongoing work would include landscaping, maintenance, and security. The intention is to employ a full time equivalent (FTE) workforce of up to 5 people, noting for the proposal scale, it would likely be local contractors working intermittently during operation. On site facilities would include a porta-loo and informal car park.

Operation and maintenance of the system would involve as needed replacement of modules, repair of inverters, trackers, and other supporting equipment, which would be expected to occur on a limited basis at certain points during the system's life cycle.

Once the facility is established, since ongoing works are minimal, the associated traffic during operations would generally be limited to light vehicles visiting the site.

There are a small number of lighting sources in the vicinity of the proposal that include residential lighting. Lights from vehicles travelling along the local roads provide dynamic and temporary sources of light.

Security lighting would be installed for nighttime illumination, generally around the substation (inverter and switchgear) and BESS. Lighting would be low level and directional within the site to minimise the potential for light spill onto adjoining areas. In addition to the standard level of lighting required for normal security and safety, lighting may also be required for scheduled or emergency maintenance around the substation, BESS, and PV panel areas.

CCTV security cameras would potentially be located within and around the site, including at the entrance gate, substation, and BESS.

The proposal would have the capacity to generate electricity during day light hours. This would predominantly be during day and evening periods 7am–6pm and 6pm–10pm, respectively throughout the year and potentially part of the night-time period (prior to 7am) during the summer months. Batteries could potentially operate at all times.

Bushfire management would be undertaken in accordance with the approved management plans. The management plans would be consistent with the approach set out in the *CFA's Design Guidelines and Model Requirements: Renewable Energy Facilities* (CFA, 2022) and any relevant Australian Standards. The vegetation within the fenced proposal area would be maintained to reduce fuel loads, where needed. Bushfire management would not result in impacts to vegetation on public land or road reserves.

Refurbishment may be required during the operation phase of the proposal:

- It is estimated that certain components of the solar equipment would have a life of a minimum of 30 years and the benefits of refurbishing the equipment would be considered closer to this time where the operational phase would extend beyond the minimum 30 year period.
- It is anticipated that the batteries that would be used in energy storage system would have a life of 10-15 years, and they would need to be replaced periodically during the operational phase for the proposal.

A Waste Minimisation and Management Plan would form part of the EMP for the proposal to control waste and implement best practice to reduce, reuse, recycle methods available, during construction and operation. The plan would be flexible to allow for use of emerging recycling and reuse technologies and services to avoid waste needing disposal at appropriately licenced landfill sites.

3.3 Decommissioning Plan

The intention is to operate the facility for a period of 30 years and if viable at the end of the 30-year period look at replacing plant to extend the life for a further 25–30 years. In the event the plant is decommissioned, the works would be managed in accordance with the EMP that would be developed for the proposal.

Decommissioning activities would include the removal and dismantling of all infrastructure on site. The land would be restored to 'make good' conditions e.g., removing infrastructure that would impact cropping activities and replacing removed fences. Key elements of decommissioning would include, but would not be limited to the following:

- The solar arrays would be removed, including the foundation posts. Materials would be sorted and packaged for removal from the site for recycling or reuse wherever possible.
- All site amenities and equipment would be removed including buildings, inverter stations, batteries and substation, and materials recycled or reused wherever possible.
- Posts and cabling installed within 1m of the ground surface would be removed and recycled.
- Fencing would be removed including small concrete footings.

The proposal would be dismantled. Components would be reused for other purposes with lower power demands and duty cycles, refurbished, recycled, or disposed of offsite in accordance with Victorian environment protection waste management requirements.

A Decommissioning EMP (DEMP) would be prepared in consultation with relevant agencies as needed and would incorporate a Decommissioning Waste Minimisation and Management Plan to

facilitate the recycling and reuse of infrastructure components and materials. The DEMP would be prepared in accordance with relevant government guidance and reuse and recycle principles.

To avoid disposal of used materials/components, the DEMP may need include measures such as shipping used materials, not recyclable in Australia, to overseas sites for recycling and reuse. Items that cannot be recycled or reused would be disposed of at licenced facilities within Australia where appropriate.

A National approach is being considered by the government to address e-waste and specifically solar waste (Sustainability Victoria, 2021), the DEMP would be consistent with any National and Victorian approach developed and would be adaptable to utilise emerging technologies and processes as they evolve.

A DEMP with an indicative timeline would be prepared in consultation with relevant agencies and DELWP as required, prior to the commencement of decommissioning. A Traffic Management Plan would be prepared prior to decommissioning commencing. Traffic over the decommissioning period would be similar to the standard construction period.

3.4 Environmental Management Plans (EMP)

An EMP and relevant sub plans would be provided to DELWP for approval prior to construction commencing.

The EMP's would provide contingent requirements for ongoing environmental response planning to key issues. This approach allows planning and management techniques to be mindful of worst-case scenarios and representative impacts as response strategies are developed.

The EMP's would cover, the three key phases and EMP goals are:

- Construction – Minimising pollution, waste generation and other potential environmental impacts during construction stages of the proposal.
- Operations – Minimising potential environmental impacts during operational stages, managing site interface issues, and maintaining good neighbour relations.
- Decommissioning – Removal of site facilities. Minimising legacy issues and arrangements to make-good with any proposed decommissioning and rehabilitation.

The proposal includes commitment to preparing the EMP's for the proposal is listed in Table 3-1.

Table 3-1 General safeguards and mitigation measures

No.	Safeguards and mitigation measures	C	O	D
G1	Prior to the commencement of each stage (construction, operation, and decommissioning) the Environmental Management Plan (EMP) for that Stage would be prepared and submitted for approval from DELWP and/or relevant agencies. Each stage would fully implement relevant approved EMP's.	C	O	D

4. Planning and policy provisions

4.1 Geelong Planning Scheme

The proposal is located within the Geelong LGA and is subject to the Greater Geelong Planning Scheme (the scheme). Refer to Figure 2-1 for the location plan showing the proposal and LGA boundaries.

4.2 Land use permit triggers – Permit required

- *Farming Zone – use and development for a renewable energy facility.*
- *Farming zone – use and development for a utility installation.*
- *Farming Zone – A building which is within any of the following setbacks:*
  - *The setback to the TRZ2 zone designated in the FZ schedule (50m)*
  - *The setback from a dwelling not in the same ownership specified in a schedule to this zone (100m)*
- *Farming Zone – Earthworks specified in a schedule to this zone, if on land specified in a schedule. Earthworks which change the rate of flow or the discharge point of water across a property boundary – All land*
- *Environmental Significance Overlay–- ESO4 – Remove, destroy, or lop any native vegetation, including dead native vegetation.*
- *Clause 52.13 Use and development for a renewable energy facility.*
- *Clause 52.29 Land Adjacent to the Principal Road Network – Create or alter an access.*
- *Clause 52.32 Removal of native vegetation.*

4.3 Zone and overlay provisions

4.3.1 Farming zone

The subject land is within the Farming Zone (FZ) as shown in Figure 4-1. The purposes of the FZ are:

- *To implement the Municipal Planning Strategy and the Planning Policy Framework.*

  To provide for the use of land for agriculture.
- *To encourage the retention of productive agricultural land.*
- *To ensure that non-agricultural uses, including dwellings, do not adversely affect the use of land for agriculture.*
- *To encourage the retention of employment and population to support rural communities.*
- *To encourage use and development of land based on comprehensive and sustainable land management practices and infrastructure provision.*
- *To provide for the use and development of land for the specific purposes identified in a schedule to this zone.*

The proposal would be consistent with the relevant purposes specifically, to ensure compatibility and minimise impacts on surrounding agricultural land during operation and post remediation. The proposal would create additional employment in the locality and support the landowner with additional income. The proposal includes measures and safeguards to protect the natural environment and systems.

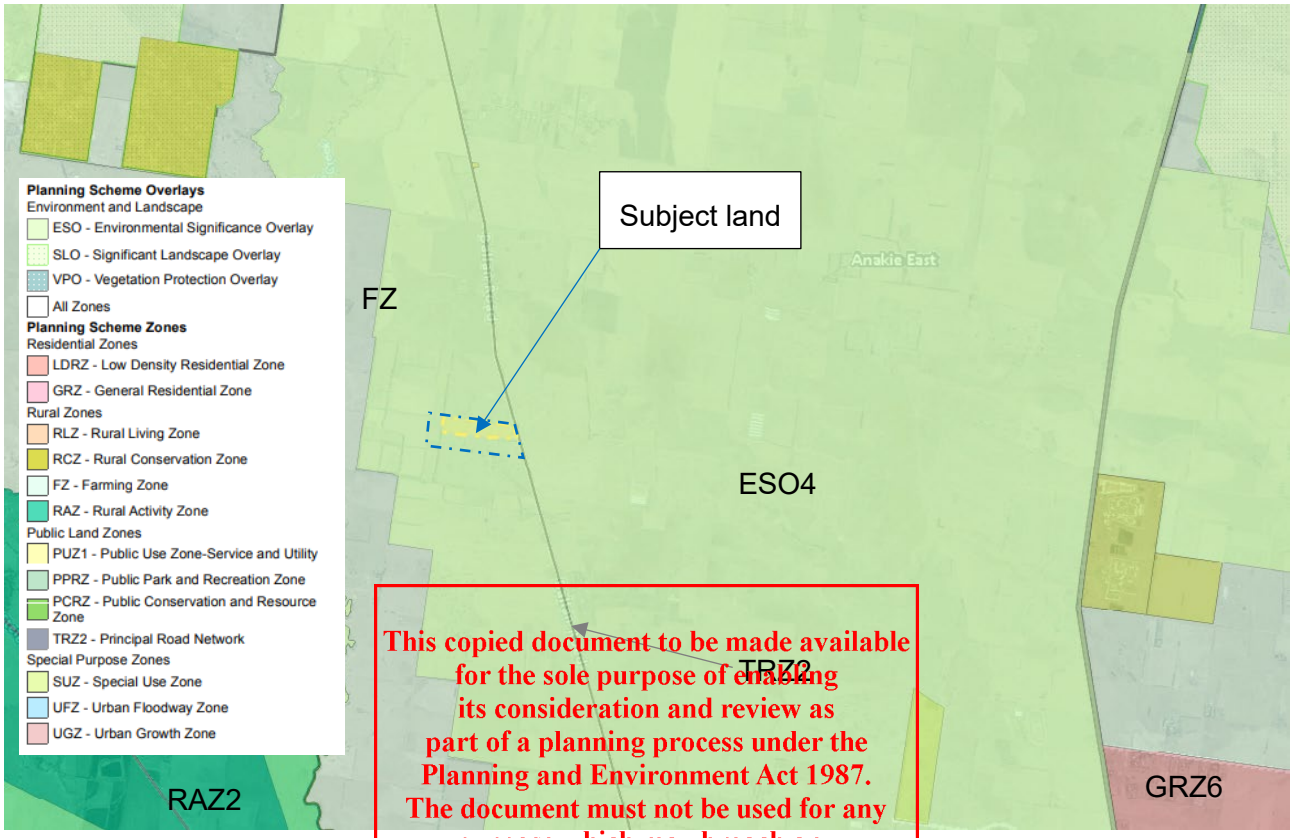


Figure 4-1 Zoning and Environmental overlay (Source: VicPlan, SoV 2022)

Proposed land use

The proposal would be defined as **a renewable energy facility (solar)** and associated **utility installation**.

The proposal (arrays and associated works) would be a:

- **Solar energy facility** meaning *land used to generate electricity from solar energy using ground-mounted photovoltaic and thermal technology, where the primary role is to export power to the electricity network.*

The substation and overhead line connected to the electricity network would be a:

- **Utility installation** meaning land used: *a) for telecommunications; b) to transmit or distribute gas or oil; c) to transmit, distribute or store power; d) to collect, treat, transmit, store, or distribute water; or e) to collect, treat, or dispose of storm or flood water, sewage, or sullage. It includes any associated flow measurement device or a structure to gauge waterway flow.*

Under the FZ Table of uses, the proposal requires a Planning Permit and must meet Clause 53.13, refer to section 4.4.6 for discussion.

The BESS would be a:

- **Minor utility installation** meaning *land used for a utility installation comprising any of the following: a) sewerage or water mains; b) storm or flood water drains or retarding basins; c) flow measurement device or a structure to gauge waterway flow; d) siphons, water storage tanks, disinfection booster stations and channels; e) gas mains providing gas directly to consumers; f) a sewerage treatment plant, and any associated disposal works, required to serve a neighbourhood; g) a pumping station required to serve a neighbourhood; h) power lines designed to operate at less than 220,000 volts but excluding any power lines directly associated with an Energy generation facility or Geothermal energy extraction; i) an electrical sub-station designed to operate at no more than 66,000 volts but excluding any sub-station directly associated with an Energy generation facility or Geothermal energy extraction; or j) a battery connected to a section of the electricity distribution network operating with a nominal voltage not exceeding 66,000 volts.*

No planning permit is required for a minor utility installation in the Farming Zone. An exemption from a planning permit applies to the BESS as a land use listed in Clause 62.01 of the Scheme, being the use of land for a minor utility installation.

4.3.2 Environmental Significance Overlay Schedule 4 (ESO4)

The land is subject to the Environmental Significance Overlay Schedule 4 (ESO4), as shown in Figure 4-1.

ESO4 relates to Grasslands within the Werribee Plains Hinterland. A permit is required to carry out any works that remove native vegetation.

This application is accompanied by plans and mapping showing:

- The proposed disturbance area and types of works associated with the proposal.
- The total extent of vegetation on the property and the extent of native vegetation proposed to be removed, lopped, or destroyed.

The application also includes an Ecology Report (NGH, 2022) prepared by NGH's qualified ecologists. The report describes the steps taken to avoid and minimise the removal of native vegetation including the practicality of alternative options which do not require removal of the native vegetation. The report findings and proposed safeguards and mitigation measures are summarised in section 5.2 of this PR and provided in full at Appendix C.

The EMP's for the site would include relevant vegetation management plans including weed management, pest management.

4.3.3 Heritage overlay

The adjoining land is identified as having a heritage place shown in pink and is identified as HO25, a woolshed. It is understood the heritage place (actual woolshed) is on the subject land as shown in Figure 4-2, circled in orange.

The heritage place, HO25, Woolshed on Marathon Estate, Pringles Road Anakie, is noted in the statement of significance as being *typical of pastoral property buildings, without significant architectural importance and eclipsed by many other woolshed structures in the region*.

The proposal provides reasonable separation, greater than 100m setback, from the woolshed maintaining its rural setting and character. There are no likely impacts to the significance of the building. No further assessment or mitigation measures are considered necessary.

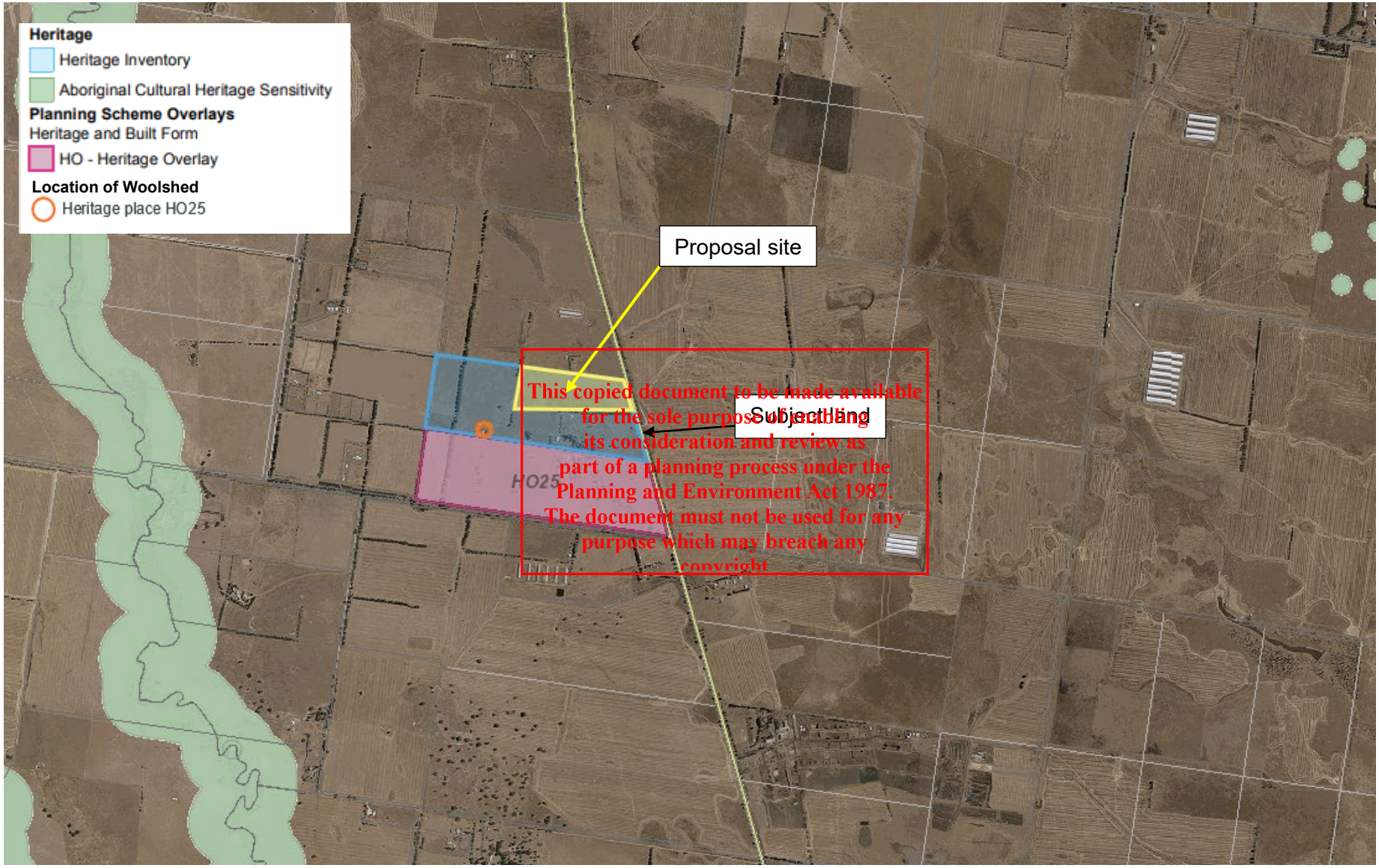


Figure 4-2 Heritage place location (woolshed) and Aboriginal cultural heritage sensitivity (Source: Adapted from VicPlan, SoV 2022)

4.4 Particular provisions

4.4.1 52.05 Signs

Minimal business identification and site safety and directional signage would be installed at the site entry. Signs would be of a small size similar to business/biosecurity type signs seen on farm gates to be compatible with the amenity and visual appearance of the rural area.

4.4.2 52.06 Car parking

52.06-6 Number of car parking spaces required for other uses

The proposal is not a use of land specified in Table 1 of Clause 52.06-6. The proposed informal parking within the fenced site area is considered suitable to cater to the low operational staff numbers (up to 5) and minimal onsite work during operation. No parking spaces would be marked out on site. Parking areas would be determined based on safe distances from electrical installations and managed by the site operator with details included in the operational EMP.

4.4.3 52.17 Native vegetation

The application includes an Ecology Report (NGH, 2022) prepared by NGH's qualified ecologists. The report describes the steps taken to avoid and minimise the removal of native vegetation. The report findings and proposed safeguards and mitigation measures are summarised in section 5.2 of this PR and provided in full at Appendix C.

4.4.4 52.29 Land adjacent to the Principal Road Network

As site access would be established within the TRZ2 zone, road reserve of Ballan Road, a permit is triggered. Site access is addressed in the Traffic Impact Assessment (AMBER, 2022). The report findings and proposed safeguards and mitigation measures are summarised in section 5.7 of this PR and provided in full at Appendix D.

4.4.5 53.02-4 Bushfire Protection Objectives

The subject land is identified as a bushfire prone area (BPA).

CFA Guidelines have been considered, refer to Section 4.7.2 of this PR. The low bushfire risk posed by the vegetation and proposed commitments to providing protection measures and preparing the required management plans for the site has been considered in Section 5.3 of this PR.

4.4.6 53.13 Renewable Energy Facility (Other Than Wind Energy Facility)

This PR and supporting documents include site and context analysis and design response. The application includes detailed plans and description of the proposal, visual and glint and glare analysis, an ecology report to address vegetation removal, rehabilitation information, measures to control potential amenity impacts including light spill, air quality (dust), noise, protection of heritage, traffic management of stormwater and agricultural impacts, electromagnetic fields, and heat island effect.

The proposal is consistent with Clause 53.13 as it is considered to be compatible with the use of the surrounding land for the purpose of forestry, agriculture and associated rural dwellings. The proposal includes decommissioning and would make good the site and return the proposal site to a state suitable for agriculture. The proposal would provide additional income for the landowner supporting the continuation of agriculture on the surrounding land, providing an income buffer for when farming is difficult due to climate or requires an income boost to allow for change and investment in new approaches or technologies. The proposal location is in line with Victorian and local strategic directions.

4.5 Referral triggers

Agency	Referral or Notice
DELWP Environment	Referral due to overlay, ESO4 and proposed removal of native vegetation.
Department of Transport	Referral due to works within the TRZ2 zone.
Country Fire Authority	Notice, as a permit is not triggered by Clause 44.06.

4.6 Planning Policy Framework

This section outlines the policies of the scheme that are of particular relevance to this application.

This includes the Municipal Strategic Statement and Local Planning Policies that are to be integrated into a combined Planning Policy Framework consistent with all Victorian Planning Schemes. Accordingly, the policies are grouped thematically.

4.6.1 Municipal Strategic Statement (MSS)

Clause 21.01 outlines the Greater Geelong City Council's vision to be the best place to live through prosperity and cohesive communities in an exceptional environment. Clause 21.02 of the MSS sets out the key elements of the City of Greater Geelong Sustainable Growth Framework. The proposal is considered to be consistent with the actions specifically in reducing greenhouse gas emissions.

4.6.2 Environmental and landscape values

These clauses focus on protecting ecological systems, biodiversity, and identified environments or landscapes.

Protection of biodiversity

Clause 12.01-S has the objective to assist the protection and conservation of Victoria's biodiversity.

Strategies:

- *Use biodiversity information to identify important areas of biodiversity, including key habitat*

for rare or threatened species and communities, and strategically valuable biodiversity sites.

- *Strategically plan for the protection and conservation of Victoria's important areas of biodiversity.*
- *Ensure that decision-making takes into account the impacts of land use and development on Victoria's biodiversity, including consideration of:*
    - *Cumulative impacts.*
    - *Fragmentation of habitat.*
    - *The spread of pest plants, animals and pathogens into natural ecosystems.*
- *Avoid impacts of land use and development on important areas of biodiversity.*
- *Consider impacts of any change in land use or development that may affect the biodiversity value of national parks and conservation reserves or nationally and internationally significant sites; including wetlands and wetland wildlife habitat designated under the Convention on Wetlands of International Importance (the Ramsar Convention) and sites utilised by species listed under the Japan-Australia Migratory Birds Agreement (JAMBA), the China-Australia Migratory Birds Agreement (CAMBA), or the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).*
- *Assist in the identification, protection and management of important areas of biodiversity.*

The proposal addresses protection of biodiversity of the site, including avian fauna. Refer to the included Ecology Report (NGH, 2022) at Appendix C.

Native Vegetation Management

Clause 12.01-2S relates to native vegetation.

Objective:

- *To ensure that there is no net loss to biodiversity as a result of the removal, destruction or lopping of native vegetation.*

Strategies:

- *Ensure decisions that involve, or would lead to, the removal, destruction or lopping of native vegetation, apply the three-step approach in accordance with the Guidelines for the removal, destruction or lopping of native vegetation (Department of Environment, Land, Water and Planning, 2017):*
    - *Avoid the removal, destruction or lopping of native vegetation.*
    - *Minimise impacts from the removal, destruction or lopping of native vegetation that cannot be avoided.*
    - *Provide an offset to compensate for the biodiversity impact from the removal, destruction or lopping of native vegetation.*

To ensure that land use and development minimises the fragmentation of areas of native vegetation and other habitats, Clause 21.05 has relevant objectives which include:

- *To protect, maintain and enhance the biodiversity of the municipality.*

Clause 52.17 Native Vegetation regulates the removal of native vegetation. A permit is required under this provision to remove, destroy, or lop native vegetation, including dead vegetation.

The purposes of this clause are:

- *To manage the removal, destruction or lopping of native vegetation to minimise land and water degradation and to ensure that there is no net loss to biodiversity as a result of the removal, destruction or lopping of native vegetation. This is achieved by applying the following three step approach in accordance with the Guidelines for the removal, destruction or lopping of native vegetation (Department of Environment, Land, Water and Planning, 2017) (the Guidelines):*
    - *Avoid the removal, destruction or lopping of native vegetation*
    - *Minimise impacts from the removal, destruction or lopping of native vegetation that cannot be avoided*
    - *Provide an offset to compensate for the biodiversity impact if a permit is granted to remove, destroy or lop native vegetation.*

The proposal is consistent with the environmental and landscape values and objectives and strategies of the scheme. The Ecology Report (NGH, 2022), refer to Appendix C, describes the biodiversity of the site and identifies measures to avoid and minimise potential impacts.

4.6.3 Environmental Risks and Amenity

These clauses address environmental risks and amenity. The head provision of Clause 13 outlines the following policies:

- *Planning should strengthen the resilience and safety of communities by adopting a best practice environmental management and risk management approach.*
- *Planning should identify, prevent and minimise the risk of harm to the environment, human health, and amenity through:*
    - *Land use and development compatibility.*
    - *Effective controls to prevent or mitigate significant impacts.*
- *Planning should identify and manage the potential for the environment and environmental changes to impact on the economic, environmental or social wellbeing of society.*
- *Planning should ensure development and risk mitigation does not detrimentally interfere with important natural processes.*
- *Planning should prepare for and respond to the impacts of climate change.*

The proposal addressed matters relevant to climate change, for example through the production of renewable energy, consideration of environmental effects, waste minimisation and management, responsible management of the site, minimising water use, and addressing any increased fire risk.

Natural hazards and climate change

Objective:

- *To minimise the impacts of natural hazards and adapt to the impacts of climate change through risk-based planning.*

Strategies:

- *Consider the risks associated with climate change in planning and management decision making processes.*
- *Identify at risk areas using the best available data and climate change science.*
- *Integrate strategic land use planning with emergency management decision making.*

- *Direct population growth and development to low risk locations.*
- *Develop adaptation response strategies for existing settlements in risk areas to accommodate change over time.*
- *Ensure planning controls allow for risk mitigation or risk adaptation strategies to be implemented.*
- *Site and design development to minimise risk to life, property, the natural environment and community infrastructure from natural hazards.*

Climate change presents several significant challenges including loss of biodiversity, increased fire risk, increased frequency of drought and high temperatures. The proposal has been designed to reduce greenhouse gas emissions, avoid and minimise impacts to biodiversity and address potential hazards including bushfire risk.

The proposal would result in reduced greenhouse gas emissions, includes measures to reduce impacts to biodiversity and the required measures to manage bushfire risks.

Bushfire planning

Clause 13.02-1S applies to all land within a designated BPA, therefore applies to the subject site. Bushfire risk is a consideration for any solar and battery proposal.

Objective:

- *To strengthen the resilience of settlements and communities to bushfire through risk-based planning that prioritises the protection of human life.*

Strategies:

- *The protection of human life is given priority through appropriate planning.*

In relation to bushfire hazard identification and assessment the Clause includes strategies to identify bushfire hazard and undertake appropriate risk assessment by:

- *Applying the best available science to identify vegetation, topographic and climatic conditions that create a bushfire hazard.*
- *Considering the best available information about bushfire hazard including the map of designated bushfire prone areas prepared under the Building Act 1993 or regulations made under that Act.*
- *Considering and assessing the bushfire hazard on the basis of:*
    - *Landscape conditions – meaning conditions in the landscape within 20 kilometres (and potentially up to 75 kilometres) of a site;*
    - *Local conditions – meaning conditions in the area within approximately 1 kilometre of a site;*
    - *Neighbourhood conditions – meaning conditions in the area within 400 metres of a site; and*
    - *The site for the development.*
- *Consulting with emergency management agencies and the relevant fire authority early in the process to receive their recommendations and implement appropriate bushfire protection measures*

The proposal includes measures to reduce risk and measures to manage bushfire and protect life and property. The detailed design of the proposal would be consistent with CFA's Guidelines (CFA, 2022).

Noise abatement

The objective of Clause 13.05-1S is to assist the control of noise effects on sensitive land uses.

The strategy is to ensure that development is not prejudiced, and community amenity is not reduced by noise emissions, using a range of building design, urban design, and land use separation techniques as appropriate to the land use functions and character of the area.

An Acoustic Report (Renzo Tonin & Associates, 2022) has been prepared for the proposal. The report findings and proposed safeguards and mitigation measures are summarised in section 5.6 of this PR and provided in full at Appendix G.

Land use compatibility

Clause 13.07-1S has the objective to protect community amenity, human health and safety while facilitating appropriate commercial, industrial, infrastructure or other uses with potential adverse off-site impacts.

Strategies:

- *Ensure that use or development of land is compatible with adjoining and nearby land uses.*
- *Avoid locating incompatible uses in areas that may be impacted by adverse off-site impacts from commercial, industrial and other uses.*
- *Avoid or otherwise minimise adverse off-site impacts from commercial, industrial and other uses through land use separation, siting, building design and operational measures.*

This PR addresses compatibility including potential amenity impacts and agricultural impacts for the proposal. Consideration of the setting including visual impacts are addressed in section 5.8 of this PR, and Appendix E. An Agricultural Assessment Report (Meridian Agriculture, 2022) has been prepared for the proposal. The report findings and proposed safeguards and mitigation measures are summarised in section 5.5 of this PR and provided in full at Appendix H.

Landscapes

Clause 12.05-2S has the objective to protect and enhance significant landscapes and open spaces that contribute to character, identity and sustainable environments.

Strategies:

- *Recognise the natural landscape for its aesthetic value and as a fully functioning system.*
- *Ensure important natural features are protected and enhanced.*

This PR addresses the aesthetic values, natural systems and features of the site. The proposal includes plans that show measures including provision of appropriate setbacks. Consideration of the visual impacts are addressed in section 5.8, and Appendix E.

4.6.4 Agriculture

Clause 14.01-1S relates to the protection of agricultural land and includes the objective to protect the state's agricultural base by preserving productive farmland.

Relevant strategies include:

- *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 state's 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.*

In considering a proposal to use, subdivide or develop agricultural land, consider the:

- *Desirability and impacts of removing the land from primary production, given its agricultural productivity.*
- *Impacts on the continuation of primary production on adjacent land, with particular regard to land values and the viability of infrastructure for such production.*
- *Compatibility between the proposed or likely development and the existing use of the surrounding land.*
- *The potential impacts of land use and development on the spread of plant and animal pests from areas of known infestation into agricultural areas.*
- *Land capability.*

Balance the potential off-site effects of a use or development proposal (such as degradation of soil or water quality and land salinisation) against the benefits of the proposal.

Clause 14.01-2S relates to sustainable agricultural land use. The relevant strategies include:

- *Ensure agricultural and productive rural land use activities are managed to maintain the long-term sustainable use and management of existing natural resources.*
- *Support the development of innovative and sustainable approaches to agricultural and associated rural land use practices.*
- *Support adaptation of the agricultural sector to respond to the potential risks arising from climate change.*
- *Encourage diversification and value-adding of agriculture through effective agricultural production and processing, rural industry and farm-related retailing.*
- *Assist genuine farming enterprises to embrace opportunities and adjust flexibly to market changes.*
- *Support agricultural investment through the protection and enhancement of appropriate infrastructure.*
- *Facilitate ongoing productivity and investment in high value agriculture.*
- *Facilitate the establishment and expansion of cattle feedlots, pig farms, poultry farms and other intensive animal industries in a manner consistent with orderly and proper planning and protection of the environment.*

- *Ensure that the use and development of land for animal keeping or training is appropriately located and does not detrimentally impact the environment, the operation of surrounding land uses and the amenity of the surrounding area.*

The proposal is considered to be consistent with the relevant goals and objectives of An Agricultural Assessment Report (Meridian Agriculture, 2022) has been prepared for the proposal. The report findings and proposed safeguards and mitigation measures are summarised in section 5.5 of this PR and provided in full at Appendix H.

Catchment planning and management

Clause 14.02-1S has the objective to assist the protection and restoration of catchments, water bodies, groundwater, and the marine environment.

Strategies:

- *Ensure that development at or near waterways provide for the protection and enhancement of the environmental qualities of waterways and their instream uses.*
- *Require appropriate measures to restrict sediment discharges from construction sites.*
- *Ensure planning is coordinated with the activities of catchment management authorities.*

The proposal avoids the water features on the site and the environmental qualities have been considered in the ecological report provided at Appendix C. Due to the minimal groundwork required, and minimal change in terrain, there are no likely impacts to the local catchment. A Soil and Water Management Plan would be prepared for the proposal prior to construction and would include necessary erosion and sediment controls.

4.6.5 Built environment and heritage

Design for rural areas

Clause 15.01-6S includes the objective to ensure development respects valued areas of rural character.

Strategies:

- *Ensure that the siting, scale and appearance of development protects and enhances rural character.*
- *Protect the visual amenity of valued rural landscapes and character areas along township approaches and sensitive tourist routes by ensuring new development is sympathetically located.*
- *Site and design development to minimise visual impacts on surrounding natural scenery and landscape features including ridgelines, hill tops, waterways, lakes and wetlands.*

The proposal site was selected and chosen specifically as it enabled selection of a site that avoids and minimises potential adverse impacts as the priority. The proposal site specifically allows for a design respecting the rural setting and surrounding developments.

Energy resource efficiency

Clause 15.02-1S includes the objective to encourage land use and development that is energy and resource efficient, supports a cooler environment and minimises greenhouse gas emissions.

Relevant strategies are to improve efficiency in energy use through greater use of renewable energy technologies and other energy efficiency upgrades.

Heritage conservation

Clause 15.03-1S includes the objective to ensure the conservation of places of heritage significance.

A heritage place has been identified on the subject land and the proposal is sited to align with the objectives of the clause.

4.6.6 Economic development

This clause seeks to provide for economic well-being.

Clause 17.01-1S Diversified economy has the objective to strengthen and diversify the economy.

Clause 21.07 Economic Development and Employment includes relevant objectives for rural areas. Relevant strategies include:

Strategies:

- *Maintain rural land in large and productive parcels, in accordance with the schedules to the farming zones.*
- *Minimise non-agricultural land uses in rural areas.*
- *Ensure that any non-agricultural land uses will not compromise farming activity in the area.*

Refer to relevant considerations and discussion in section 4.6.4.

4.6.7 Infrastructure

Clause 19.01-1S Energy Supply

Objective:

- *To facilitate appropriate development of energy supply infrastructure.*

Strategies:

- *Support the development of energy facilities in appropriate locations where they take advantage of existing infrastructure and provide benefits to industry and the community.*
- *Support transition to a low-carbon economy with renewable energy and greenhouse emission reductions including geothermal, clean coal processing and carbon capture and storage.*
- *Facilitate local energy generation to help diversify the local economy and improve sustainability outcomes.*

Clause 19.01-2S Renewable Energy

Objective:

- *To promote the provision of renewable energy in a manner that ensures appropriate siting and design considerations are met.*

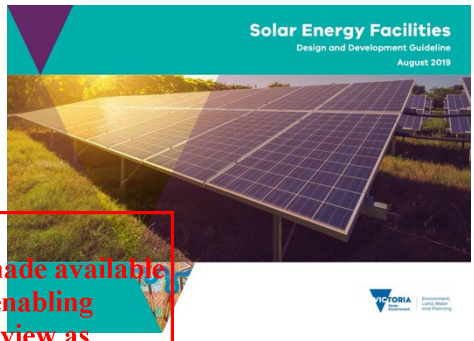
Strategies:

- *Facilitate renewable energy development in appropriate locations.*
- *Protect energy infrastructure against competing and incompatible uses.*
- *Develop appropriate infrastructure to meet community demand for energy services.*
- *Set aside suitable land for future energy infrastructure.*
- *Consider the economic and environmental benefits to the broader community of renewable energy generation while also considering the need to minimise the effects of a proposal on the local community and environment.*

The proposal is for a renewable energy facility. The location has been selected as it allows for design that avoids and minimises impacts. The proposal is considered to be compatible with surrounding land uses.

4.7 Other policies and guidelines

4.7.1 Solar Energy Facilities – Design and Development Guideline



The Victorian Government has developed the Solar Energy Facilities – Design and Development Guideline (DELWP, 2019) aiming to help outline the assessment and development process for large-scale solar energy facilities in Victoria.

This guideline provides:

1. *Information for solar farm developers (proponents), the community, regulators and decision-makers (responsible authorities) relating to the Planning and Environment Act 1987 (the P&E Act) and the Victoria Planning Provisions.*
2. *Information and direction about the policy, legislative and statutory planning requirements*
3. *Relating to the siting and design of solar energy facilities.*
4. *An overview of best-practice advice relating to each stage of the site selection, design, construction, operation and decommissioning continuum.*

The document outlines what solar facilities are, how to identify suitable locations, best practice for proponents, and information and considerations for applying for a planning permit.

The Guidelines require a site analysis and design response to be prepared. There are detailed matters that are required as part of the design response as follows:

The Guidelines require a site analysis and design response to be prepared. There are detailed matters that are required as part of the design response as follows:

1. *Detailed plans and elevations of the proposed development including the layout and height of the facility and associated building and works, and their materials, reflectivity, colour, lighting and landscaping*
2. *Detailed plans and elevations of the proposed transmission infrastructure and electricity utility works required to connect the facility to the electricity network, access roads and parking areas*
3. *Accurate visual simulations illustrating the development in the context of the surrounding*
4. *Area and from key public viewpoints*

5. *The extent and assessment of any vegetation removal*
6. *A rehabilitation plan for the site.*

The design response should also include one or more written reports and assessments including:

1. *A description of the proposal including the types of process to be utilised, materials to be stored and the treatment of waste.*
2. *An explanation of how the proposed design derives from and responds to the site analysis including cumulative impacts with any other existing and proposed renewable energy facilities in the surrounding area.*
3. *An explanation of agricultural values and production including irrigation infrastructure impacts and whether any land is productive farmland of strategic significance.*
4. *Whether a works approval or licence is required from EPA Victoria or another authority administering the regulatory requirements of the Dangerous Goods Act 1985.*
5. *A description of how the proposal responds to any significant landscape features for the area identified in the planning scheme.*

An assessment of:

1. *The potential amenity impacts (such as noise; glint or glare; light spill; emissions to air, land or water; vibration; smell and electromagnetic interference): an assessment of potential noise impacts should have regard to EPA Victoria's Noise from industry in regional Victoria guidelines.*
2. *The effects of traffic to be generated on roads.*
3. *The visual impact of the proposal in the surrounding landscape.*
4. *The visual impact on abutting land that is described in a schedule to the National Parks Act 1975 and Ramsar wetlands and coastal areas.*
5. *The impact of the proposal on any species (including birds and bats) listed under the Flora and Fauna Guarantee Act 1988 or the Environment Protection and Biodiversity Conservation Act 1999.*
6. *The impacts on Aboriginal or non-Aboriginal cultural heritage.*

The Guideline also gives further detail around the decision guidelines of Clause 53.13 Renewable Energy Facility as follows:

1. *The effect of the proposal on the surrounding area in terms of noise, glint, light spill, vibration, smell and electromagnetic interference.*
2. *Whether the impact is acceptable of can be managed in accordance with relevant Australian and New Zealand standards or other regulatory requirements.*
3. *If the assessment was undertaken by a suitably qualified person.*
4. *The spatial extent, length and duration of the impact and whether it is for a limited or extended period.*
5. *Whether the impact can be mitigated via an appropriate built form, landscaping or other management response.*

The impact on significant views including visual corridors and sightlines:

1. *The amount of change proposed by works including earthworks, and the sensitivity of the landscape features to that change.*
2. *The visibility of the solar energy facility from vantage points accessible to the public and the ability to screen areas of development from view.*

3. *The locations and distances from which a solar energy facility can be viewed from a sensitive land use.*
4. *The significance of the landscape as described in the planning scheme including in an overlay, a relevant strategic study or by landscape features referenced in the planning scheme.*
5. *Landscape values associated with nearby land such as specified areas of landscape and environmental significance, specified coastal locations and areas identified to accommodate future population growth of regional cities and centres.*

The impact of the proposal on strategically important agricultural land, particularly within a declared irrigation district:

1. *The impact on (including numbers of) irrigators downstream of the proposed site that depend on the ongoing operation of irrigation assets traversing the site.*
2. *The usage level of water compared to the actual capacity of the irrigation infrastructure servicing the site, based on rural water corporation mapping.*
3. *Whether or not the irrigation infrastructure servicing the site has benefitted from commonwealth or state government investment in infrastructure modernisation.*
4. *Whether the proposed site is connected to the modernised irrigation infrastructure and is integral to the rural water corporation's current and/or future planning for the viability of the irrigation district.*
5. *Whether or not the overall change in land use at the site aligns with a rural water corporation's asset management planning strategy for the viability of the irrigation district.*
6. *Whether the change in land use closes off any future opportunities for a rural water corporation to make irrigation footprint adjustments identified under a plan or strategy.*

The impact of the proposal on the natural environment and rural systems:

1. *How any onsite earthworks, buildings or other works will alter the natural processes occurring on land.*
2. *Whether the removal, lopping or destroying of any vegetation can be avoided or minimised through alternative design arrangements.*
3. *Proximity to natural and man-made water courses and the establishment of appropriate setbacks from these to maintain habitat and natural processes.*
4. *Impacts on landscape values associated with nearby public land described in a schedule to the National Parks Act 1975 or with Ramsar wetlands.*
5. *How bushfire and flood management measures will be dealt with to the satisfaction of the relevant referral authorities.*

The impact of a proposal on the local road network:

1. *Whether access to and from the site meets requirements established by the relevant road management authority*
2. *The impact of traffic movements to and from the site with the road network operating normally*
3. *The impact of traffic movements causing wear and tear on the road network.*

This PR and supporting documents show that the general considerations of Solar Energy Facilities – Design and Development Guideline (DELWP, 2019) and the provisions of Clause 53.13 have

been addressed. The potential impacts to views, agricultural land, natural environment and systems and the local road network have been avoided and minimised.

4.7.2 Design Guidelines and Model Requirements: Renewable Energy Facilities (CFA Guidelines) (March 2022)

The purpose of these guidelines is to provide details about standard measures and processes in relation to fire safety, risk and emergency management that should be considered when designing, constructing, and operating new renewable energy facilities, and upgrading existing facilities.

Renewable energy facilities that support the generation of electricity in Victoria include wind farms, solar farms, and battery storage facilities, which are the focus of this guideline.

There are certain access requirements some of which include:

1. *Adequate access to and within the facility will assist CFA in responding to and managing fires on-site. To enable access for fire vehicles, CFA requires that the following provisions be considered:*
2. *3.1.1 A four (4) metre perimeter road should be constructed within the ten (10) metre perimeter fire break.*
3. *3.1.2 Roads are to be of all-weather construction and capable of accommodating a vehicle of 15 tonnes.*
4. *3.1.3 Constructed roads should be a minimum of four (4) metres in trafficable width with a four (4) metre vertical clearance for the width of the formed road surface.*

Specific guidelines for solar energy facilities include:

1. *6.1.1 Solar facilities are to have a 6 metre separation between solar panel banks/rows.*
2. *6.2.1 Solar farm operators must provide specifications for safe operating conditions for temperature and the safety issues related to electricity generation, including isolation and shut-down procedures, if solar panels are involved in fire. This information must be provided within the content of the emergency information book.*
3. *6.3.1 Solar arrays are to have grass vegetation maintained to 100mm under the array installation or mineral earth or non-combustible mulch such as stone.*
4. *6.3.2 Where practicable, solar energy installations can be sited on grazed paddocks. In this case, vegetation is to be managed as per the requirements of this guideline, or as informed through a risk management process.*

Whilst the subject site is not within a Bushfire Management Overlay (BMO) the recommendations for fuel management would be considered and contained in any Fire Management Plan that would be prepared. Fuel Management includes “Solar energy facilities must have grass maintained to no more than 100mm under solar panels during the Fire Danger Period. Operators of solar energy facilities on grazed paddocks must ensure that if additional measures to maintain grass to this level are required, they are implemented prior to, and for the duration of the Fire Danger Period”.

There are model requirements for the design of the facility, that can be modified in consultation with the CFA. Separation must be to at least the distance where a fire would not create the potential for ignition of the adjacent infrastructure. The proposal was discussed with the CFA. The proposal includes a traversable 10-metre fire break around the perimeter and around the BESS from other infrastructure. Onsite water supply would be a static water supply, or a reticulated source as needed. The CFA recommended that facility operators prepare an Emergency Management Plan, a Risk Management and Fire Management Plan.

4.8 Legislation

4.8.1 Planning and Environment Act 1987 (Vic)

The purpose of the Planning and Environment Act is to establish a framework for planning the use, development, and protection of land in Victoria in the present and long-term interests of all Victorians.

The Planning and Environment Act 1987 objectives are:

(a) To provide for the fair, orderly, economic and sustainable use, and development of land.

(b) To provide for the protection of natural and man-made resources and the maintenance of ecological processes and genetic diversity.

(c) To secure a pleasant, efficient and safe working, living and recreational environment for all Victorians and visitors to Victoria.

(d) To conserve and enhance those buildings, areas or other places which are of scientific, aesthetic, architectural or historical interest, or otherwise of special cultural value.

(e) To protect public utilities and other assets and enable the orderly provision and co-ordination of public utilities and other facilities for the benefit of the community.

(f) To facilitate development in accordance with the objectives set out in paragraphs (a), (b), (c), (d) and (e).

(g) To balance the present and future interests of all Victorians.

The Act gives effect to the planning schemes that apply to the proposal. The P&E Act also includes provisions for planning permits, developer contributions, etc that would guide the process for determination of the proposal.

This planning permit application complies with Part 4, section 47 of the P&E Act and section 13 of the Planning and Environment Regulations 2015.

The matters set out in s. 60(1) and (1A) of the P&E Act and relevant provisions of the planning scheme have been considered where possible in this PR.

4.8.2 Environment Protection Act 2017 (Vic)

The *Environment Protection Act 2017* and the *Environment Protection Amendment Act 2018* (which replaced the *Environment Protection Act 1970* on 1 July 2021) establish the legislative framework for protecting the environment in Victoria from pollution and waste. The project is being developed under the provisions of the new *Environment Protection Amendment Act 2018*.

In contrast to the *Environment Protection Act 1970*, which focused on managing pollution and waste impacts after they occurred, the new *Environment Protection Amendment Act 2018* seeks to prevent these impacts from occurring. At the centre of this act is the 'general environmental duty', which requires any person in Victoria (businesses, industry, and the community) engaging in an activity that may risk harming human health and the environment from pollution and waste to minimise those risks, so far as reasonably practicable. This can be achieved by implementing appropriate controls that are proportionate to the risk (i.e., the greater the risk of potential harm, the greater the management expectation).

4.8.3 Environment Protection and Biodiversity Conservation Act 1999 (Aus)

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) came into force on 16 July 2000. The EPBC Act protects matters of National Environmental Significance. The objectives of the EPBC Act are as follows:

1. *To provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance;*
2. *To promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources;*
3. *To promote the conservation of biodiversity;*
4. *To provide for the protection and conservation of heritage;*
5. *To promote a cooperative approach to the protection and management of the environment involving governments, the community, landholders and Indigenous peoples;*
6. *To assist in the cooperative implementation of Australia's international environmental responsibilities;*
7. *To recognise the role of Indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity; and*
8. *To promote the use of Indigenous peoples' knowledge of biodiversity with the involvement of, and in cooperation with, the owners of the knowledge.*

An EPBC referral is not recommended for this proposal as the proposal is not considered to be a controlled action, as stated in the Ecological Assessment (NGH, 2022).

4.8.4 Flora and Fauna Guarantee Act 1988 (Vic)

Victoria's *Flora and Fauna Guarantee Act 1988* (FFG Act) provides a framework for biodiversity conservation in Victoria. The FFG Act provides for the listing of threatened species, communities of flora and fauna and potentially threatening processes. A number of non-threatened flora species are also protected under the Act.

A permit is required to remove species protected under the Act from public land and may also be required to remove protected species from private land in certain circumstances.

4.8.5 Climate Change Act 2017 (Vic)

The *Climate Change Act 2017* commenced operation on 1 November 2017 and seeks, among other purposes, to set a long-term greenhouse gas emissions reduction target and to provide the setting for five-yearly interim reduction targets to reach the long-term target. Section 6 states that for the purposes of the Act, "the long-term emissions reduction target for the State is an amount of net zero greenhouse gas emissions by the year 2050".

Section 20 states:

- *The Government of Victoria will endeavour to ensure that any decision made by the Government and any policy, program or process developed or implemented by the Government appropriately takes account of climate change if it is relevant by having regard to the policy objectives and the guiding principles.*

4.8.6 Renewable Energy Target (RET) legislation

The Australian RET includes legislated targets which would require significant investment in new renewable energy generation capacity in coming years. Reducing Australia's emissions by 43% by 2030, in line with Australia's proposed target under the Paris Agreement, moving to a National outcome of net zero by 2050. The Victorian Government has launched a second Victorian Renewable Energy Target to help meet its commitment of sourcing 100% renewable electricity for all Victorian Government operations by 2025. The proposed renewable facility would produce clean energy and offset approximately 9993 tonnes of carbon emissions per year.

4.8.7 Aboriginal Heritage Act 2006 (Vic)

In Victoria, Aboriginal cultural heritage is primarily protected by the *Aboriginal Heritage Act 2006* and the Aboriginal Heritage Regulations 2018. Aboriginal cultural heritage is protected by requiring planning permit applicants to prepare Cultural Heritage Management Plans (CHMP) if and when their proposed actions pose a risk to Aboriginal cultural heritage. Under the Aboriginal Heritage Act, actions are considered to pose a risk to Aboriginal cultural heritage, and therefore require the preparation of a mandatory CHMP, when they are both a "high impact activity" and occur in an "area of cultural heritage sensitivity". No part of the activity area is in an area of cultural heritage sensitivity therefore a mandatory CHMP is not required. Consultation with the RAPs has been undertaken by the proponent.

4.8.8 Dangerous Goods Act 1985 (WorkSafe Victoria considerations)

The objects of the *Dangerous Goods Act 1985* relevant to the proposal are:

- *To promote the safety of persons and property in relation to the manufacture, storage, transport, transfer, sale and use of dangerous goods and the import of explosives into Victoria*
- *To ensure that adequate precautions are taken against certain fires, explosions, leakages and spillages of dangerous goods and that when they occur they are reported to the emergency services and the inspectors without delay*
- *To ensure that information relating to dangerous goods is provided by occupiers and owners of premises to the relevant authorities*
- *To allocate responsibilities to occupiers and owners of premises to ensure that the health and safety of workers and the general public is protected*
- *To provide for licensing of persons required by the regulations to hold a licence in relation to dangerous goods*
- *To provide for the implementation of the ADG Code*
- *To provide for the management of risks arising out of security concerns associated with explosives and high consequence dangerous goods.*

The proposal includes a BESS. Batteries are a potential dangerous good and have associated fire risk in transportation and storage on site and require specific management. The proposed BESS includes the installation of 8 x 30ft shipping container style, lithium-ion batteries on site near the site entry. The project would be constructed in accordance with the requirements of WorkSafe Victoria where needed.

5. Planning assessment

This section provides the assessment of the proposal against the relevant provisions of the Greater Geelong Planning Scheme and Guidelines. It also provides an assessment of the project against relevant renewable energy policy. The assessment is undertaken thematically.

5.1 Site analysis and design response

5.1.1 Land zone

The subject land is within the Farming Zone (FZ) as shown in Figure 4-1. Works are also proposed within the road reserve of Ballan Road, zoned Transport Zone (TRZ2). The works are permissible in the zone subject to receiving a planning permit and compliance with clause 53.13 of the scheme.

The proposal would be consistent with the relevant purpose of the FZ, specifically, the proposal is considered to be compatible and minimises impacts on surrounding agricultural land during operation and post remediation. The proposal would create additional employment in the locality and support the landowner with additional income, specifically agriculture would continue in a capacity suitable for the landowners on remaining productive agricultural land. The proposal includes measures and safeguards to protect the natural environment and systems.

The proposal would be consistent with provisions under the FZ schedule, specifically the proposal would be setback 300m from the nearest dwelling not in the same ownership as the subject land and greater than 5m from all other boundaries.

A 30m setback from the front boundary (Ballan Road frontage TRZ2) is proposed and would be consistent with the decision guidelines. The Department of Transport has been consulted in the development of the design for the proposal.

Before deciding on an application to use land, construct a building or construct or carry out works, in addition to the decision guidelines in Clause 65, the responsible authority must consider Clause 35.07-6 specifically:

- ***General issues*** *– The Municipal Planning Strategy and the Planning Policy Framework. Any Regional Catchment Strategy and associated plan applying to the land. The capability of the land to accommodate the proposed use or development, including the disposal of effluent. How the use or development relates to sustainable land management. Whether the site is suitable for the use or development and whether the proposal is compatible with adjoining and nearby land uses. How the use and development makes use of existing infrastructure and services.*
    - The Municipal Planning Strategy and the Planning Policy Framework are addressed in section 4.6 of this PR.
    - The proposal is generally consistent with the Corangamite Regional Catchment Strategy including climate change adaptation.
    - The proposal would be sustainably managed, as outlined in section 5.4, section 5.5 and the ecology assessment report provided at Appendix C.
    - The subject land is considered suitable for the proposal as described generally in this PR. The proposal is compatible with agricultural activities on the subject and surrounding land. Potential impacts would be avoided or minimised for near rural dwellings.

- There were various reasons for choosing the proposal site related to making use of existing infrastructure and services, two include ease of access to the site and grid connection directly at the front of the site, refer to suitability of the site discussion in section 5.1.3.

- ***Agricultural issues and the impacts from non-agricultural uses*** *– Whether the use or development will support and enhance agricultural production. Whether the use or development will adversely affect soil quality or permanently remove land from agricultural production. The potential for the use or development to limit the operation and expansion of adjoining and nearby agricultural uses. The capacity of the site to sustain the agricultural use. The agricultural qualities of the land, such as soil quality, access to water and access to rural infrastructure. Any integrated land management plan prepared for the site.*
    - The proposal would potentially support and sustain agriculture production on the site, as outlined in section 5.5 and the agricultural assessment provided at Appendix H. The proposal is compatible with continuing agriculture practices (generally cropping and grazing) on surrounding land as discussed generally in this report, particularly considering control of heat island effect, soil and water management, and vegetation management.
- ***Environmental issues*** *– The impact of the proposal on the natural physical features and resources of the area, in particular on soil and water quality. The impact of the use or development on the flora and fauna on the site and its surrounds. The need to protect and enhance the biodiversity of the area, including the retention of vegetation and faunal habitat and the need to revegetate land including riparian buffers along waterways, gullies, ridgelines, property boundaries and saline discharge and recharge area. The location of on-site effluent disposal areas to minimise the impact of nutrient loads on waterways and native vegetation.*

    - The proposal would be sustainably managed, and a site specific Soil and Water Management Plan would be developed prior to construction. There are no waterways within the site and no foreseen significant adverse impacts as outlined in section 5.4 (consideration of waterways) and section 5.5 (agricultural assessment summary). The ecology assessment considers the natural functions of the site and native vegetation removal impacts, refer to section 5.2 and the full report at Appendix C.
- ***Design and siting issues*** *– The need to locate buildings in one area to avoid any adverse impacts on surrounding agricultural uses and to minimise the loss of productive agricultural land. The impact of the siting, design, height, bulk, colours and materials to be used, on the natural environment, major roads, vistas and water features and the measures to be undertaken to minimise any adverse impacts. The impact on the character and appearance of the area or features of architectural, historic or scientific significance or of natural scenic beauty or importance. The location and design of existing and proposed infrastructure including roads, gas, water, drainage, telecommunications and sewerage facilities. Whether the use and development will require traffic management measures.*
    - The proposal is generally grouped with the existing dwelling on the land and is sited to be as far as practicable from adjoining dwellings. The proposal is compatible with surrounding developments when considering height and scale, specifically height of dwellings, height and scale of poultry farms. The view of the proposal would be most prominent from Ballan Road, but as the speed is 100km/hr, views would generally be quick glance views and predominately when travelling from the north to south. The proposal is considered to have no views on the heritage listed woolshed

on the land, refer to section 4.3.3 for consideration of the heritage significance. The proposal would connect to existing electrical services at the front of the site, refer to discussion in section 5.1.3. Traffic would noticeably increase in the area during construction and decommissioning, traffic during operation would be minimal. A traffic impact assessment has been completed for the proposal and impacts would be managed with appropriate traffic management plans, refer to section 5.7 and the report at Appendix D.

5.1.2 Character and landscape

Primary production/agriculture grazing (open paddocks) is the predominant character and land use of the area as shown in Figure 5-1. Generally, the subject land is gently sloped down to the water courses in the area. The surrounding properties are made up of a mix of smaller scale agricultural lots with hobby scale farming and larger properties used for broadacre cropping and grazing. Rural dwellings are generally located on the agricultural lots. Increased vegetation, including established trees, are present around rural dwellings

Significant size poultry farms and feedlots are present in the locality, introducing a rural industrial character to the rural/agricultural landscape. The scale of some of the sheds (total combined area) is similar to the proposal footprint.

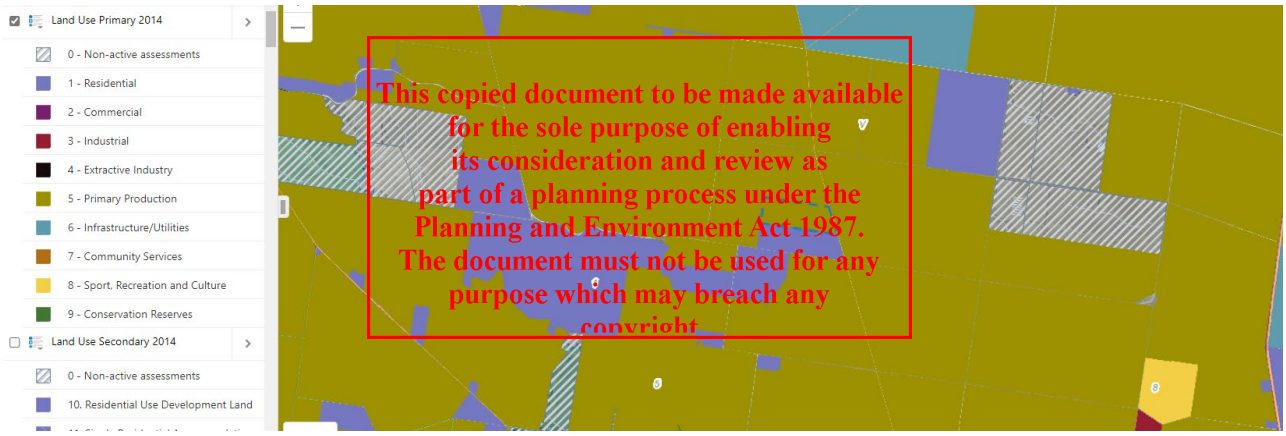


Figure 5-1 Land use mapping (Source: VicPlan)

5.1.3 Suitability of the site

The proposal site was selected and chosen specifically as it enabled selection of a site that avoids and minimises potential adverse impacts as the priority to address clause 53.13 of the scheme and the Farming Zone decision guidelines as referenced in section 5.1.1. The proposal site specifically:

- Avoids and minimises impacts to areas of quality native vegetation.
- Minimises impacts of noise and traffic (specifically volumes and access impacts).
- Provides for minimisation of visual impacts and allows for screening where needed.
- Allows for avoidance of waterways and mapped areas of Aboriginal cultural sensitivity.
- Is of a suitable size that allows for quality solar gain and best practice bushfire management, specifically with response to the existing vegetation on the property and on surrounding land.
- Allows for design and construction that would minimise soil disturbance and impacts of overland flow.

- Allows for design and construction that would be compatible with farming on the remaining parts of the subject land. Agriculture would continue in a capacity suitable for the landowners.
- Allows for design and construction that would be compatible with surrounding farm zone land uses.
- Has connections available to the electricity network and telecommunications network.
- Can access sewage collection (porta-loo) and water delivery services required for the proposal.

The proposal site is suitable because:

- This PR and supporting studies has found environmental and social impacts would be avoided, minimised, or mitigated to provide for positive environmental outcomes and protection of amenity.
- The proposal is a viable scale while responding to site constraints and minimising environmental impacts to the site and surrounding locations.
- It has optimal solar resources, suitable land, capacity to rehabilitate, proximity to electrical network and connection capacity.
- Existing distribution lines run parallel to the site. The connection to the power network can be made via a short overhead line.
- Once the proposal reaches the end of its operational life, the site can be remediated to a suitable agricultural condition so cropping or grazing can be resumed.

The siting of the infrastructure for this proposal has been an iterative process, allowing for changes to the layout as needed to allow for necessary project amenity and mitigate impacts.

The constraints and opportunities for the site are discussed below and in the supporting reports that accompany this PR.

5.2 Ecology

NGH Pty Ltd, on behalf of the proponent, has completed the detailed Ecological Assessment (NGH, 2022) for the proposal, refer to the summary below and full report at Appendix C. The assessment considered the entire subject land, 44.41ha study area. The assessment:

- Undertook a desktop search of threatened species and communities listed under the *Flora and Fauna Guarantee Act, 1988 (FFG)* and the *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC)* and desktop assessment of EVC modelling and aerial imagery to determine the extent of native vegetation within the defined Study Area.
- Addressed legislative requirements including Clause 52.17 of the scheme and the permit requirement for removal, destruction or lopping of native vegetation.
- Completed a site assessment to determine the extent of native vegetation and complete a habitat hectares assessment and determined the offset requirements.

The assessment included the native vegetation assessment, scattered tree assessment, vegetation mapping and incidental fauna observations. The key findings were:

- The EVC with the study area (subject land) is EVC 55_61 Plains Grassy Woodland. Habitat zones are located within the proposal site, these are:

  - Habitat 1a-1k. This zone is comprised of EVC 55_61 This habitat zone is comprised of several small areas (HZ1a-HZ1m) of EVC 55_61 Plains Grassy Woodland covering 5.27 ha. These habitat zones are recolonising native grasses interspersed with exotic pasture grasses. The native grass cover within this zone was between 25-50%. There is an absence of trees, shrubs, recruitment, and logs.
  - Habitat 2a-2d. This habitat zone is comprised of three areas (HZ2a-HZ2c) of EVC 55_61 Plains Grassy Woodland covering 13.5 ha. These habitat zones are native grasses interspersed with exotic pasture grasses. The native grass cover within this zone was >50%. There were 2 River Red Gums (Eucalyptus camaldulensis), some stags and large logs scattered throughout these areas. There was absence of recruitment and shrubs.

- One large tree is located within the development footprint. The large tree is a stag (dead tree) with a DBH of 129cm. The large tree is hollow bearing containing 1 large, 1 medium and 1 small hollow. The large tree would be impacted by the proposed works and therefore, requires an offset.
- The study area is completely covered by an Environmental Significance – ESO overlay and is located in the Victorian Volcanic Plain Bioregion. All FFG and EPBC listed flora species were determined to have a low likelihood to occur on site. The proposed development footprint will have minimal impact of threatened flora. Golden Sun Moth (*Synemon plana*) listed as Vulnerable under the *FFG Act* and Critically Endangered *EPBC Act has a* low-moderate likelihood of occurring on site. Steps have been undertaken to avoid and minimise impacts to this species and the proposed native vegetation removal will have a negligible impact on these species. A habitat assessment for Striped Legless Lizard and Pink-tailed Worm Lizard was undertaken. The results of the survey results determined these species have a low likelihood of occurring on site. All other listed FFG and EPBC fauna species has a low likelihood of occurring on site. No further targeted survey will be required.
- Weeds and pests were identified during the site inspection.
- Planted vegetation was identified to the across the study area. Spotted Gum (Corymbia) is planted on boundary of Ballan-Geelong Road (inside the fence boundary). A section of this would be impacted for the entrance to the proposal, however no offset is required for removal of planted vegetation. The majority of the development footprint was exotic vegetation, where the existing development footprint has been utilised for grazing of livestock. The exotic vegetation occurs in the form of grassland. No offset is required for this vegetation removal.
- No EPBC referral is needed.

The proposal has been designed to reduce the potential for ecological impacts including the following steps:

- The proposed development footprint was modified and reduced to avoid native vegetation.
- The impact area is confided to the development footprint. This includes all areas within the 'project fence line' and access road to the 'project fence line'.
- The boundary plantings will be retained.
- 'Extent of Works' fencing during construction or erect signage to say 'no-go zones' tree protection areas.
- Mitigation measures to minimise the biodiversity loss includes:

- Take steps necessary to avoid harm or injury to wildlife.
- Fauna salvage prior to tree removal.
- A suitably qualified ecologist or wildlife handler on site during tree removal or removal of the vegetation, habitat features (e.g., logs and rocky habitat), and HBT.
- Two-factor HBT removal protocol to be established.
- Implement an unexpected threatened species find protocol prior to and during construction works.

The proposal would result in 0.071ha of native vegetation being removed. 1 large tree would also be removed, this impact requires an offset. Third party offsets would be purchased through a broker.

There is potential for weed spread and introduction due to the nature of construction works proposed and number of vehicles likely to visit the proposal site.

Measures to avoid and minimise potential impacts to ecology of the site are provided in Table 5-1.

Table 5-1 Ecology safeguards and mitigation measures

No.	Safeguards and mitigation measures	C	O	D
E1	A Landscape (Flora, Fauna, Weeds, Pest) Management Plan would be prepared and form part of the EMP. The Landscape Management Plan for the site would include measure to avoid and minimise potential impacts to ecology and would be implemented through all stages of the proposal in accordance with the Ecological Assessment (NGH, 2022).	C	O	D
E2	The impact area is confined to the development footprint. This includes all areas within the 'project fence line' and access road to the 'project fence line'.	C	O	D
E3	No areas outside the development footprint would be impacted, including vehicle movements. Any increase to the development footprint would require re-assessment of offset impacts and ecological impacts.	C	O	D
E4	The boundary plantings, other than those required for removal for the site entry, would be retained.	C	O	
E5	'Extent of Works' fencing would be installed prior to construction or erect signage to say 'no-go zones', include tree protection areas as needed.	C		D
E6	Mitigation measures to minimise the biodiversity loss includes: • Take steps necessary to avoid harm or injury to wildlife. • Fauna salvage prior to tree removal. • A suitably qualified ecologist or wildlife handler on site during tree removal or removal of the vegetation, habitat features (e.g., logs and rocky habitat), and HBT.	C		

No.	Safeguards and mitigation measures	C	O	D
E7	An unexpected threatened species finds protocol would be implemented. If a species is identified during the construction phase that is suspected of being a threatened species, all works would stop to allow assessment of the species by a suitability qualified person prior to continuation.	C		
E8	No stockpile locations for imported material outside of the defined development Footprint were identified as part of the assessment scope. No stockpiling of any materials would occur outside the development Footprint.	C	O	D
E9	All machinery and plant equipment will be cleaned using a high-pressure washer (or other suitable device) prior to entering work sites. • Any exotic plant material containing seed heads, including topsoil containing weed propagules, will be disposed of at an appropriate waste management facility or otherwise properly treated to prevent weed spread.	C	O	D
E10	Herbicides will be used in accordance with the requirements on the label. Any person undertaking herbicide application will be trained to do so and have the proper certificate of completion/competency or statement of attainment issued by a registered training organisation.	C	O	D
E11	Any fallen timber encountered on site will be left in situ wherever possible or relocated to a suitable place nearby. • Fallen timber will not be 'pushed' into surrounding vegetation and would be 'lifted' and 'placed' to avoid unnecessary disturbance. • Any Coarse Woody Debris (CWD) created from the proposed works would be placed in surrounding vegetation. • Any CWD mulched would be spread thinly <100mm deep in surrounding vegetation.	C	O	D
E12	Erosion and run-off control works, as well as rehabilitation and stabilisation measures, would be undertaken where necessary.	C	O	D

C: Construction (prior to and/or during); O: Operation; D: Decommissioning

Consistency with planning provisions

The proposal is considered to be consistent with clause 42.01 ESO4 environmental objectives, clause 52.17 of the scheme as well as state planning policy framework provisions, clause 12.01 and farming zone decision guidelines as discussed in section 5.1 being consistent with the regional catchment strategy and the proposal would be sustainably managed.

The proposal has shown compliance with the environmental issues raised in clause 35.07-6, *the need to protect and enhance the biodiversity of the area, including the retention of vegetation and faunal habitat. The proposal is* consistent with the general decision guidelines clause 65.01, requiring consideration of t*he extent and character of native vegetation and the likelihood of its destruction, whether native vegetation is to be or can be protected, planted or allowed to regenerate:*

- The Ecology Assessment (NGH, 2022), has addressed the potential removal of native vegetation and impacts on biodiversity and fragmentation of the landscape. To ensure that there is no net loss to biodiversity, measures of avoidance, minimisation and offsetting have been the focus for the siting of the proposal. Removal of native vegetation and protection of habitat would be carefully managed with the commitment and inclusion of appropriate safeguards and mitigation measures. The measures would be incorporated into EMP's for the proposal and implemented as needed through all stages of the proposal.

5.3 Bushfire

Bushfire presents a threat to human life and assets and can adversely impact ecological values. Bushfire risk can be evaluated and managed by considering environmental factors that increase the risk of fire (fuel load and type, topography, and weather patterns), as well as specific activities (such as hot works) or infrastructure components that exacerbate combustion or ignition risks (such as transmission lines, energy storage systems and other electrical components).

The proposal site has been predominantly cleared of overstorey vegetation for agricultural purposes and is comprised mostly of grassland and lines of trees. Tree lines have a width of less than 20m. The topography of the proposal site is gently sloped.

The entire subject land is identified as a bushfire prone area but is not subject to the Bushfire Management Overlay (BMO) as shown in Figure 5-2.

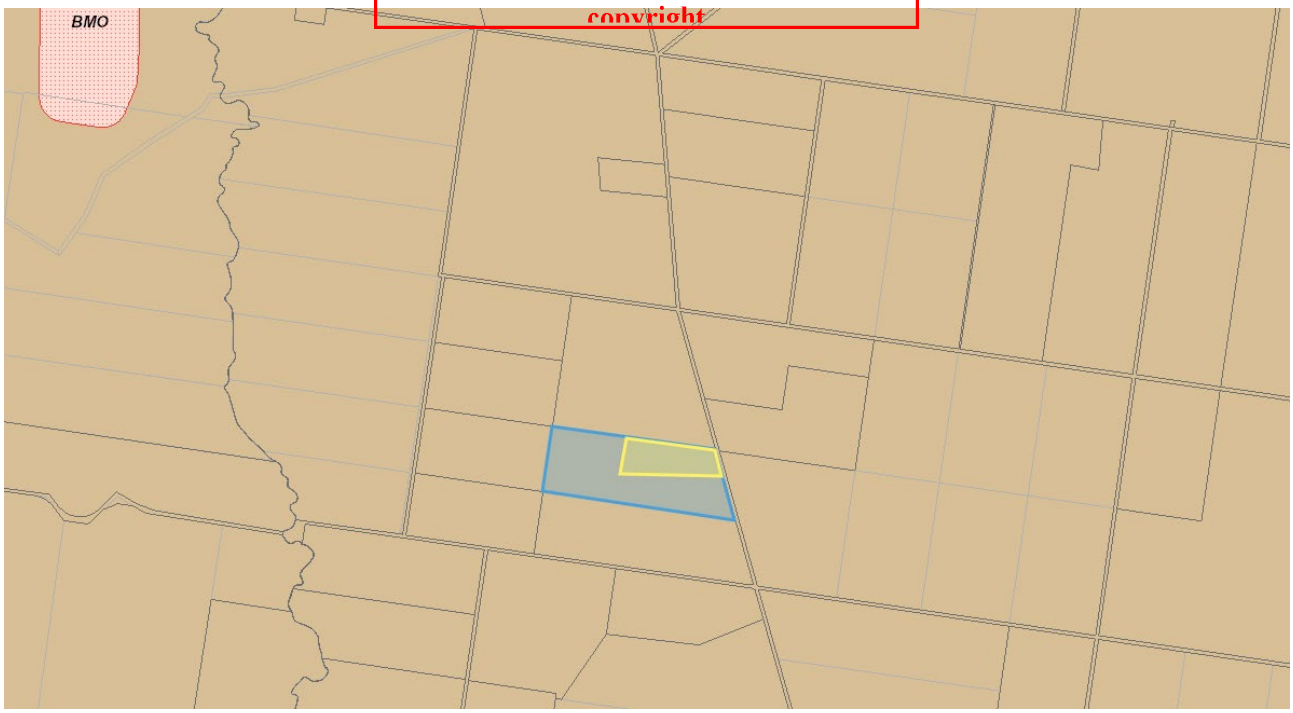


Figure 5-2 Bushfire prone area mapping and the proposal site (SoV_VicPlan 2022)

The land is located in a rural area, surrounded by some smaller holdings, these are generally considered to be managed land with areas of grazed grassland. Larger cropped sites are also

present to the north and east. Consultation with the CFA included feedback on the risk for the subject land and it was considered to have generally low bushfire risk. The bushfire vegetation mapping for the site is shown at Figure 5-3. The vegetation is mostly open grassland.

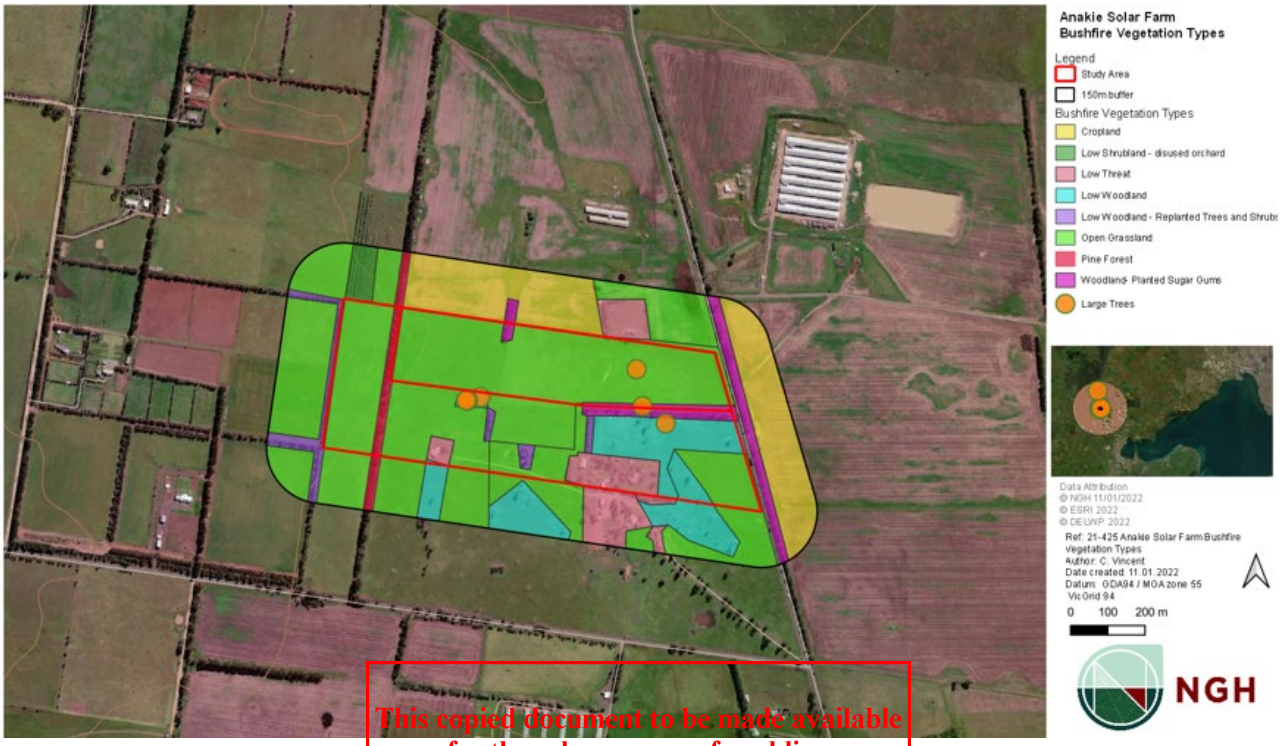


Figure 5-3 Bushfire vegetation mapping (NGH, 2022)

The main bushfire hazards for the proposal site include the following:

- The substation and BESS.
- Vegetation along the east and west boundaries, and grassland patches and tree lines throughout the subject land.
- The existing transmission lines east of the proposal site.
- Uncontrolled grassfires or housefires in the immediate area.
- Car accidents and incorrect cigarette disposal along the road passing the site.

There is potential fire risk during all stages of the proposal. Uncontrolled fires could have potential impacts to life, the community, and economic impacts due to impacts to agricultural land or dwellings.

As the proposal is for an electrical installation, there is potential for fire risk from spark or ignition due to static electricity, overheating, etc.

Vegetation management (i.e., mowing) and hot exhausts can also have a fire ignition risk.

The setbacks for the proposal are a minimum of 15m setback from the north boundary (minimum 30m from the shed on the adjoining property) and 30m east boundary to the array, the setback areas include areas of managed landscaping (i.e., keeping grasses to a low height. Any areas of proposed screen planting would use fire resistant or retardant plants as the priority for screening vegetation (located to the south of the proposal site). For example, screen plantings would be selected using the CFA's Plant selection tool *Plant Selection Key Interactive | CFA (Country Fire Authority)* or Australian Plants Society, Victoria, *Fire Resistant and Retardant Plants | Australian Plants Society Victoria (apsvic.org.au)*). Setbacks to other site features (dwellings) to the south and

west would achieve a setback of 100m or greater. The setback area would include a 10m fire break between the landscaped areas (tree lines/screening vegetation) and the solar infrastructure, being a cleared defendable space. The fire break would be a traversable fire break around the perimeter of the facility suitable for use by emergency services vehicles, the width would provide for passing and turning.

The substation, and BESS (the key risk areas for chance of ignition) would be separately buffered with a fire break, close to the site entry and near static water supply where required. The surface of the area would be finished with non-combustible materials.

The potential risks associated with bushfire would be reduced as the proposal's detailed plans would be designed in accordance with the model guidelines and any risk assessment findings. Fire and emergency management plans would be prepared prior to construction implemented during construction, operation, and any decommissioning. The proponent commits to the following mitigation measures for the proposal, as outlined in Table 5-2.

Table 5-2 Bushfire safeguards and mitigation measures

No.	Safeguards and mitigation measures	C	O	D
BF1	Prior to construction the following plans would be prepared to form part of the EMP's for the site: • Emergency Management Plan. • Risk Management. • Fire Management Plan. The EMP would be implemented during construction, operation and decommissioning as required.	C	O	D
BF2	The plans for construction would be consistent with the EMP documents for the site in consultation with the CFA as required consistent with the CFA guidelines (CFA, 2022).	C		
BF3	The vegetation management plan should be prepared by an ecologist. The plan would include planting lists for the site. Any planted vegetation would be Fire Resistant and Retardant Plants as the priority.	C	O	
BF4	Regular vegetation maintenance would occur within the fenced area of the proposal site throughout the operational phase to maintain low fuel loads to reduce risks associated with bushfire during the bushfire season and any buffer period necessary.	C	O	D
BF5	Machinery capable of causing an ignition would not be used during bushfire danger weather, including Total Fire Ban days.	C	O	D

C: Construction (prior to and/or during); O: Operation; D: Decommissioning

Consistency with planning provisions

The proposal is considered to be consistent with particular provisions of the state planning policy framework, clause 13.02 of the scheme as discussed below:

- The provision of all bushfire management areas within the site would be consistent with the farming zone purpose to ensure that non-agricultural uses, including dwellings, do not

adversely affect the use of land for agriculture. The proposal has been designed to give priority to the protection of human life and property.

- Consistent with the general decision guidelines clause 65.01, the proposal has been designed with consideration of the degree of fire hazard associated with the location of the land and the use, development or management of the land so as to minimise any such hazard. The proposal would not significantly increase the risk of bushfire within the landscape, in terms of ignition, fuels or changes in population. The application of mitigation measures and buffers provided around infrastructure would reduce risk to an acceptable level, in light of the low-risk landscape present.
- The proposal has included measures to avoid and minimise risk from grass fires and electrical fires on the proposal plans included at Appendix A.
- The proposal would have appropriate management plans prepared prior to construction and would form part of the EMP for the site. Advice from meetings with the CFA has been incorporated into the design. If required further consultation with the CFA would occur as part of the preparation of the EMP.

5.4 Waterways (flooding, inundation, overland flow, groundwater)

There are no ephemeral drainage lines/gullies or wetlands throughout the site. The closest water course is located greater than 150m from the subject land boundary to the north of the site as seen in Figure 5-4. The land generally slopes away from this water course and towards the rear of the subject land. The water table depths are indicated for the site ranging between 5–10m.

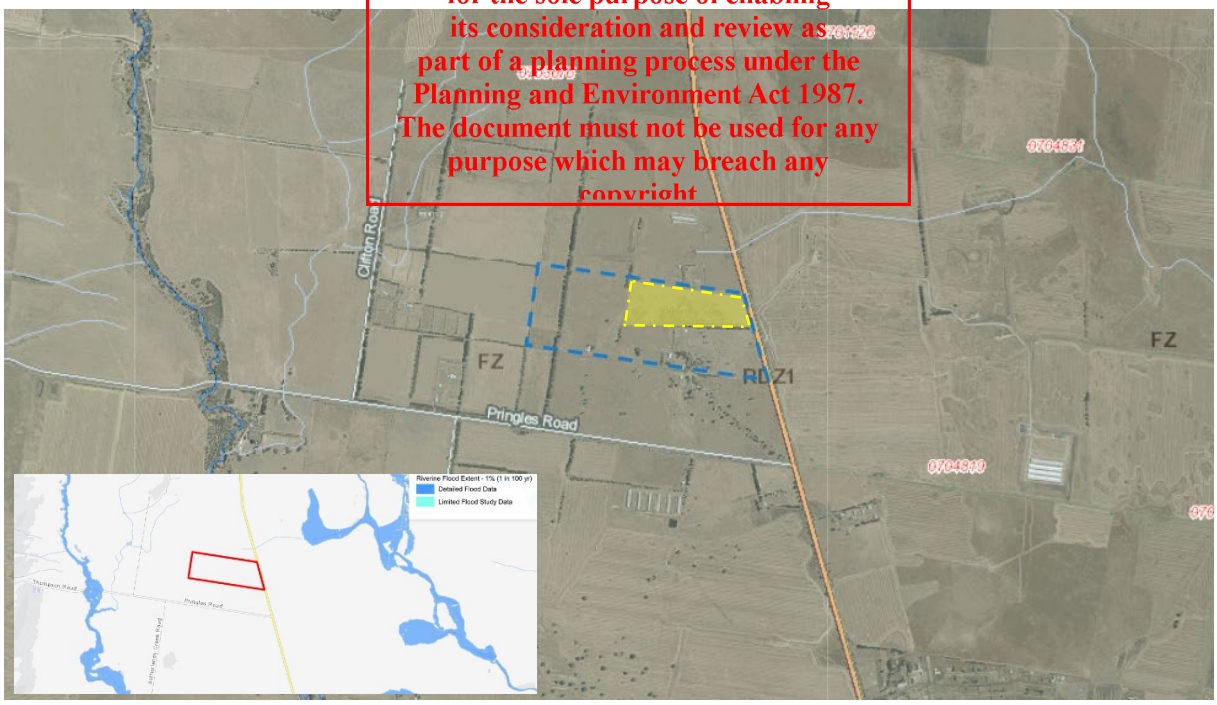


Figure 5-4 Water courses and flooding map (Source: VicPlan and Corangamite flood portal, 2022)

There is low potential for erosion or sediment impacting waterways in the area. There are no likely impacts to the water table as infrastructure is limited to pile or screw driven posts, minimal trenching for connecting power between arrays and substation, and minor building/structure footings. There are no major earthworks anticipated for the proposal and as a result there would be no significant changes to the drainage regime of the site during construction and operation. The

soil and stormwater management for the proposal would be designed and maintained in accordance with the Victorian EPA 2020 guidelines including:

- Publication 1894, Manage soil disturbance.
- Publication 1893, Use a treatment train (multiple control) approach.
- Publication 1895, Manage stockpiles.
- Publication 1897, Manage truck and other vehicle movement.
- publication 1896, Manage how you work within or adjacent to waterways.

The potential risks associated with waterways for the proposal can be reduced by designing in accordance with relevant codes and best practice standards. These measures are outlined in Table 5-3.

Table 5-3 Soil and water safeguards and mitigation measures

No.	Safeguards and mitigation measures	C	O	D
W1	A Soil and Water Management Plan would be included in the EMP for the proposal. The plan would specifically address overland flow and sediment and erosion control. The plan would avoid or minimise earthworks which change the rate of flow or the discharge point of water across a property boundary.	**C**	**O**	**D**

C: Construction (prior to and/or during); O: Operation; D: Decommissioning

Consistency with planning provisions

The proposal is considered to be consistent with the provisions of the scheme, specifically the provisions of State Planning Policy Framework Clause 12.03-1S as it relates to river corridors and waterways and Local Planning Policy Framework Clause 21.05 Natural Environment. Appropriate management plans would be prepared prior to construction to manage soil and water impacts of the proposal.

The proposal has shown consistency with the farming zone decision guidelines as discussed in section 5.1, specifically being consistent with the regional catchment strategy and the proposal would be sustainably managed. The proposal has addressed the environmental issues raised in clause 35.07-6, *the impact of the proposal on the natural physical features and resources of the area, in particular on soil and water quality,* and clause 65.01 *the degree of flood* or *erosion hazard associated with the location of the land and the use, development or management of the land so as to minimise any such hazard:*

- The proposal would be sustainably managed, and a site specific Soil and Water Management Plan would be developed prior to construction. There are no waterways within the site. Overland water flow can be controlled within the site boundaries but may not be needed depending on the outcomes of the Soil and Water Management Plan developed for the site. There are no foreseen adverse impacts to soils as outlined section 5.5 (agricultural assessment summary).

5.5 Agricultural considerations

The Solar Energy Facilities Design and Development Guideline (DELWP, 2019) requires assessment of:

- Potential impacts to agricultural lands that may be high value and of strategic importance
- Agricultural productivity/carrying capacity of the land
- Agricultural use, pre, during and post operation
- Agricultural values and impacts to the wider agricultural land use in the region.

In addition to desktop research an Agricultural Assessment (Meridian Agriculture, 2022) has been prepared for the proposal, the findings are summarised below, and the report is provided at Appendix H.

The property is very slightly undulating and slopes to the east.

The surface geology of the site is newer basalts (Qvn) with a section of You Yang's granite (Dug) at depth towards the southeast corner of the site.

The site, as shown in Figure 5-5, includes the following soil landscapes and types:

- 121 Undulating rises and broad plains (Anakie East).
- 6.1.3 Volcanic Western Plains with poorly developed drainage.

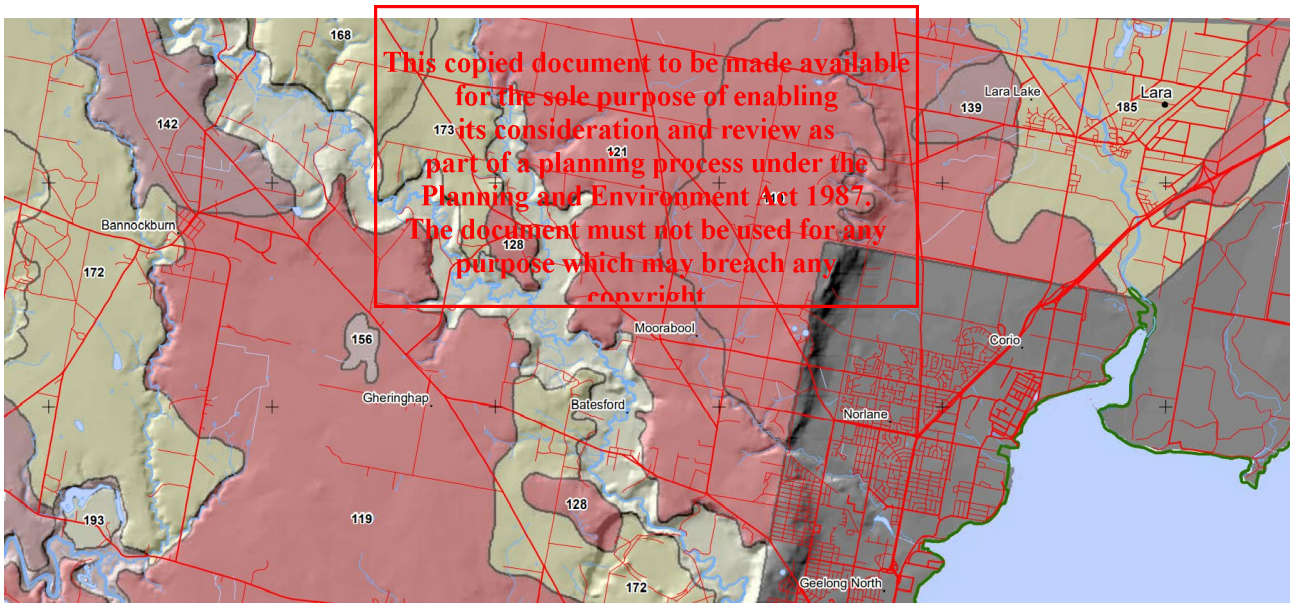


Figure 5-5 Soils mapping (Source: Agriculture Victoria)

While no soil tests are available, soils developed from the newer volcanics are typically duplex soils (having distinct soil horizons) and may have impeded internal drainage.

These soils can be difficult to cultivate especially when they are wet, and crops may suffer from waterlogging in years of high rainfall.

Historical images indicate that the property has been used for grazing, mostly for cattle and occasional running of sheep from at least 2010. The land pre-subdivision would have included sheep grazing due to the presence of the heritage woolshed on the land.

While the property has not been cropped, the properties to the north and east have been cropped in recent years. There are two housed-poultry farms to the north (400m) and to the south (800m).

The land has no direct strategic importance and is not within an irrigation district.

While the area is small, it would be possible to crop the land. Potential crop yields can be inferred from the growing season rainfall.

Based on the price of wheat, the income would be expected have a gross margin of $827/ha or $13,250 for the block, depending on operating costs.

The length of growing season is used to provide an estimate of potential stock carrying capacity, averaging around 6.5 months of the year, with a potential stocking rate of around 13 Dry Sheep Equivalents (DSE)/ha.

Because the property has not been cropped there would be continued growth of pasture after the construction of the solar proposal.

There would be medium-term loss of part of the agricultural land of the site, but this would not prohibit grazing of cattle or cropping on the remainder of the subject land during operation of the proposal. Co-location, sheep grazing, within the solar array may be a future agricultural option depending on operational management constraints and animal welfare.

The proposal would have no effect on the ability of surrounding property owners to operate, nor would it impact on the agricultural sector in the wider region. By virtue of its small size, the property contributes insignificantly to the agricultural output of the region and is not located on a unique, high value soil type.

When the proposal is decommissioned, there would be no residual detrimental impact on the productivity of the site with any decline in soil fertility easily corrected.

The proposed agricultural management measures are outlined in Table 5-4.

Table 5-4 Agricultural safeguards and mitigation measures

No.	Safeguards and mitigation measures	C	O	D
A1	As part of rehabilitation works, amendments to soil should be applied to address any decline in soil fertility.	C		D

Consistency with policy provisions

The Agricultural Assessment (Meridian Agriculture, 2022) has addressed the potential for state, regional and local agricultural impacts, land capability, continuation of farming on the subject land, and compatibility of the proposal considering surrounding agricultural land uses.

The proposal is considered to be consistent with the farming zone purpose. The assessment demonstrates that the proposal is consistent with the Natural Resources Management provisions of the scheme, specifically the provisions of State Planning Policy Framework Clause 14.01-1S Protection of Agricultural Land and Local Planning Policy Framework Clause 21.05 Natural Environment.

The proposal has shown consistency with the farming zone decision guidelines as discussed in section 5.1, specifically being consistent with the regional catchment strategy water and land provisions and the proposal would be sustainably managed. The proposal has addressed the environmental issues raised in clause 35.07-6, *whether the use or development will support and enhance agricultural production, whether the use or development will adversely affect soil quality or permanently remove land from agricultural production, the potential for the use or development to limit the operation and expansion of adjoining and nearby agricultural uses, the capacity of the*

site to sustain the agricultural use, the agricultural qualities of the land, such as soil quality, access to water and access to rural infrastructure and clause 65.01, *factors likely to cause or contribute to land degradation:*

- The proposal would be sustainably managed and support the farming enterprise on the subject land and a site specific Soil and Water Management Plan would be developed. There are no foreseen compatibility or adverse impacts to agriculture continuing on the subject and surrounding land (during, construction, operation, and post rehabilitation) as detailed in the Agricultural Assessment.

5.6 Noise

The Solar Energy Facilities Design and Development Guideline (DELWP, 2019) requires assessment of noise impacts and requires levels at or below the levels in EPA Victoria's Noise from industry in regional Victoria guideline.

An Acoustic Assessment (Renzo Tonin & Associates, 2022) has been prepared for the proposal to determine noise levels, the findings are summarised below, and the report is provided at Appendix G. *Note: A worst case scenario has been used to prepare the acoustic assessment. The resulting noise levels would likely be less than outlined in the Acoustic Assessment based on the reduced proposal site (as shown in this PR report at Figure 2-8).*

The proposal would have the capacity to generate electricity during day light hours. This would predominantly be during day and evening periods (7am-6pm and 6pm-10pm, respectively) throughout the year and potentially part of the night time period (prior to 7am) during the summer months. Batteries could potentially operate at all times.

There are 6 sensitive receivers, R1 to R6 considered for the purpose of the assessment, refer to Figure 5-6 and as listed in Table 5-5. The dwellings (R1 to R5) are all located within the Farm Zone and are 230m or greater from the proposal site. R6 is a shed.

Table 5-5 Sensitive receivers and distance to the proposal site

Receiver number	Address	Approximate distance to site boundary
R1	1435-1475 Ballan Road, ANAKIE VIC 3213	230m
R2	1385-1425 Ballan Road, ANAKIE VIC 3213	340m
R3	170 Pringles Road, ANAKIE VIC 3213	>700m
R4	80 Clifton Road, ANAKIE VIC 3213	>830m
R5	120 Clifton Road, ANAKIE VIC 3213	>830m
R6	1485-1575 Ballan Road, ANAKIE VIC 3213	55m

Figure 5-6 Sensitive receivers mapped for noise assessment (Renzo Tonin & Associates, 2022)

To assess noise Renzo Tonin and Associates used the methods in the EPA Publication 1826 'Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues' (EPA pub. 1826).

The assessment considered the applicable noise limits from EPA pub. 1826 as shown in Table 5-6.

Table 5-6 EPA 1826-P1 noise limits

Period	Generating zone	Receiving zone	EPA 1826-P1 limit, L_{eq} dB(A)[1]
Day	Farming Zone	Farming Zone	46
Evening			41
Night			36

EPA 1826-P1 period definitions:

- *Day: Monday-to-Saturday 7am-to-6pm; Sundays NA*
- *Evening: Monday-to-Saturday 6pm-to-10pm; Sundays or Holidays 7am-to-10pm*
- *Night: All days 10pm-to-7am*

In relation to construction noise and vibration, the applicable location of assessment is outside surrounding dwellings, assessed over a 30-minute period. Considered was the EPA Publication

1834 'Civil Construction, Building and Demolition Guide' (EPA Pub. 1834). EPA Pub.1834 provides the guiding design and construction principles and mitigation measures that would be implemented for the proposal to control and limit construction noise and vibration, including but not limited to using quitter equipment or methods, maintaining equipment, managing traffic and haulage, limiting noise caused by people on the site, considering location of sensitive receivers in construction timing and order.

EPA Pub.1834 also sets the noise level standards that would be implemented for normal working hours, weekend/evening work hours and night hours:

- *Between 6pm and 8pm Mondays to Friday, 1pm and 8pm on Saturdays and 7am to 8pm on Sundays and public holidays, construction noise levels at dwellings be limited to 46 dB(A)*

Specifically for haulage the proposal would limit Heavy Goods Vehicles (HGV) to standard construction hours (Weekdays 7am–6pm; Saturdays 7am-1pm) minimising construction traffic noise.

Vibration would be far less onerous than greater vibration considerations outlined in relevant standards, stating detection of vibration at 50m. As the closest dwelling is 55m from the proposed solar infrastructure, and any vibration impacts would dissipate with distance, there would be no likely discernible impacts.

The expected noise levels of the operation were assessed and were based on the sound power levels (maximum levels of specific equipment and machinery). Table 5-7 provides details of typical equipment and corresponding sound power levels which have been incorporated into this assessment. Equipment has been assumed to be distributed uniformly across the site except where equipment locations have been indicated specifically in provided drawings.

Table 5-7 Typical equipment and associated power levels

Equipment	$L_{W,eq}$ Sound Power Levels, dB(A) re. 1pW
NEXTracker Gemini 2P tracker motors (450 in total)	52 (each)[3]
Inverter/power stations: SMA SC 2475-EV inverters (20 in total)	85 (each)[3]
Substation area: 7 MVA transformer (2 in total)	86 (each)[2]
Battery area: 50 MWH battery storage units (4 in total)	87 (each)[2]
Battery area: Transformers (8 in total)	83 (each)[2]

Table 5-8 presents the predicted noise levels at the nearest dwellings. Noise levels conform with EPA 1826-P1 night time criteria and therefore also conform with day and evening EPA 1826-P1 criteria.

Table 5-8 Predicted noise levels at dwellings from operation

Dwelling ID	Predicted noise levels, L_{eq} dB(A)	EPA 1826-P1 recommended night time noise limit (most stringent), L_{eq} dB(A)	Complies?
R1	34	36	✓
R2	30	36	✓
R3	28	36	✓
R4	18	36	✓
R5	17	36	✓
R6	16	36	✓

'On the basis of the assessed configuration, it considered that the 'Proposal' is low risk with respect to operational and construction noise and vibration and can operate continuously and at full capacity without adverse acoustic impact on residential amenity.' (Renzo Tonin & Associates, 2022). No specific measures are required for operation.

The proposed noise management measures are outlined in Table 5-9.

Table 5-9 Acoustic safeguards and mitigation measures

No.	Safeguards and mitigation measures	C	O	D
A1	Implement construction noise mitigation measures outlined in the Acoustic Assessment (Renzo Tonin & Associates, 2022), incorporate relevant measures into EMP's.	C		

Consistency with planning provisions

The proposal is considered to be consistent with the provisions of the scheme, specifically the provisions of clause 53.13 as it relates to noise and protection of amenity. Appropriate management plans would be prepared prior to construction to manage noise impacts of the proposal.

The proposal has addressed the general decision guidelines Clause 65.01, specifically *the effect on the environment, human health and amenity of the area*. No adverse noise impacts are anticipated.

The proposal suitably considers and addresses potential noise impacts and provides proposed mitigations consistent with the Solar Energy Facilities–- Design and Development Guideline (DELWP, 2019).

5.7 Traffic

The Solar Energy Facilities Design and Development Guideline (DELWP, 2019) requires preparation of a Traffic Impact Assessment (TIA). The TIA should:

- Identify access routes and all roads that would be used to transport construction materials.
- Identify access routes, types of vehicles and traffic generation when the facility operates.
- Specify the timing, type of vehicle, daily volume, and scheduled delivery times of construction materials.
- Provide timelines for the whole construction stage.
- Identify intersection upgrades and any road works required to accommodate access to the site and specify if these are temporary arrangements.

A Traffic Impact Assessment (TIA) (AMBER, 2022) has been prepared for the proposal, the findings are summarised below, and the report is provided at Appendix D.

Access to the proposal site would be via a new access to Ballan Road. Staff are expected to primarily be located in Anakie and Geelong with most plant and equipment expected to be delivered from Geelong Port, with the remainder being sourced locally or interstate.

Road transport is the preferred option for the delivery of construction infrastructure. It is expected that the haulage route for most vehicles, including heavy and over-dimensional vehicles during construction would be directly via Highways and Ballan Road (a Department of Transport managed road).

Materials would generally be transported to the site on heavy vehicles up to 19m B-double size, minimal use of oversized vehicles would be required. Materials to be transported include, but are not limited to the following:

- PV solar panels.
- Piles, mounting structures and frameworks.
- Electrical equipment and infrastructure including cabling, auxiliary electrical equipment and machinery, inverters, switchgear, and the on-site substation (and transformer).
- BESS.
- Construction and permanent buildings and associated infrastructure.
- Earthworks, grading and lifting machinery and equipment.

A Construction Traffic Management Plan would be prepared following proposal approval to manage haulage traffic during the construction phase.

The TIA details how road impacts of the project traffic, particularly from heavy vehicle use and oversize and overmass vehicles, would be avoided or managed using road-use management strategies.

Ballan Road:

- Is an arterial road managed by Department of Transport and is zoned TRZ2.
- Has a carriageway width of approximately 6.0 metres and a speed limit of 100km/hr.
- Has a low level of traffic evenly distributed between north and south movements. Currently there is approximately 1,100 vehicle movements per day and 110 vehicle movements in each of the peak hours.
- Is a B-Double declared road.

The construction is expected to take approximately 6 months, with the peak construction period expected to take 1–2 months.

A maximum of 50 staff would be on-site during peak construction periods. It is understood that shuttle buses would be provided that can accommodate the majority of staff, with the remaining staff to access the site using private vehicles.

The estimated total and (peak) maximum daily traffic movements (one way) during construction are detailed in the Traffic Impact Assessment (AMBER, 2022) and summarised below:

The following provides a breakdown of activities and staff numbers and vehicle movements:

- Construction
  - During peak construction the proposal could generate up to 38 heavy and 108 light vehicle movements per day. A *vehicle movement* means a vehicle travelling in one direction (i.e. a truck accessing the site would generate one movement towards the site and one movement away from the site when it departs).
  - 57 vehicle movements are likely during the morning and evening peak hours during the peak construction period, which would reduce to 20 vehicle movements over the typical construction periods.
- Operations–- based on 5 FTE staff (emergency and refurbishment excluded)
  - Up to 10 vehicle trips are the expected per day in normal operations when staff visit the site.
- Decommissioning
  - Similar numbers to typical rather than peak construction.

Construction activities would be undertaken during standard daytime construction hours, as follows:

- Monday to Friday: 7am–6pm.
- Saturday: 7am–1pm.
- No work on Sundays or public holidays.

Any construction outside of these normal working hours would only be undertaken with prior approval from relevant authorities.

Construction traffic would include:

- Light vehicles including shuttle buses – to transport staff.
- Medium and heavy rigid trucks – to deliver raw materials and small plant.
- Articulated vehicles and B-Doubles – to transport larger plant.
- Restricted access vehicles/oversized and overmass (subject to specific road permits) – to transport oversize plant such as the substation transformer.

During operation the proposal is expected to generate a minimal level of traffic associated with maintenance and operation services. The proposal is expected to be operated by up to 5 staff resulting in a traffic generation of up to 10 vehicle movements per day (noting this is the worst case and would not be a daily occurrence as operational staff would be expected to visit the site intermittently) which would result in a negligible change to the traffic environment.

Traffic generated during decommissioning would be similar to traffic generation during the average construction period.

Access to the site would be designed in accordance with *Guideline Drawing AGRD Part 4 – Typical Design to Rural Properties* (Vic Roads, 2020).

The road network is able to accommodate the traffic generated by the proposal, with Ballan Road expected to continue to operate with a good level of service. Traffic Management Plans would be implemented for all stages of the proposal. Safeguards are outlined in Table 5-10.

Table 5-10 Traffic safeguards and mitigation measures

No.	Safeguards and mitigation measures	C	O	D
T1	Prior to construction a Traffic Management Plan (TMP) would be prepared, this would form part of the EMP for the proposal.	C		
T2	The operational EMP would include measures for management of traffic for maintenance and emergency.		O	
T3	A Traffic Management Plan would be prepared prior to the decommissioning phase in conjunction with the relevant road authorities.			D
T4	All TMP's and EMP documents would be prepared in accordance with recommendations in the TIA (AMBER, 2022).	C	O	D

Consistency with planning provisions

The proposal is considered to be consistent with the provisions of the scheme, specifically the provisions of clause 53.13 as it relates to traffic generation and road safety and impacts on roads that would be used for the proposal. Appropriate management plans would be prepared prior to construction to manage traffic impacts of the proposal.

The proposal has shown consistency with the farming zone decision guidelines as discussed in section 5.1. The proposal has addressed the design and siting issues raised in clause 35.07-6, *whether the use and development will require traffic management measures* and general decision guidelines clause 65.01 specifically *the adequacy of loading and unloading facilities and any associated amenity, traffic flow and road safety impacts, the impact the use or development will have on the current and future development and operation of the transport system,* and *the effect on the environment, human health and amenity of the area*. All anticipated traffic impacts would be managed by the implantation of a Traffic Management Plan and safe access designs that would form part of the EMP for the site.

The proposal suitably considers and addresses potential traffic impacts and provides proposed mitigations consistent with the Solar Energy Facilities - Design and Development Guideline (DELWP, 2019).

5.8 Visual impact and amenity (including light spill and dust control)

The Solar Energy Facilities Design and Development Guideline (DELWP, 2019) requires assessment of the visual impact of a solar energy facility, including:

- *The sensitivity of the landscape and its ability to absorb change.*
- *The size, height, scale, spacing, colour and surface reflectivity of the facility's components.*
- *The number of solar energy facilities located close to each other another within the same landscape.*
- *The excessive removal, or planting of inappropriate species of vegetation.*

- *The location and scale of other ancillary uses, buildings and works including transmission lines, battery storage units and associated access roads.*
- *The proximity to environmentally sensitive areas such as public land, water courses and low-lying areas.*

To address the requirements of the guideline, a Visual Impact Assessment (VIA) was completed by NGH and is included in Appendix E.

For the purpose of this VIA, visual elements of the proposal considered includes the installation solar infrastructure and associated works and has the following key features:

- 11.7 hectares (ha) of single axis (tracking) solar array.
- Inverter/switch station.
- BESS.
- Overhead transmission line connection.
- Site entry (new crossover) (construction/operation access).
- Perimeter fire break, and security measures such as fencing, lighting and CCTV.

The proposal site has an elevation of approximately 106m to 100m AHD falling to the rear (west) of the site, refer to Figure 5-7 for views over the proposal site from the northeast corner of the land.

The site of the proposal is in a gently undulating/sloping landscape with hills (ridgeline) in the distance roughly 5km from the proposal with an elevation of approximately 160m AHD to the west and 230m AHD to the northwest, refer to Figure 5-8 for the view from the ridgeline west of the proposal site.

Dwellings to the south of the proposal site are approximately the same level as the proposal site. Dwellings to the west are located on an elevation of approximately 93-90m AHD, below the level of the proposal site. The location of dwellings proximate to the site are shown in Figure 5-9.

Figure 5-7 Views of the panel area and background landscape from the northeast corner of the site (Source: NGH 2022)

Figure 5-8 Views from the ridgeline located approximately 4-5km to the west of the proposal site, showing potential for distant (background) views of the proposal site (NGH, 2022)

Considering topography, vegetation, land use, and other distinct landscape features, the surrounding land is described as an undulating rural landscape with low scale woodland areas with a modified landscape surrounding the rural township of Anakie along the main travel routes towards Geelong.

A VIA for the operation stage of the proposal has been conducted considering:

- The specific elements of the proposal including the site access and fire break, fencing, lighting, substation, inverter, solar panel array areas, battery system, and landscaping. Associated effects of light spill and dust impacts (that can also result in air quality impacts).
- The potential for the proposal to be viewed from representative viewpoints.
- The degree of contrast the proposal would have within the identified landscape management zones (LMZ). LMZs were assigned to viewpoints based on the results of the field work, and the contrast at that viewpoint was evaluated.
- The findings of the Glint and Glare Assessment (MOIR, 2022). There are no potential glare impacts to dwellings from the proposal.

Table 5-11 evaluates the expected level of visual impact from the 3 representative viewpoints (V1-V3), representing the rural dwellings and public viewpoints (roads) within 2km of the proposal site.

This evaluation considers the views of the proposal without any mitigation measures and then with proposed mitigation measures.

Following changes to the proposal design to reduce visual impacts with mitigation measures, no high impact viewpoints were identified. Moderate and low impacts were found to be possible. Relevant mitigation measures have been identified and included in Table 5-11 and Table 5-12. Mitigated outcomes are considered to result in low impacts for adjoining landowners and road users.

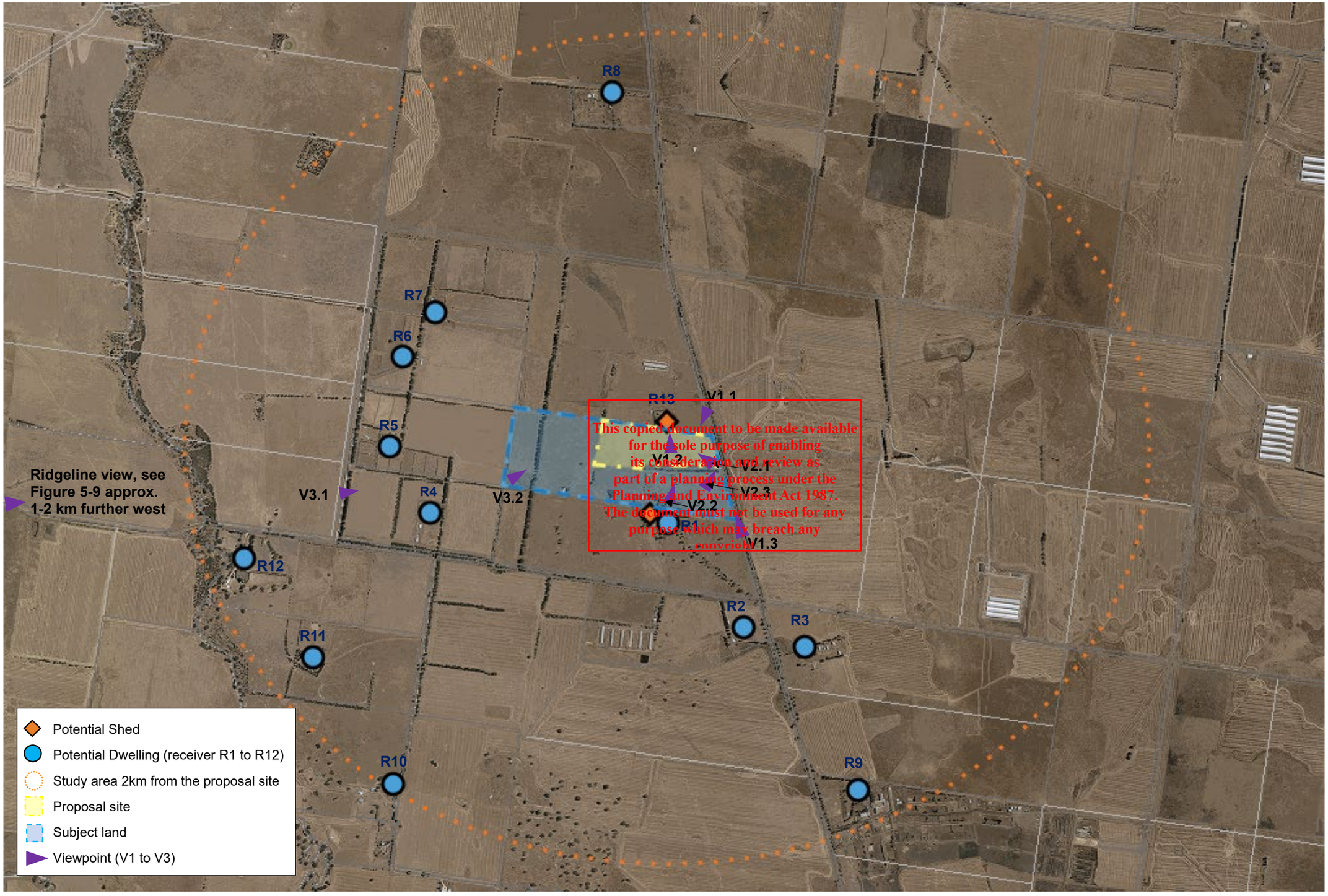
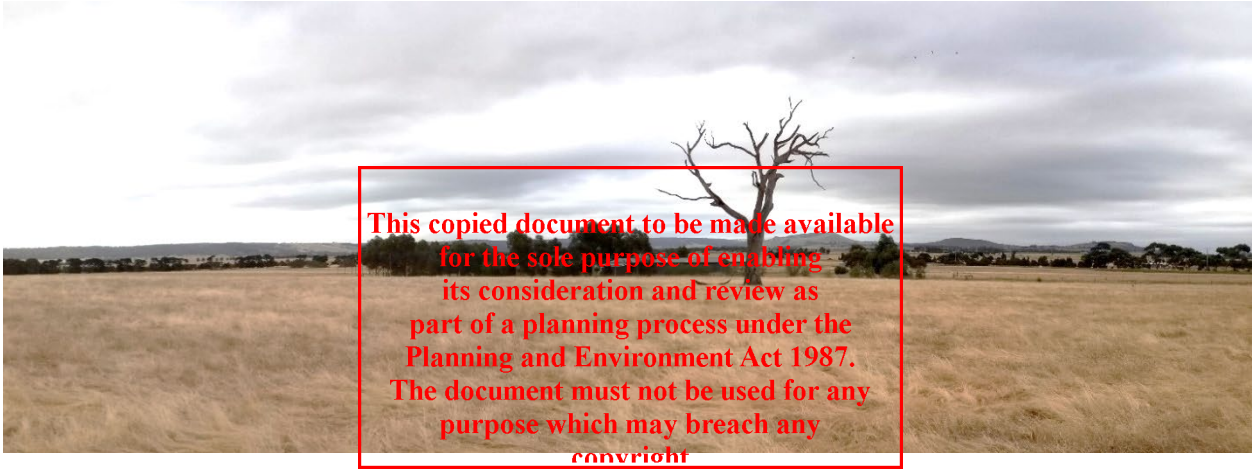


Figure 5-9 Rural dwellings within 2km of the development site and viewpoints (Source: NGH Adapted from Vic Plan, State of Victoria, 2022)

Table 5-11 Visual impacts at representative viewpoints and their associated receivers.

VIEWPOINT 1 (V1) (representing R3 and R9/ Ballan Road traffic)		
Summary of viewpoint		Viewpoint description / impact
Landscape	Rural and associated dwellings	V1 is located on Ballan Road (refer to representative photos provided below for V1.1 and V1.3 and as identified on Figure 5-9), just north and south of the proposal site. The representative photos are taken on the east (V1.1) and west (V1.3) side of the road and show areas for improvements to vegetation where views from traffic are possible (typically glance views from vehicles travelling south) and where recent plantings provide quality screening from the road (when directly opposite the site and for north travelling vehicles approaching the site). In addition to road traffic this viewpoint represents the shed at R13 to the north and dwellings R2, R3 and R9 to the south. The main visual change would be a new site access, increased heavy vehicle movements and potential dust impacts, predominantly limited to the construction phase. Trees in the area (including vegetation screening around R13, as seen in photo V1.2 below) and flat landscape generally provide effective screening or minimal to no view from the representative dwellings. Anakie is a rural town with minor tourism attractions and is within driving distance from the major centre of Geelong. Regional and local significance of the site is low, with scenic quality of the locality being moderate. Ballan Road viewpoints range from distant to foreground views. Views were assessed as generally having a moderate sensitivity given the travel speed and surrounding agricultural activities. View durations are generally short as vehicle speeds are up to 100km/hr, and the expected number of local vehicles on these local roads is considered to be low to moderate. The established front boundary tree line provides reasonable screening for the level of potential impact from V1. **No mitigations are considered to be required for this viewpoint in addition measures recommended for dust management, materials used, control of light spill, and traffic management.** Traffic management measures included in this PR and supporting TIA (Amber, 2022) would minimise construction traffic impacts and would be temporary (short term). Traffic impacts during operation are minimal due to very low numbers of vehicles visiting the site during operation as shown in the TIA (Amber 2022).
Scenic quality	Moderate	
Proximity	Foreground (road traffic) and Middle ground (dwellings)	
Sensitivity	Moderate	
LMZ objective	B	
Contrast	Low due to vegetation screening	
Inherent visual impact	Moderate	
Mitigated visual impact	Low	

V1.1 view from the northeast of the proposal site on Ballan Road, looking southwest across the proposal site representing views from road users.

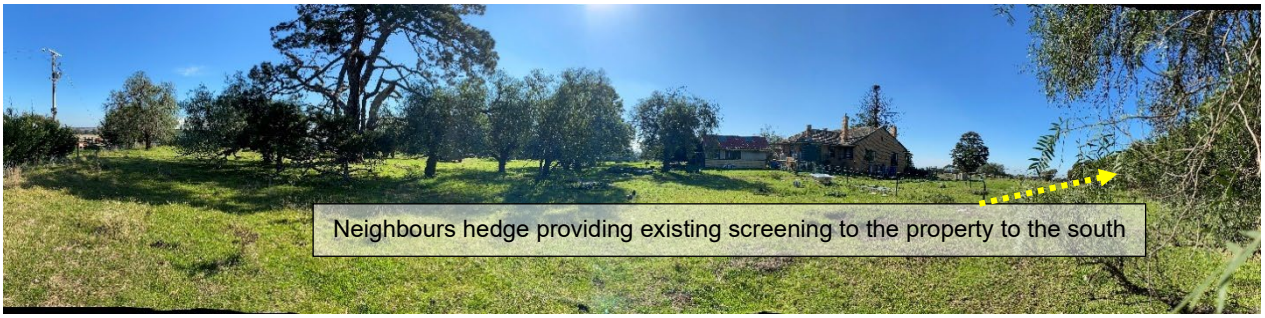


V1.2 from south side of the proposal site looking north showing R13 (shed) showing there is some vegetation screening around the shed.

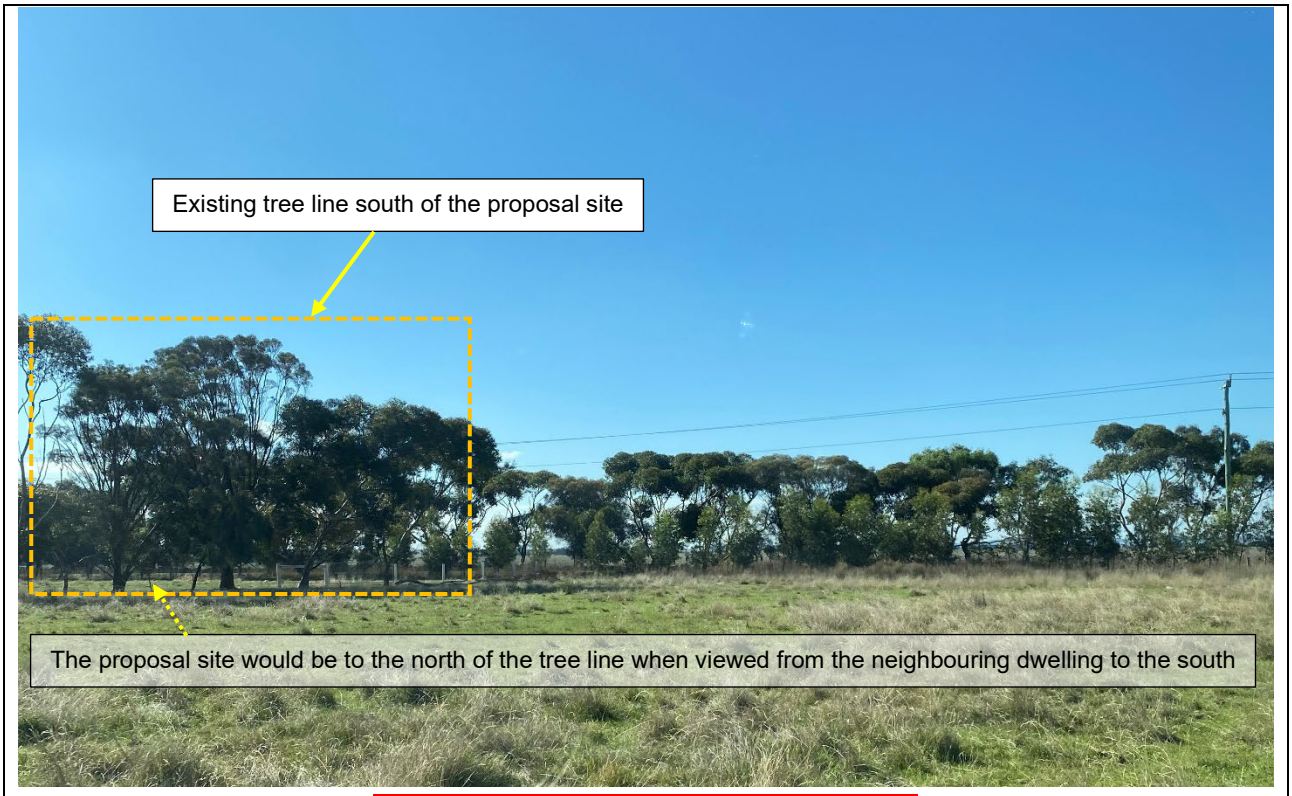
V1.3 Existing planted tree line on front boundary providing quality screening (representing views from R3 and R9.

VIEWPOINT 2 (V2) (representing dwelling R2)		
Summary of viewpoint		Viewpoint description / impact
Landscape	Rural	V2 (photos below V2.1 and V2.2) representing views from dwelling R2 (and any building in close proximity to R2) located to the south of the subject land. This viewpoint is located 118m to the south of the proposal site. There are trees and structures on the subject land that would screen some views to the proposal. The proposal would contrast with the colour of the grasses on the land from this viewpoint, particularly when dried out in hotter weather, the shade created by existing trees and colour of bark would be a similar colour to the solar infrastructure providing for some integration and ability of the landscape to absorb impacts. This agricultural and rural dwelling viewpoint was assessed as generally having a moderate sensitivity due to being the highest potential for views from this site. If there is a view of the proposal, the view duration could be expected to be longer due to the closer proximity to the site, but existing vegetation and 100m separation would provide effective screening for agricultural activities. **Additional screen planting within the tree line to the south of the proposal would minimise any potential visual impacts for the dwelling at R2. In addition, the measures proposed for dust control, colours of materials used, control of light spill and traffic management would minimise construction and operational impacts.**
Scenic quality	Moderate	
Proximity	Foreground	
Sensitivity	Moderate	
LMZ objective	B	
Contrast	Moderate	
Inherent visual impact	Moderate	
Mitigated visual impact	Low	

V2.1 taken from inside proposal site looking northwest towards the location of the shed (R13) .



V2.2 taken inside the subject land looking north, adjacent to the dwelling located to the south.



V2.3 taken from near the dwelling on the subject land looking northeast showing the established screening vegetation and opportunities for improved screening of the tree line vegetation (mid-storey plantings – providing hedge style screening).

VIEWPOINT 3 (V3) (representing R4 to R7, Pringles Road and Clifton Road)		
Summary of viewpoint		Viewpoint description / impact
Landscape	Rural	Viewpoint 3 (V3 – photos below V3.1 and V3.2), representing views from agricultural land and dwellings identified as R4-R8 located to the west of the subject land and local road use. This viewpoint is located 600m plus from the proposal site. R4 to R8 are on an elevation approximately 10m below the proposal site. The proposal has low contrast from this viewpoint due to the dark greens of the pine trees (and other boundary vegetation) present on the subject land and surrounding properties providing high ability to absorb the proposal into the background. Local roads, agricultural (including rural dwellings) viewpoints were assessed as generally having a low to moderate sensitivity due to low use of roads and topography and vegetation screening the majority of views maintaining the rural character. If there is a view of the proposal, the view duration could be expected to be longer due to the closer proximity to the site, activities undertaken on adjoining land (agricultural and rural residential uses), lower travel speeds and potential
Scenic quality	Moderate	
Proximity	Foreground	
Sensitivity	Moderate	
LMZ objective	B	
Contrast	Low	
Inherent visual impact	Low	
Mitigated visual impact	N/A	

		for increased interaction for local residents with heavy vehicles during construction when entering Ballan Road. There are limited to no views of the proposal site from this viewpoint. **No mitigations are considered to be required for this viewpoint in addition to the measures proposed for dust control, colour of materials used, control of light spill and traffic management.**

V3.1 View from Clifton Road looking northeast towards the proposal site confirming topography (land rising to the east) and layering of existing vegetation providing screening of the proposal site.

V3.2 View from the southwest corner of the subject land to the northeast – topography and established tree lines limiting views of array area from properties to the west and southwest

Many sites have established mid-sized trees planted along site boundaries. The subject site has trees located along its frontage and some other tree lines around the proposal site. Undulating topography to the west prevents some views into the site, until you get higher on the ridge where you can see down. When driving down from the ridge east you may get some views into the project.

The impacts, post mitigation, are assessed as Moderate and Low. The proposal would be generally completely screened by existing vegetation and topography except for:

- The shed (R13) immediately to the north. There are some established trees at the location of the shed along part of the common boundary that would filter views of the proposal site.

- Some local traffic moving out of driveways entering directly onto Ballan Road and high speed glance views from vehicles, primarily when travelling north to south along Ballan Road with a speed of 100km/hr.

Potential views from the dwelling (R2) and associated buildings to the south would be further screened by improved existing tree lines. The mitigation measures committed to by the proponent in this PR relating to management of traffic, control of light spill and dust minimisation would avoid and minimise associated impacts. The materials and colour of onsite infrastructure would, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that would blend with the landscape. Mitigation measures for the proposal are listed in Table 5-12.

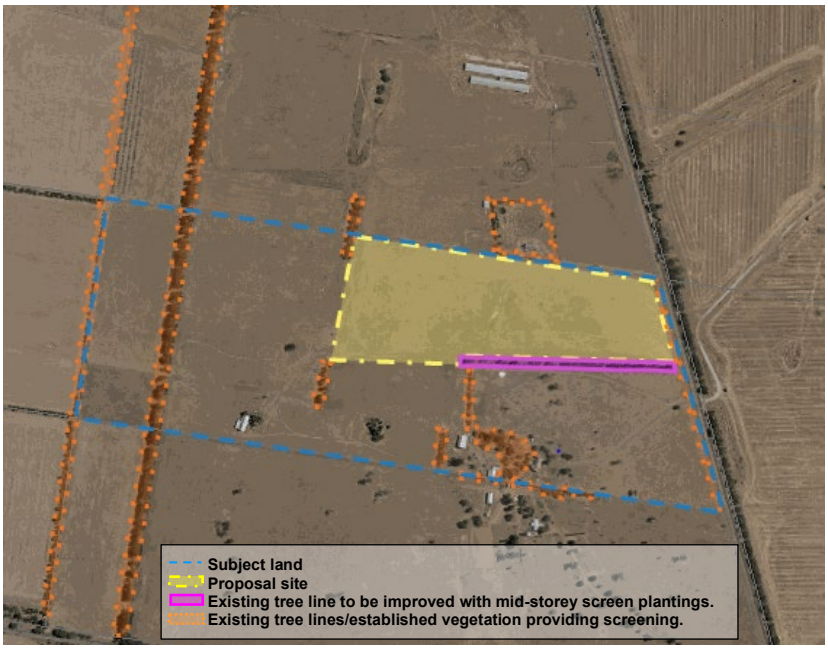
Adverse cumulative impacts occur when the infrastructure or activities at the proposal site exacerbate the negative impacts of other activities occurring nearby. Due to the undulating and flatter nature of the land in direct proximity to the site, it is unlikely that the proposal would contribute to cumulative visual impacts for residents within 2km of the development site as combined views of the solar infrastructure and industrial scale rural (poultry) sheds would not be common.

Distant views of a number of agricultural structures and the proposal (from 4-5km away from the site) may be possible due to the rising ridgelines to the west and north, however would only form a minor component of the entire field of view.

Views from most if not all viewpoints would remain dominated by agricultural land use and existing vegetation.

Table 5-12 Safeguards and mitigation measures for visual impacts

No.	Safeguards and mitigation measures	C	O	D
V1	A construction and operational Landscape Management Plan would be prepared and would include, but not limited to: • A Landscape Plan. The plan would be consistent with the provisions of any Landscape Management Plan. The plan would include planting lists for the site. Any planted vegetation (screen planting) would be fire resistant and retardant plants as the priority. • Management and regular maintenance plans for screen plantings, specifically to the south and east.	C	O	
V2	The Landscape Plan would include improved screening vegetation would be planted within the existing fenced tree line immediately to the south of the proposal site (as shown and described below):			

No.	Safeguards and mitigation measures	C	O	D
	 • Plantings would be at least two rows deep to break up views of infrastructure including the fencing and minimising any lighting impacts. The fenced tree-line area would be increased in width where necessary to accommodate the screen plantings. • The plant species to be used in the screen would be native and derived from the naturally occurring vegetation community in the area. They should be fast growing and comprise a mixture of mid-storey plants capable of reaching a height of 2m within 2 years and up to 3m within 8 years. • Planting would be completed as part of early works, or during winter/spring to increase the chance of plant survival, or as agreed with DELWP. All screen plantings (including tree lines within the subject land, particularly to the south and east) would be maintained during construction and for the operational life of the proposal. Dead plants would be replaced. Pruning and weeding would be undertaken as required to maintain the screen's visual amenity and effectiveness in screening views.			
V3	The materials and colour of onsite infrastructure would, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that would blend with the landscape.	C	O	
V4	During construction, dust would be controlled in response to visual cues. Areas of soil disturbed by the project would be	C	O	D

No.	Safeguards and mitigation measures	C	O	D
	rehabilitated progressively or immediately post-construction. Dust management measures for all stages would be incorporated into the EMP.			
V5	If considered necessary for safety during winter or low light, lighting would be minimal and limited to the substation area. Wherever possible, safety lighting would be directed downwards to minimise light spill. Lighting would comply with the relevant Australian standards for the control of obtrusive effects of outdoor lighting.	C	O	D

C: Construction (prior to and/or during); O: Operation; D: Decommissioning

Consistency with planning provisions

The proposal would meet the relevant provisions of the Greater Geelong Planning Scheme, specifically the provisions of clause 53.13 as it relates to protection of amenity and visual impacts associated with the design of the proposal. The proposal would be consistent with the FZ purpose, as they relate to visual impacts, specifically:

- *To ensure that non-agricultural uses, including dwellings, do not adversely affect the use of land for agriculture.*
    - The proposal would not have adverse visual impacts that affect the use of the land for agriculture (including changes to the landscape, views, light spill and dust), dwellings associated with agricultural use would also have reasonable amenity protected, provided the mitigation measures recommended are implemented.
- *To provide for the use and development of land for the specific purposes identified in a schedule to this zone.*
    - Solar energy facilities are a land use identified in the schedule.

The proposal would also be consistent with the farming zone decision guideline Clause 35.07-6

- *General issues - Whether the site is suitable for the use or development and whether the proposal is compatible with adjoining and nearby land uses.*
    - The proposal would be compatible with adjoining agricultural land use and associated rural dwellings with agricultural use. Dwellings would also have reasonable amenity protected, provided the mitigation measures recommended in this VIA are implemented.
- *Design and siting issues - The need to locate buildings in one area to avoid any adverse impacts on surrounding agricultural uses and to minimise the loss of productive agricultural land. The impact of the siting, design, height, bulk, colours and materials to be used, on the natural environment, major roads, vistas and water features and the measures to be undertaken to minimise any adverse impacts. The impact on the character and appearance of the area or features of architectural, historic or scientific significance or of natural scenic beauty or importance.*

- The proposal is sited to be as far as practicable from adjoining dwellings and avoids impacts to high quality vegetation on the site and makes best use of existing screening vegetation and topography. The proposal is compatible with surrounding developments when considering height and scale, specifically height of dwellings, and height and scale of poultry farms buildings. The additional mitigation measures provide for further integration with the landscape when viewed from the dwelling to the south. The view of the proposal would be most prominent from Ballan Road, but as the speed is 100km/hr, views would generally be quick glance views and predominately when travelling from the north to south. Views would also be possible from the property to the north, however existing trees surround the shed on the land and the remaining land is currently cropped and is a lower use area. Views would generally be end views of the array rows as the panels would track east to west.

The proposal suitably considers and addresses visual impacts and proposed mitigations consistent with the Solar Energy Facilities - Design and Development Guideline (DELWP, 2019).

Appropriate management plans would be prepared prior to construction to manage visual impacts of the proposal.

5.9 Glint and glare

The Solar Energy Facilities Design and Development Guideline (DELWP, 2019) requires analysis of glint and glare. The analysis should consider impacts on:

- Dwellings and roads within 1km of the proposed facility, taking into consideration their height within the landscape.
- Aviation infrastructure including any air traffic control tower or runway approach path close to the proposed facility.
- Any other receptor to which a responsible authority considers solar reflection may be a hazard.

A Glint and Glare Assessment (MOIR L.A., 2022) has been prepared for the proposal, the findings are summarised below, and the report is provided at Appendix F.

The Solar Glare Hazard Analysis Tool (SGHAT) was used to evaluate glare resulting from the proposal at different locations around the proposal site and impact on people in cars and for dwellings (receptors). Single axis tracking PV panels capable of rotating to a maximum of 60° with a north south orientation have been considered for this analysis. Potential visual receptors within 2000 metres of the site were considered which include nearby dwellings, sheds or outhouse buildings, rail network and road route users.

Modelling to show the potential glare consequences for the proposal was based on:

- Position of the sun over time with respect to the location of the proposal.
- Tracking axis tilt, tracking axis orientation and properties of the PV modules.
- Location of sensitive receptors (receivers) from the proposal including residential dwellings, Road and Rail receptors and Flight path receptors.
- Potential to screen the impact by surrounding topography.

Single-axis trackers follow the movement of the sun as it moves east to west throughout the day. Yields are maximized, and light reflection is minimised when panels are directly facing the sun. In times when the sun is not in the tracking range, we assume that the panels instantaneously revert

to their resting angle of 0° (flat). Due to this, glare from the backtracking mechanism was more conservatively simulated and at times of sunset and sunrise, when the sun is at a lower angle relative to the array, glare impacts would be more noticeable.

The solar panels have been assessed based on a maximum height of 5.1 metres above ground level. An average eye height of 2.4 metres has been considered to represent a truck driver's eye height and for dwelling occupants an average eye height of 1.5 metres has been considered.

Four road user (route) receptors and 23 dwelling receptors were identified, see Figure 5-10. No airstrips or flight paths were identified within 2km of the proposal site.

Figure 5-10 Glint and glare assessment location of receptors (MOIR, 2022)

Based on the desktop assessment the only potentially effected receptors would be the subject dwelling (OP6, OP7 and OP20 (shed)) and would potentially experience annual 'Yellow' glare (potential temporary after image) from the solar array. Existing vegetation would provide the required mitigation for any potential glare for the associated dwelling.

Clifton road route receptors would experience almost negligible 'Yellow' glare from the Project. Existing vegetation would provide the required mitigation for any potential glare for the route receptors.

No specific mitigation measures are necessary.

Consistency with planning provisions

The proposal is considered to be consistent with the provisions of the scheme, specifically the provisions of clause 53.13 as it relates to protection of amenity and impacts of glare. The proposal has addressed the general decision guidelines Clause 65.01, specifically *the effect on the environment, human health and amenity of the area*. No significant adverse glare impacts are anticipated.

The proposal suitably considers and addresses potential glint and glare impact and provides proposed mitigations consistent with the Solar Energy Facilities - Design and Development Guideline (DELWP, 2019).

5.10 Electromagnetic fields

The (DELWP, 2019) solar farm guidelines state *electrical equipment produces electromagnetic radiation. Radiation produced by transformers and inverters is reduced through performance standards that apply to standard components. The Australian Radiation Protection and Nuclear Safety Agency advises that the strength of this radiation will decrease with distance from the source, and it will become indistinguishable from background radiation within 50m of a high voltage power line and within 5 to 10m of a substation. The design and layout of the facility should account for this information.*

Electric and magnetic fields (EMFs) are produced whenever electricity is used. EMFs also occur naturally in the environment, such as the Earth's magnetic field and discharges during thunderstorms (WHO, n.d.).

Electric fields are produced by voltage and magnetic fields are produced by current. When electricity flows, EMFs exist close to the wires that carry electricity and close to operating electrical devices and appliances (WHO, 2007). Electric and magnetic field strength reduces rapidly with distance from the source.

Over decades of EMF research, no major public health risks have emerged, but uncertainties remain (WHO, 2007). While it is accepted that short-term exposure to very high levels of electromagnetic fields can be harmful to health, the International EMF Project, established by the World Health Organisation, has thus far concluded that there are no substantive health consequences from exposure to Extremely Low Frequency (ELF) electric fields at the low levels generally encountered by the public (WHO, 2007), such as those that would be produced by electricity generation at the proposal site.

The proposal includes six main types of infrastructure that could create EMFs:

1. Solar arrays.
2. Inverter.
3. Underground cables.
4. Overhead transmission lines.
5. Onsite substation.
6. Energy storage facility.

There is low potential for EMF impacts during the construction and decommissioning phases of the proposal. Staff would be exposed to EMFs over intermittent periods during works at and around the existing 22kV transmission line and inverter. Exposure to EMFs during the construction would be short term, therefore the effects are likely to be negligible.

The site is surrounded by agricultural land and public access would be restricted. Given the levels associated with the infrastructure components, and the distance to the site perimeter fence, EMFs from the proposal are likely to be indistinguishable from background levels at the boundary fence. The underground cabling would not produce external electric fields due to shielding from soil, and its magnetic fields are expected to be well within the public and occupational exposure levels recommended by ARPANSA and ICNIRP.

By prudently designing and siting infrastructure, exposure to EMFs and potential for adverse health impacts can be further reduced. Adverse health impacts from EMFs are therefore unlikely as a result of the proposal.

The potential risks associated with EMFs for the proposal can be reduced by designing the infrastructure in accordance with the codes and best practice standards by a suitable qualified person. These measures are outlined in Table 5-14.

Table 5-13 EMF safeguards and mitigation measures

No.	Safeguards and mitigation measures	C	O	D
E1	All electrical equipment would be designed in accordance with relevant codes and industry best practice standards in Australia.	C		
E2	All design and engineering would be undertaken by qualified and competent person/s with the support of specialists as required. Work to be carried out in accordance with relevant Victorian standards, for example, The Blue Book 2017 (Energy Safe Victoria, 2017).	C	O	
E3	Design of electrical infrastructure would minimise EMFs.	C		

Consistency with planning provisions

The proposal is considered to be consistent with the provisions of the scheme, specifically the provisions of clause 53.13 as it relates to protection of amenity and impacts of electromagnetic fields. Appropriate plans would be prepared prior to construction, showing measures to manage impacts associated with electrical equipment. All construction would be undertaken by appropriately qualified and licenced persons. The proposal has addressed the general decision guidelines Clause 65.01, specifically *the effect on the environment, human health and amenity of the area*. No adverse impacts from potential electromagnetic fields are anticipated.

The proposal suitably considers and addresses potential electromagnetic field impacts and provides proposed mitigations consistent with the Solar Energy Facilities - Design and Development Guideline (DELWP, 2019).

5.11 Heat island effect

The (DELWP, 2019) solar farm guidelines state *where a solar energy facility is proposed adjacent to existing horticultural or cropping activities, a minimum 30m separation distance is appropriate, measured from the property boundary to any part of the physical structure of the facility. The PV heat island effect on sensitive vegetation (such as cold-climate horticultural cropping) describes the transfer of heat from built form to its surrounds, where the ambient temperature around the built form is higher than that of surrounding vegetated areas, particularly at night. While there are few*

studies of spatial heat dissipation from solar infrastructure, those that exist acknowledge the potential for ambient air temperatures within the perimeter of a solar energy facility to potentially increase by 3 to 4 degrees Celsius. However, those studies also found that the heat that was generated dissipated rapidly over a short distance. Some found that at 30m from the solar PV array, the air temperature variation was indistinguishable from ambient air temperature.

'Heat island' is defined as an area having higher average temperature than its surroundings owing to the greater absorption, retention, and generation of heat by buildings, pavements, and activities. This is usually used in reference to the impact of an urban area on its rural surroundings. Studies have shown that Photovoltaic (PV) panels convert incident solar radiation into heat, and this can alter the airflow and temperature profiles near the panels. Whether such changes may subsequently affect the thermal environment of near-by populations of humans and other species have been questioned (Fthenakis and Yu, 2013). However, to date there have been limited empirical studies on the potential for a heat island effect in utility scale solar farms.

The limited studies that do exist also show results that can be seen as contradictory, as they are so site and project specific. Some studies suggest that PV systems can cause a cooling effect on the local environment, depending on the efficiency and placement of the PV panels while others demonstrate a warming effect (Barron-Gafford, Minor, Allen, Cronin, Brooks, and Pavao-Zuckerman, 2016). Other studies conclude that whilst air temperatures may increase within the solar farm itself, they rapidly decrease to the ambient temperature beyond the perimeter of the solar farm (Fthenakis and Yu, 2013).

Fthenakis and Yu (2013) undertook an analysis of the potential for large solar farms to generate a heat island effect and increase air temperature within the solar farm area. The study found at the centre of the solar farm, the annual average air temperature at a height of 2.5m increased by up to 1.9^{0}C. However, this increase in temperature dissipated at a height of 5m. Additionally, the solar farm completely cooled overnight.

The research suggested a small potential effect on climate within the proposal site. This effect may enhance retention of ground cover in very cold or hot conditions onsite. No impacts on adjacent properties and agricultural activities would occur.

The topic has also been subject to recent consideration by a Victorian Planning Panel for solar farms proposed in Greater Shepparton for solar farms proposed by Neoen and X-Elio. This is detailed in the *Panel Report for the Greater Shepparton Solar Energy Facility Planning Permit Application 2017-162, 2017-274, 2017-301 and 2017-344* (Panel Report, 2018). Neoen, in preparation of a response to key issues raised in objecting submissions, commissioned a *Statement of Evidence by Greg Barron-Gafford* from the Research Group Biography, Ecosystem Science (University of Arizona) (Barron-Gafford, 2018).

Barron-Gafford (2018), in his Statement of Evidence (SoE) to the Victorian Planning Panel included results on the radius of the measured heat effects. This identified that the PVHI effect was indistinguishable from air temperatures over native vegetation when measured at a distance of 30m from the edge of the PV array (Figure 5-11). In his SoE he states that:

'this pattern held true for both daytime and night-time conditions. Because the PV panels themselves trap the energy from diffuse sunlight that was able to reach the ground underneath them, air temperatures remain elevated within a PV array. As you leave this "overstorey" of PV panels, energy is able to radiate back towards the atmosphere, as it does in a natural setting, and the PVHI quickly dissipates'.

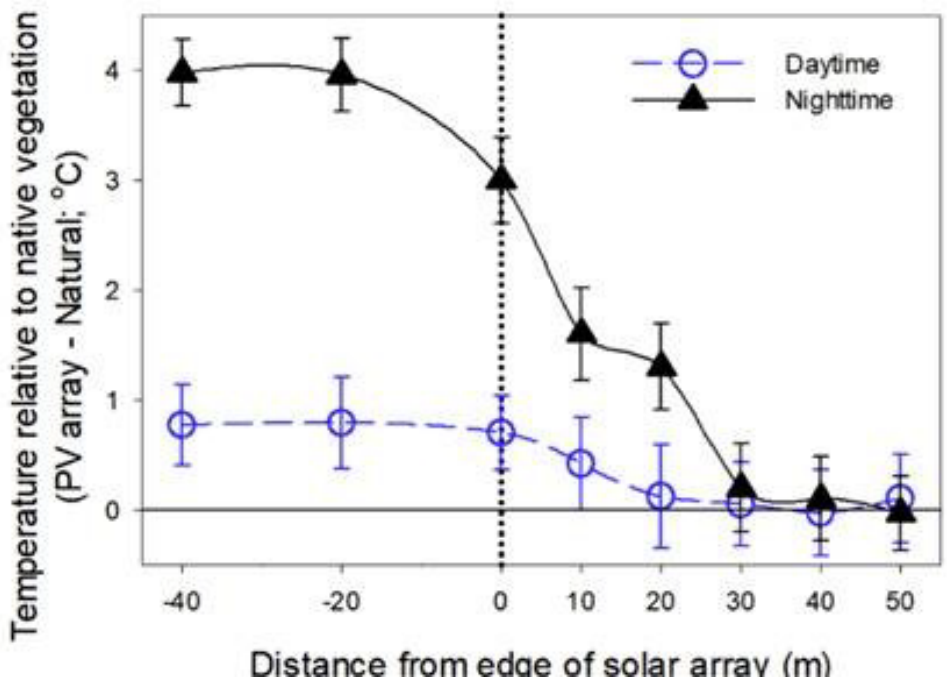


Figure 5-11 Measures of air temperature within and outside of the PV array (Barron-Gafford, 2018)

In conclusion, the Victorian Planning Panel Report (Panel Report, 2018), accepted that solar arrays would affect air and soil temperatures within the solar array perimeter, but that in relation to outside of the solar array perimeter, a heat island effect is unlikely to occur, but where orchards are the like are present a 30m buffer should be maintained.

The proposal would include setbacks of a minimum of 15m from the north boundary to the solar (PV) array and greater than 30m from all other boundaries, refer to the proposed mitigation measures in Table 5-15. The setbacks proposed are considered acceptable based on the land uses approved (shed, a minimum setback of 30m would be achieved) and agricultural activities of adjoining land (mostly cropping and grazing). As such there are no likely potential heat island effects from the proposal on adjoining land and no sensitive receivers or orchards or the like within relevant proximity to/30m of the infrastructure. The closest receiver is the associated dwelling located 188m from the array and the closest non-associated dwelling is located approximately 300m to the south of the array.

Table 5-14 Heat island effect safeguards and mitigation measures

No.	Safeguards and mitigation measures	C	O	D
HIE1	The proposal would include setbacks of a minimum of 15m from the north boundary to the solar array and greater than 30m from all other boundaries. The solar array would have a minimum separation of 30m from the existing shed to the north.	C		

Consistency with planning provisions

The proposal is considered to be consistent with the provisions of the scheme, specifically the provisions of clause 53.13 as it relates to protection of amenity and potential climate impacts. The plans provided at Appendix A show setbacks complying with the proposed mitigation measures.

The proposal has addressed the general decision guidelines Clause 65.01, specifically *the effect on the environment, human health and amenity of the area*. No adverse impacts from potential heat island effect are anticipated.

The proposal suitably considers and addresses potential heat island effect impacts and provides proposed mitigations consistent with the Solar Energy Facilities - Design and Development Guideline (DELWP, 2019).

5.12 Waste and dangerous goods

The proposal includes works that require management of waste and use of dangerous goods.

Dangerous goods would be required to be transported, stored, and disposed of as part of the proposal. This relates to the proposed ancillary battery energy storage facility.

Management of waste would be required during construction, operation (maintenance and general waste) and decommissioning of the proposal. Installation, operational maintenance, and decommissioning of the ancillary battery energy storage facility.

Dangerous goods would be required to be transported, stored, and disposed of as part of the proposal. This relates to the proposed BESS and proposed use of lithium-ion batteries.

Batteries may require replacement up to a maximum of two times during the life of the proposal. The batteries are designed for outdoor use, generally only require a secure foundation i.e., concrete slab, and specified clearances for service access.

Lithium-ion batteries are considered to pose little threat to people or property, although they may pose an environmental hazard or fire risk. The batteries, however, would be classified as a Class 9 miscellaneous dangerous goods and Class 9 hazardous goods (both new and waste batteries).

Lithium-ion batteries are classified as hazardous waste under the Commonwealth Hazardous Waste Act 1989 and are classified as Dangerous Goods under the ADG Code. The ADG Code requires dangerous goods to be carried in a secure, safe, and environmentally controlled manner. The code specifies 'special provisions' and 'packing instructions' applying to the transportation of Lithium-ion batteries.

Lithium-ion batteries do not contain any heavy metals. They do contain valuable material that can be recycled. The Australian Battery Recycling Initiative (ABRI) website indicates four companies which provide a collection and recycling service for used lithium-ion batteries.

The major hazard offered by lithium-ion battery technologies is fire. The proposal includes measures to minimise fire risk associated with the BESS. The proponent and/or their contractor would be responsible for identifying the need for and notifying of WorkSafe Victoria as appropriate for transport and or storage/handling of dangerous or hazardous goods associated with the proposed BESS.

The potential risks associated with waste and dangerous goods for the proposal can be reduced by handling them in accordance with Australian Standards and codes as well developing protocols for maintenance and incident response. These measures are outlined in Table 5-16.

Table 5-15 Waste safeguards and mitigation measures

No.	Safeguards and mitigation measures	C	O	D
H1	A waste minimisation and management plan would be	C	O	D

No.	Safeguards and mitigation measures	C	O	D
	developed as part of the EMP for the proposal. Waste would only be disposed of at a facility lawfully permitted to accept the waste.			
H2	The proponent and/or their contractor would be responsible for identifying the need for and notifying of WorkSafe Victoria as appropriate for transport and or storage/handling of dangerous or hazardous goods associated with the proposed ancillary battery energy storage facility. The transportation of new and waste lithium-ion batteries would comply with the requirements of the Dangerous Goods Code, including specific 'special provisions' and 'packing instructions' applying to the transportation of Li-ion batteries.	C	O	D
H3	Dangerous or hazardous materials would be stored and handled in accordance with AS1940-2004: The storage and handling of flammable and combustible liquids.	C	O	D
H4	Protocols would be ~~developed for lithium ion battery storage,~~ maintenance, and incident response to mitigate Li-ion fire risks.	C	O	D

Consistency with planning provisions

The proposal is considered to be consistent with the provisions of the scheme, specifically the provisions of clause 53.13 as it relates to protection of amenity and waste impacts associated with the construction, operation, and decommissioning of the proposal. Appropriate management plans would be prepared prior to construction to manage waste for the proposal.

The proposal has addressed the general decision guidelines Clause 65.01, specifically *the effect on the environment, human health and amenity of the area*. No adverse impacts from potential waste are anticipated.

The proposal suitably considers and addresses potential waste generation and impacts and provides proposed mitigations consistent with the Solar Energy Facilities - Design and Development Guideline (DELWP, 2019).

5.13 Cumulative impacts

The Solar Energy Facilities Design and Development Guideline (DELWP, 2019) requires consideration of cumulative impacts. *The clustering of solar energy (or other renewable energy) facilities in an area can result in efficiencies by sharing existing, or augmenting, electricity network infrastructure. However, too many facilities in an area can:*

- *Reduce the availability and/or productivity of strategic agricultural land, particularly in irrigation districts.*
- *Result in landscape-scale visual impacts, due to an overconcentration of built form in an area.*
- *Impact the area's biodiversity, habitat or wildlife, due to an overconcentration of built form.*

The cumulative impacts of solar energy facilities on an area can be reduced by:

- *Having a mix of land use activities including solar energy facilities in the area.*
- *Agrophotovoltaics — the dual use of a site with agriculture.*
- *Having enough distance between solar energy facilities within an area to minimise or avoid environmental impacts and natural hazard risk exposure.*

The proposal avoids built form cumulation or concentration as the closest solar facilities (as mapped by DELWP, refer to Figure 5-12) are located approximately 26km from the proposal site. The proponent has considered efficiencies and capacity in consultation with the electricity network operator.

Due to the small scale of the proposal and limited solar facilities in the immediate area surrounding the proposal site, the proposal is not considered to:

- Reduce the availability and/or productivity of strategic agricultural land because the land would be returned to agricultural land after decommissioning. During construction and operation, the land surrounding the proposal would continue to be available for agricultural purposes. There is significant land in the region to support agriculture as a primary strategic economic land use.
- Result in landscape-scale visual impacts because there are no other visible solar farms within 5km of the proposal site and therefore no cumulative landscape impacts.
- Impact the area's biodiversity, habitat, or wildlife, because the impacts at site scale have been avoided and minimised as a priority, resulting in minimal to negligible impacts within the region.

The subject land will have a mix of land uses and maintain agricultural activities and has separation from solar energy facilities within the area avoiding or minimising environmental impacts and natural hazard risks.

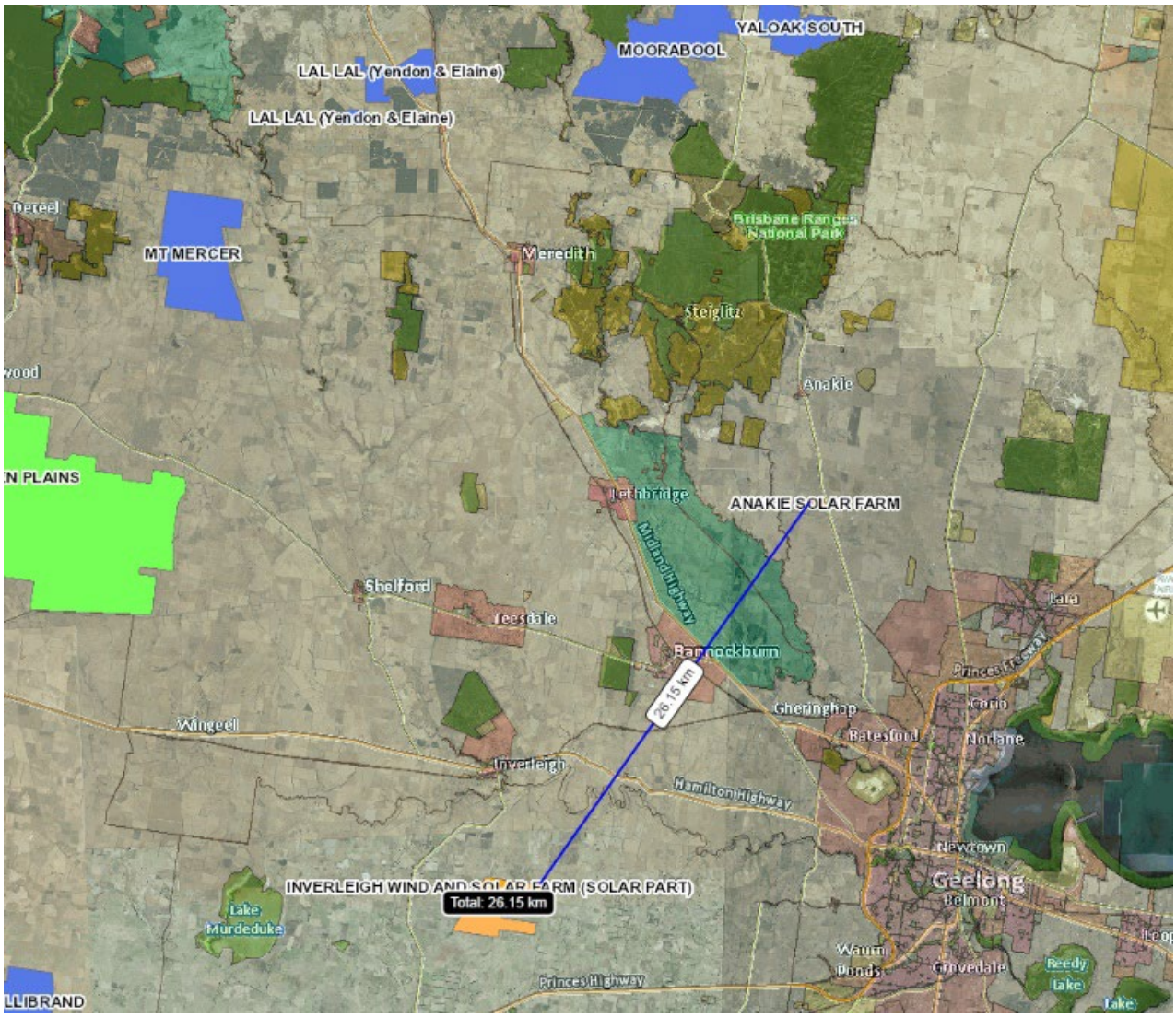


Figure 5-12 Distance of surrounding solar farms from the proposal site (VicPlan, 2022)

ADVERTISED PLAN

6. Community Engagement

6.1 Engagement of Registered Aboriginal Party

BNRG Leeson contacted the Registered Aboriginal Party, the Wadawurrung People, represented by the Wadawurrung Traditional Owners Aboriginal Corporation.

Specifically, the engagement included discussions to understand the cultural sensitivity of the proposal site. No areas of sensitivity were identified.

6.2 Engagement strategy

BNRG Renewables Ltd completed engagement for the proposal with available stakeholders, including pre-lodgement meetings with agencies and follow up consultation with DELWP Environment and the CFA. Traffic consultation with the Department of Transport was completed by the traffic engineer engaged for the proposal.

6.2.1 Door knocking/face to face contact

The engagement included face to face contact including a visit to properties near the proposal site. For the residents that were available, a BNRG representative provided details about the proposal, including proposed layout, design and construction, and operation.

6.2.2 Community drop-in session

The engagement included a community drop in session at a local hall. A BNRG representative and the engagement team attended.

6.3 Outcomes

Outcomes of the engagement have been considered in the preparation of this PR. Feedback included:

- An interest in the number and type of potential jobs.
- After viewing the aerial photos and plans, satisfied there would be no unacceptable impact.
- Interest in the potential extent of interruption along the main road during construction. Generally satisfied this would be minimal.

Ongoing and proposed future engagement

The proponent is committed to continuing consultation with the community as the project develops.

7. Conclusion

The proposed Anakie Solar Farm meets the relevant provisions of the Greater Geelong Planning Scheme and is consistent with Section 47 of the *Planning and Environment Act 1987*. The proposal has taken into consideration all matters relevant to renewable energy facilities outlined in DELWP's Solar Energy Generating Facility Guidelines.

The proponent commits to carrying out the proposal in accordance with the safeguards and mitigation measures outlined in this PR. Overall, the proposal is expected to have minimal environmental and amenity impacts and would result in a positive impact for the community and local economy.

The proposal would provide the following benefits:

- Producing clean energy, offsetting approximately 9993 tonnes of carbon emissions per year.
- The BESS would aid peak energy needs.
- It would diversify income and increase revenue to ancillary services such as food, lodging and tourism for the local area during construction.
- It would create jobs – up to 50 staff on site at any time during construction (peak times) and up to 5 FTE during operation over the life of the proposal.
- The proposal is consistent with the Clause 53.13 Renewable Energy Facility and other relevant provisions of the planning scheme.
- The nature of the proposal would not negatively impact the character and amenity of the site and the adjoining land uses, specifically for rural dwellings in proximity to the proposal site.

This PR and all supporting documents has shown that there are reasonable grounds for the Minister to consider issuing a planning permit for the proposal. The safeguards and mitigation measures committed to by the proponent in this PR would enable a development that avoids and minimises impacts on the amenity of the community and the environment.

8. References

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Appendix A Proposal plans

ADVERTISED PLAN

ADVERTISED PLAN

GENERAL NOTES

Legend

- PV Panels
- Inverter/Transformer
- MV Switchgear
- BESS
- Roads
- Fence/Site Boundary
- Property Boundaries
- Overhead Line
- Underground Line
- Hydrology
- 10m Transversable Fire Break
- Veg. Avoidance Area

PROJECT NAME:
Anakie - VIC

DRAWING TITLE:
Anakie Site Location Plan

DRAWN BY: A.YOUNG

CHECKED BY: -

APPROVED BY: -

DATE: 17/11/2022

Company:
BNRG Renewables Ltd.
Solar Projects Developer.

Unit 1b, Custom House Plaza 3,
Harbourmaster Place,Dublin 1
IRELAND.
CONTACT NO-
E-MAIL :

PROJECT NO: -

SCALE: 0:000

SHEET SIZE: A3

DRAWING NO: -

SHEET NO: 01

REVISION: -

UNIT: -

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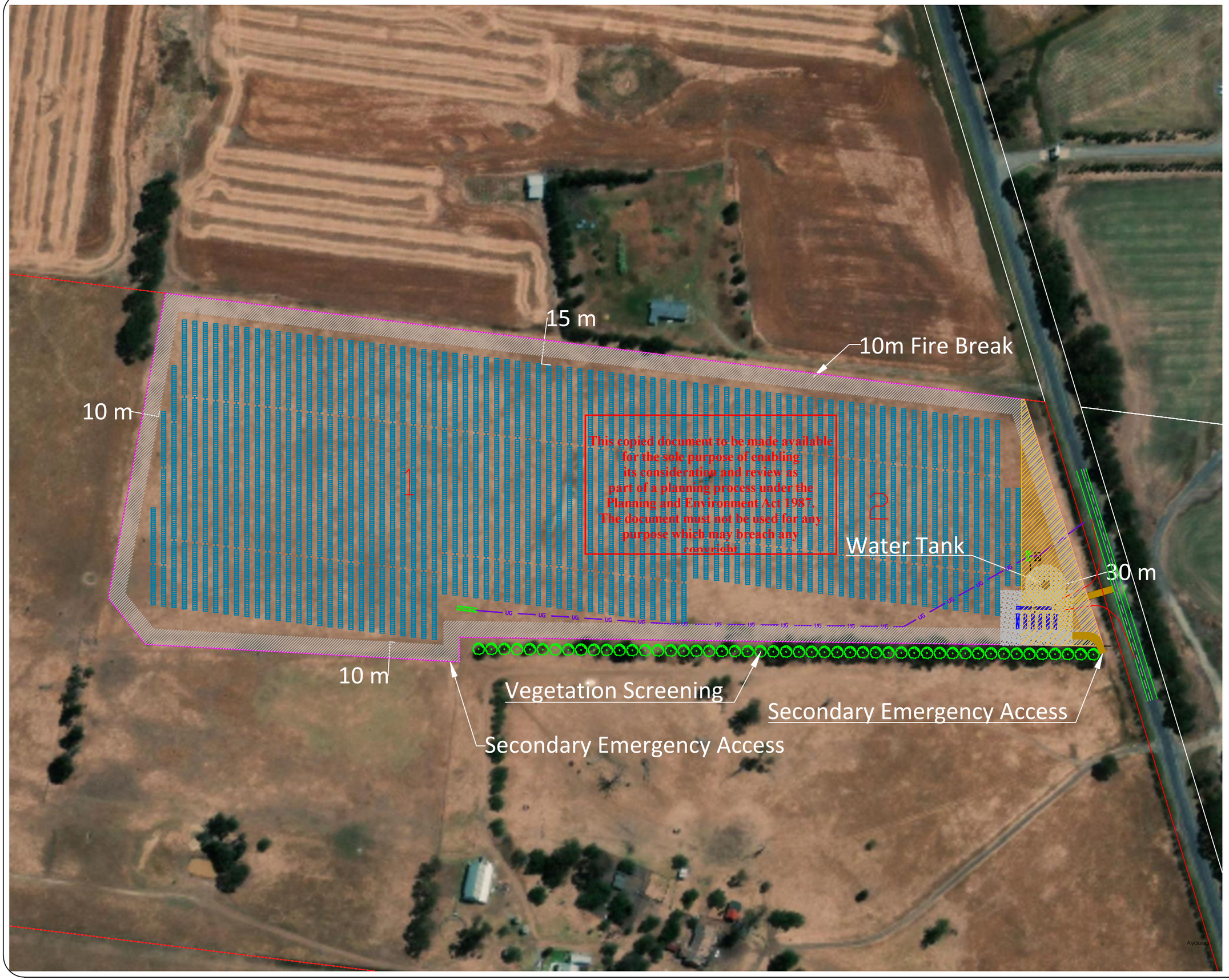


GENERAL NOTES

Legend

- PV Panels
- Inverter/Transformer
- MV Switchgear
- BESS
- Roads
- Fence/Site Boundary
- Property Boundaries
- Overhead Line
- Underground Line
- Hydrology
- 10m Transversable Fire Break
- Veg. Avoidance Area

PROJECT NAME: Anakie - VIC

DRAWING TITLE: Anakie Site Layout

DRAWN BY: A.YOUNG

CHECKED BY: -

APPROVED BY: -

DATE: 17/11/2022

Company:
BNRG Renewables Ltd.
Solar Projects Developer.

Unit 1b, Custom House Plaza 3,
Harbourmaster Place,Dublin 1
IRELAND.
CONTACT NO-
E-MAIL :

PROJECT NO: -

SCALE: 0:000

SHEET SIZE: A3

DRAWING NO: -

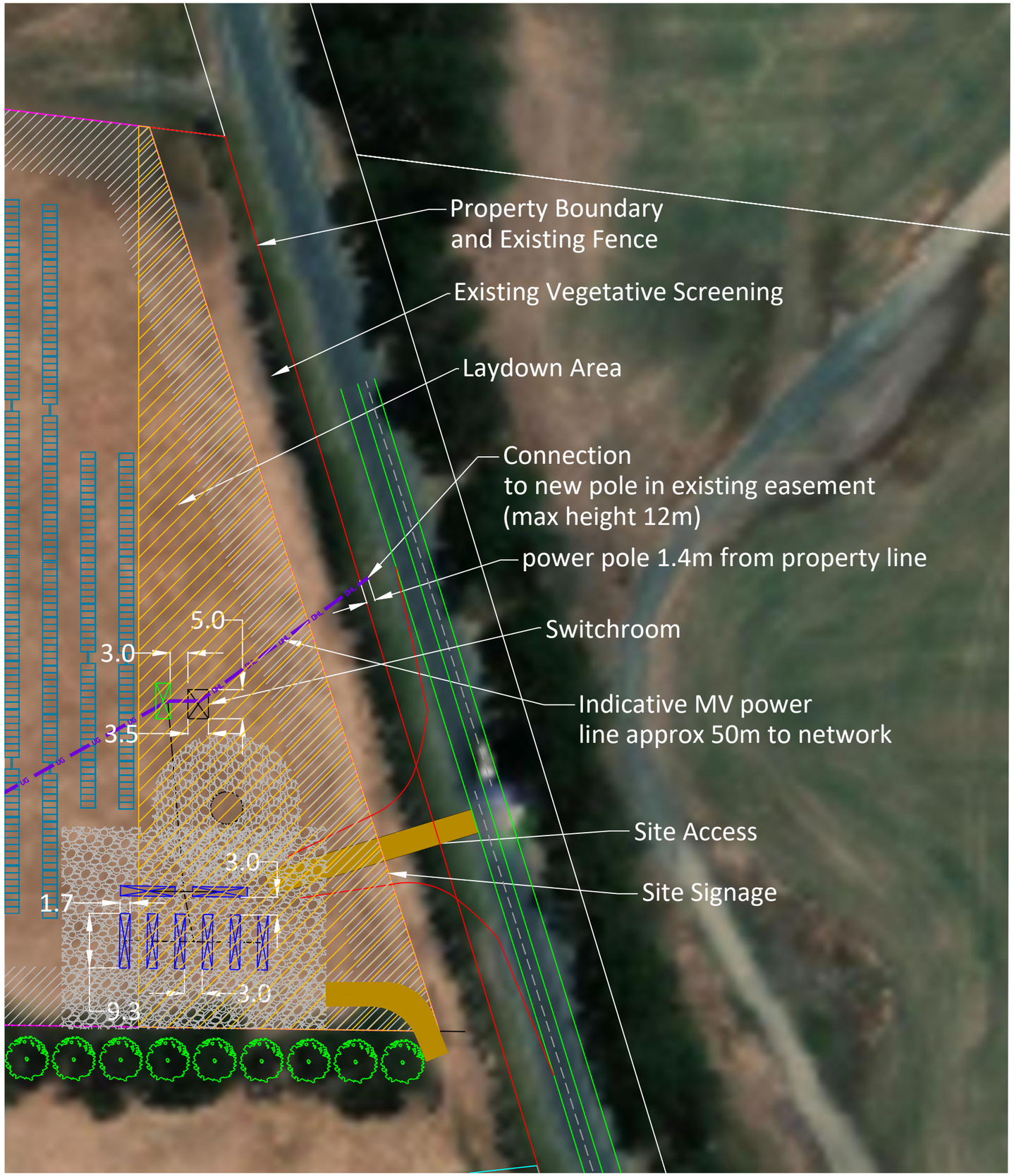
SHEET NO: 01

REVISION: -

UNIT: -

N W E S

ADVERTISED PLAN



GENERAL NOTES

Legend

- PV Panels
- Inverter/Transformer
- MV Switchgear
- BESS
- Roads
- Fence/Site Boundary
- Property Boundaries
- Overhead Line
- Underground Line
- Hydrology
- 10m Transversable Fire Break
- Veg. Avoidance Area

PROJECT NAME:
Anakie - VIC

DRAWING TITLE:
Anakie Layout Details

DRAWN BY: A.YOUNG

CHECKED BY: -

APPROVED BY: -

DATE: 17/11/2022

Company:
BNRG Renewables Ltd.
Solar Projects Developer.

Unit 1b, Custom House Plaza 3,
Harbourmaster Place,Dublin 1
IRELAND.
CONTACT NO-
E-MAIL :

PROJECT NO: -

SCALE: 0:000

SHEET SIZE: A3

DRAWING NO: -

SHEET NO: 01

REVISION: -

UNIT: -

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SITE PLAN
Scale 1:200 @ A1

0 30 60 90 120m

LEGEND

- SITE BOUNDARY
- FENCE AS PROPOSED
- SOLAR PV ARRAY
- BESS
- MV SWITCHGEAR
- INVERTER / TRANSFORMER
- ACCESS ROAD
- 10 m FIRE BREAK
- APPROXIMATE EXTENT OF EXISTING VEGETATION
- APPROXIMATE EXTENT OF PROPOSED SCREENING. REFER TO PLANTING PLAN AND PLANTING SCHEDULE
- LAYDOWN AREA

ADVERTISED PLAN

moir landscape architecture
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Islington NSW 2296
Phone (02) 49653500
admin@moirla.com.au
www.moirla.com.au

Architect:

Engineer:

No.	Date	Revision	By
A	30/9/2022	CONCEPT LANDSCAPE PLAN	SW
B	7/10/2022	CONCEPT LANDSCAPE PLAN	SW

North

Status:
Final
Anakie Solar Farm

Anakie Victoria

BNRG Renewables Ltd

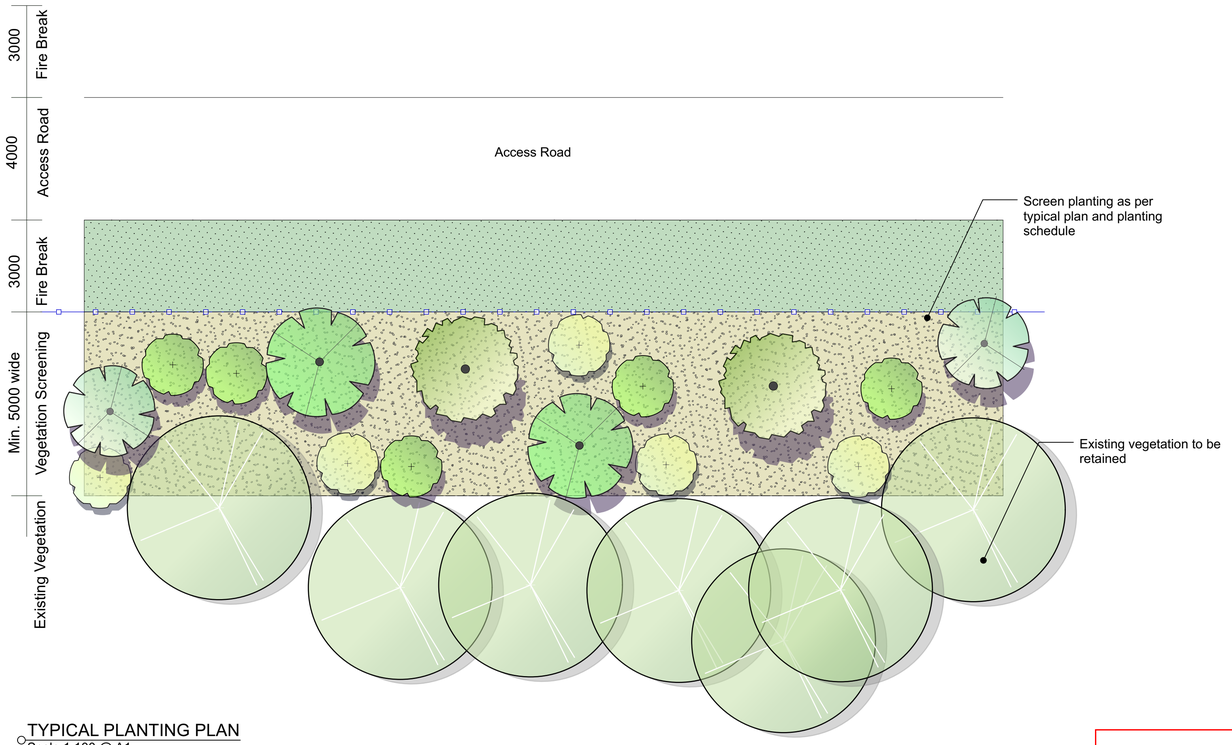
SITE PLAN

Scale: 1:2000
ORIGINAL DRAWING AT A1.

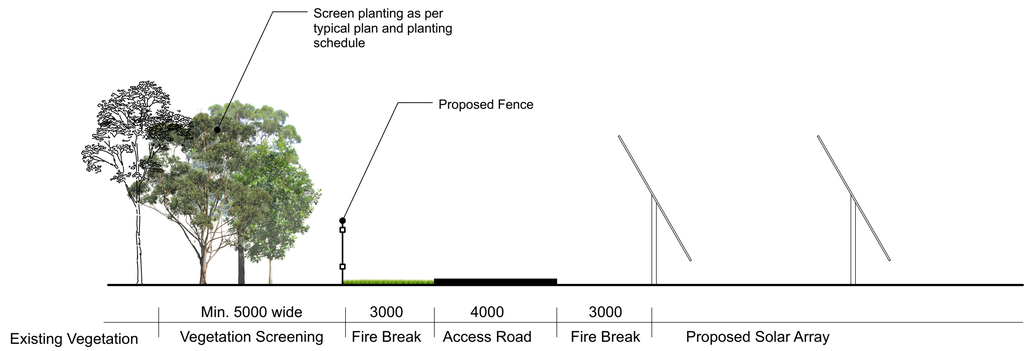
Drawn By: SW Approved By: DM
Checked By: SR

Project No. **2152**

Drawing No. LP01 Rev. B



TYPICAL PLANTING PLAN
Scale 1:100 @ A1



TYPICAL SECTION
Scale 1:100 @ A1

Indicative Planting Schedule

Code	Botanical Name	Common Name	Pot Size	Mature Height	Mature Width	Notes
Trees						
ACA mel	*Acacia melanoxylon*	Blackwood	27 Ltr	12m	5m	Native / Local
ACA par	*Acacia paradoxa*	Hedge Wattle	25 Ltr	4m	4m	Native / Local
ALL ver	*Allocasuarina verticillata*	Drooping Sheoak	27 Ltr	9m	5m	Native / Local
Shrubs						
BAN mar	*Banksia marginata*	Silver Banksia	200mm Pot	2m	2m	Native / Local
BUR spi	*Bursaria spinosa*	Sweet Bursaria	200mm Pot	3m	2m	Native / Local

LEGEND

Site boundary

Existing tree - to be retained & protected

Turf

Road

Fence as proposed

TREES

Acacia melanoxylon Blackwood

Acacia paradoxa Hedge Wattle

Allocasuarina verticillata Drooping Sheoak

SHRUBS

Banksia marginata Silver Banksia

Bursaria spinosa Sweet Bursaria

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Architect:

Engineer:

No.	Date	Revision	By
A	30/9/2022	CONCEPT LANDSCAPE PLAN	SW
B	7/10/2022	CONCEPT LANDSCAPE PLAN	SW

North

Status: Final

Anakie Solar Farm

Anakie Victoria

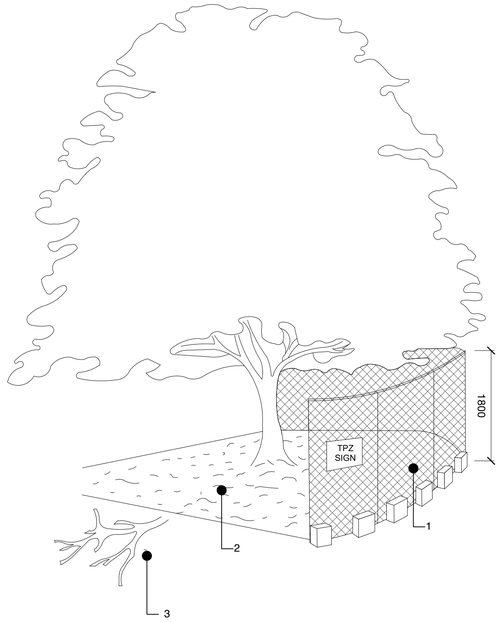
BNRG Renewables Ltd

DETAIL PLAN

Scale: 1:100
ORIGINAL DRAWING AT A1.
Drawn By: SW Approved By: DM
Checked By: SR

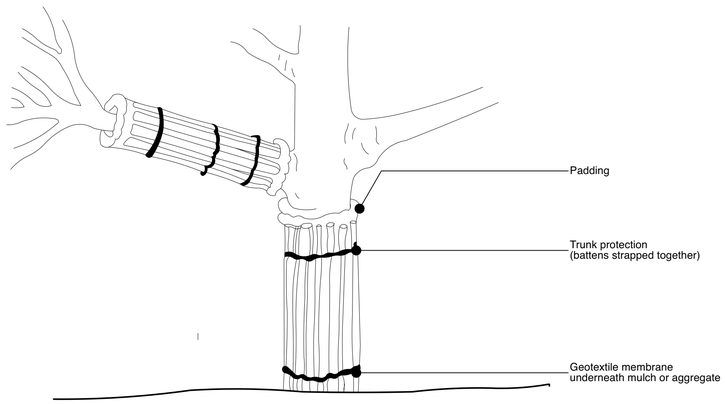
Project No. 2152

Drawing No. LP02 Rev. B

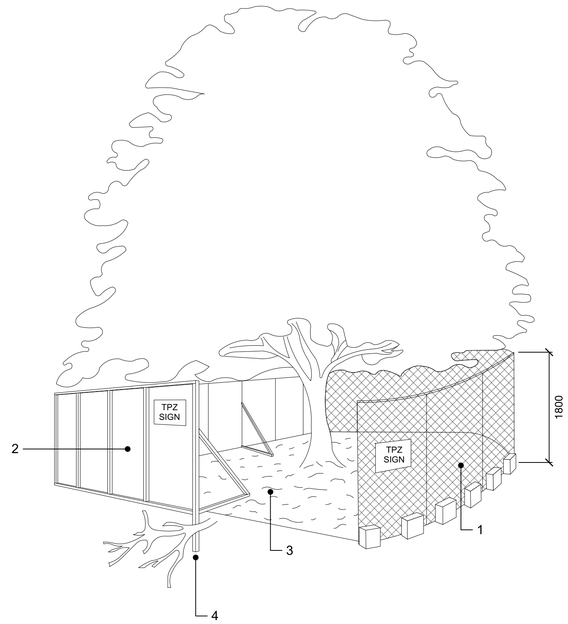


LEGEND:
1: Chain wire mesh panels with shade cloth (if required) attached, held in place with concrete feet
2: Mulch installation across surface of TPZ
3: Bracing is permissible within the TPZ. Installation of supports should avoid damaging roots

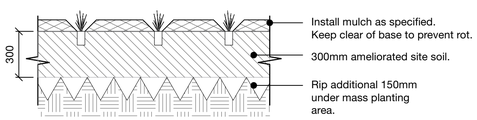
TREE PROTECTIVE FENCING
Scale 1:50 @ A1



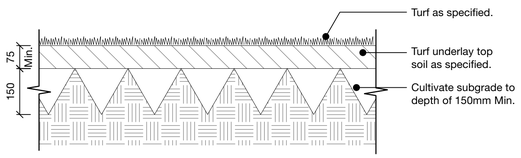
NOTE:
1. For trunk and branch protection use boards and padding that will prevent damage to bark. Boards are to be strapped to trees, not nailed or screwed.
2. Rumble boards should be of suitable thickness to prevent soil compaction and root damage.



LEGEND:
1: Chain wire mesh panels with shade cloth (if required) attached, held in place with concrete feet
2: Alternative plywood or wooden paling fence panels. This fencing material also prevents building materials or soil entering the TPZ
3: Mulch installation across surface of TPZ
4: Bracing is permissible within the TPZ. Installation of supports should avoid damaging roots



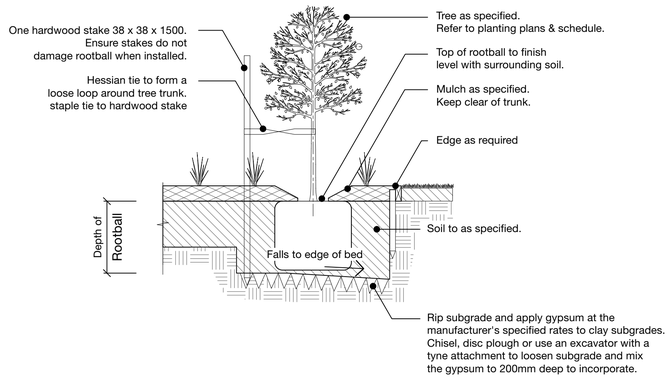
TYPICAL MASS PLANTING
Scale 1:20 @ A1



ADVERTISED PLAN

TYPICAL TURF DETAIL
Scale 1:10 @ A1

NOTES:
1. Finish crossfall to turf shall be 1:80 min.
   Finish flush with adjoining surfaces.
2. Soil as specified, provide a turf underlay that complies with AS4419.
3. Remove contaminated areas, deleterious material such as large rocks greater than 50mm, rubbish and large twigs.
4. Lay turf parallel to contour, close butted and lightly tamp.
5. Fill joints with top dressing soil.
6. Provide subsoil drainage to address any poorly draining areas.
7. Water in and maintain consistent deep watering for 14 weeks minimum. (Separate to the plant establishment period)
8. Consistently top dress depressions to provide an even surface.
9. Mow, top dress and control pests and disease consistently during the remainder of the planting establishment period.
10. All turf orders to be supplied free of plastic reinforcement mesh.



TREE IN MASS PLANTING
Scale 1:20 @ A1

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Architect:

Engineer:

No.	Date	Revision	By
A	30/9/2022	CONCEPT LANDSCAPE PLAN	SW
B	7/10/2022	CONCEPT LANDSCAPE PLAN	SW

North

Status:
Final
Anakie Solar Farm

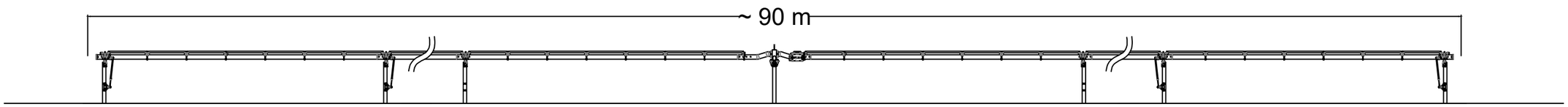
Anakie Victoria

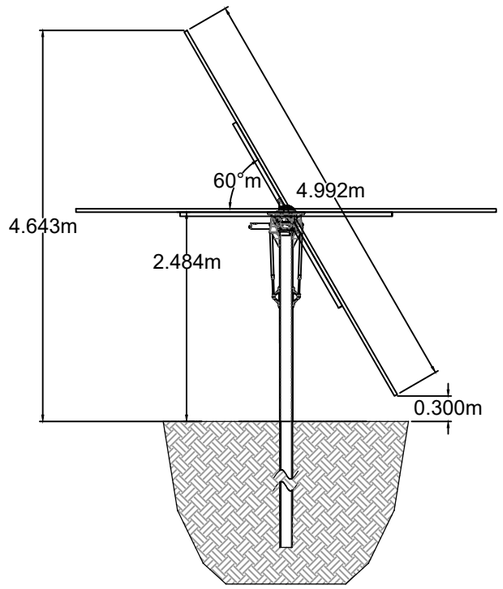
BNRG Renewables Ltd

DETAILS

Scale: AS SHOWN
ORIGINAL DRAWING AT A1.
Drawn By: SW Approved By: DM
Checked By: SR

Project No. **2152**
Drawing No. LP03
Rev. B





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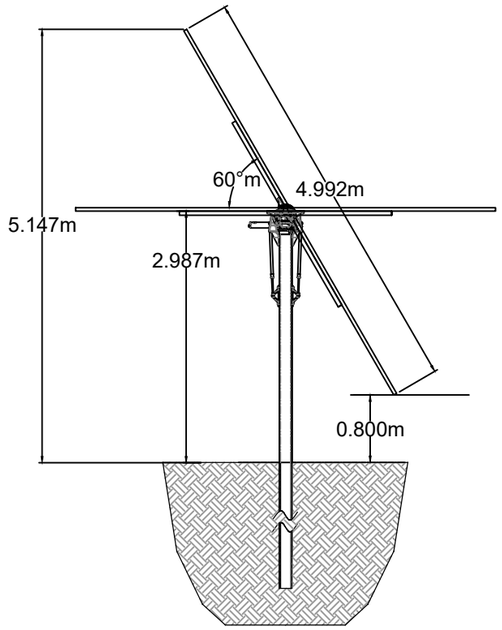

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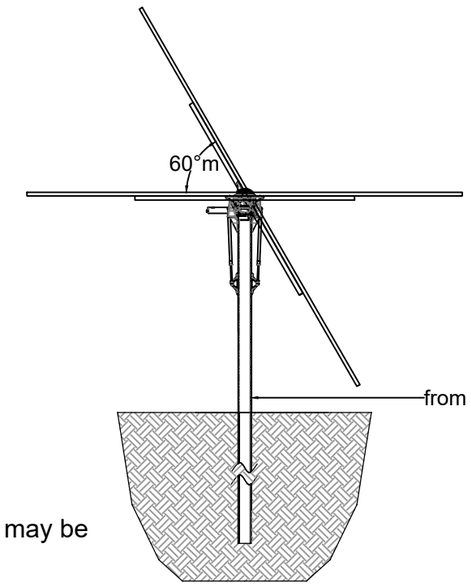
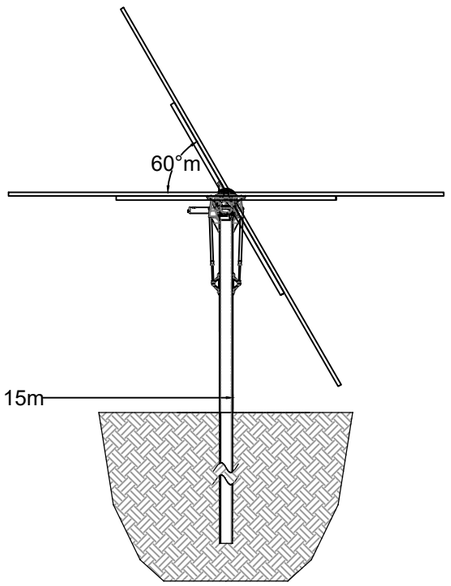
ADVERTISED PLAN





from 5m to 15m

Note:
1. The layout drawing is for reference. There may be partial adjustments in the detailed design.

GENERAL NOTES

PROJECT NAME:

DRAWING TITLE:
Tracker Elevation

DRAWN BY: A. Lopes

CHECKED BY:

APPROVED BY:

DATE: 19/07/2022

Company:
BNRG Renewables Ltd.
Solar Projects Developer.

Unit 1b, Custom House Plaza 3,
Harbourmaster Place,Dublin 1
IRELAND.
CONTACT NO:
E-MAIL :

PROJECT NO:

SCALE:

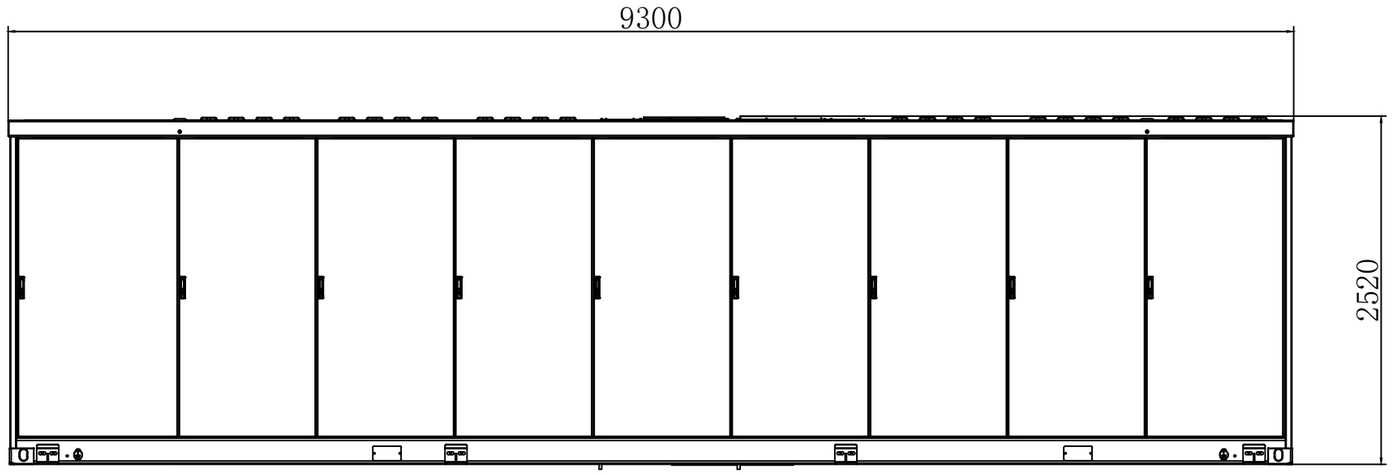
SHEET SIZE: A3

DRAWING NO:

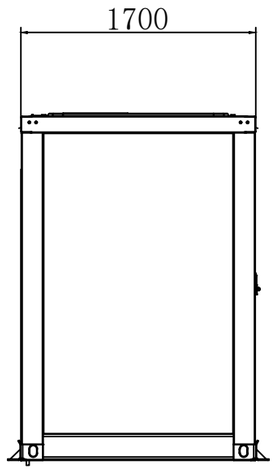
SHEET NO: 01

REVISION: 1.0

UNIT:

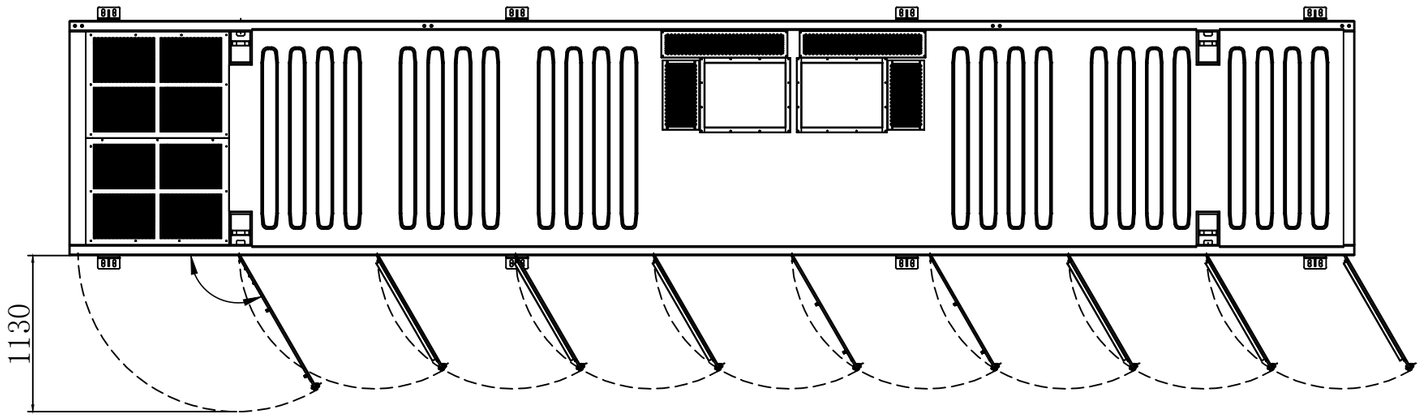


Front View



Side View

ADVERTISED PLAN



Top View

Note:
1. The layout drawing is for reference. There may be partial adjustments in the detailed design.
2. Size: 9300mm×2520mm×1700mm (W×H×D)

GENERAL NOTES

PROJECT NAME:

DRAWING TITLE: BESS Elevation

DRAWN BY: A. Lopes

CHECKED BY:

APPROVED BY:

DATE: 23/06/2022

Company:
BNRG Renewables Ltd.
Solar Projects Developer.

Unit 1b, Custom House Plaza 3,
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CONTACT NO: +353 1 791 7882
E-MAIL : dmoloney@bnrg.ie

PROJECT NO:

SCALE:

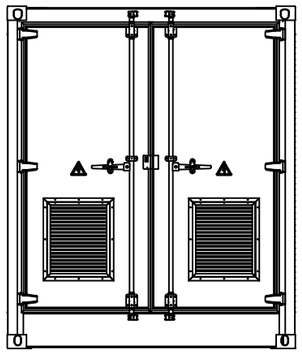
SHEET SIZE: A3

DRAWING NO:

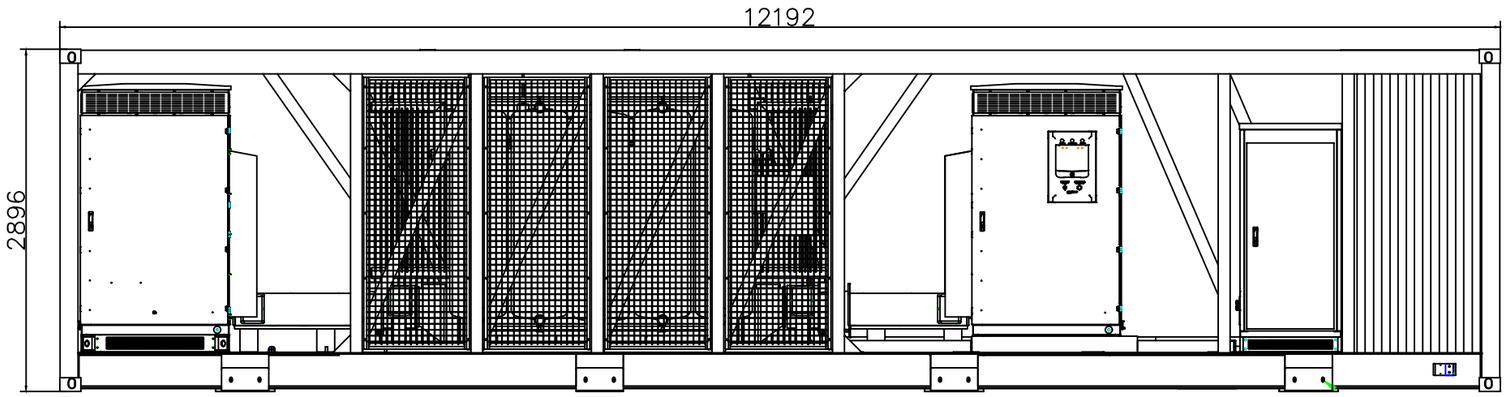
SHEET NO: 01

REVISION: 1.0

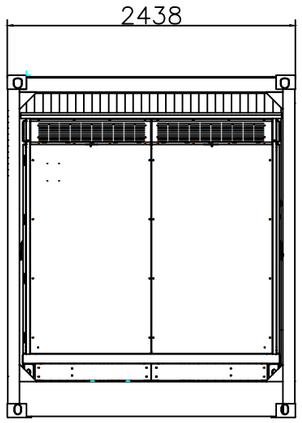
UNIT: Millimeters



Right View



Front View



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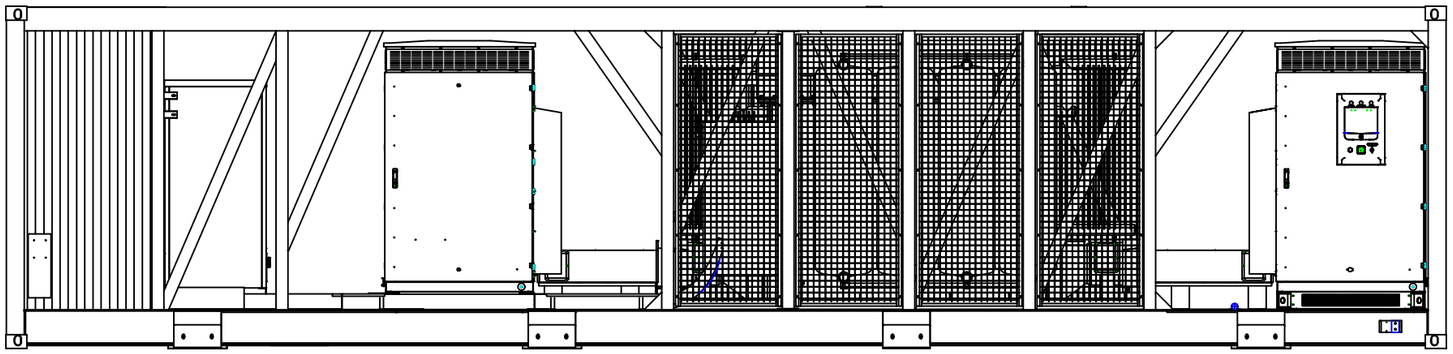
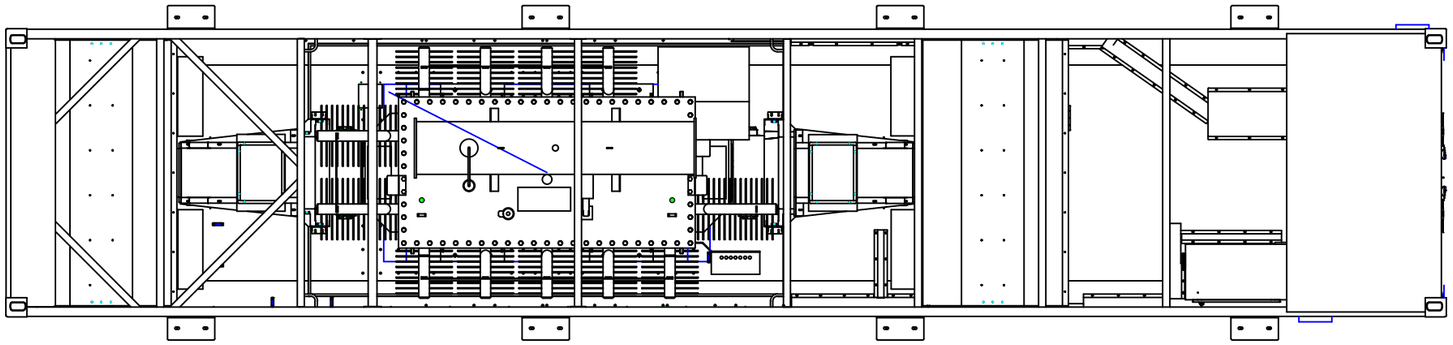


Back View

ADVERTISED PLAN



Top View

Note:
1. The layout drawing is for reference. There may be partial adjustments in the detailed design.
2. Size: 12192mm×2896mm×2438mm (W×H×D)

GENERAL NOTES:

PROJECT NAME:

DRAWING TITLE:
SG4950HV-MV Elevation

DRAWN BY: A. Lopes

CHECKED BY:

APPROVED BY:

DATE: 24/06/2022

Company:
BNRG Renewables Ltd.
Solar Projects Developer.

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CONTACT NO: +353 1 791 7882
E-MAIL : dmoloney@bnrg.ie

PROJECT NO:

SCALE:

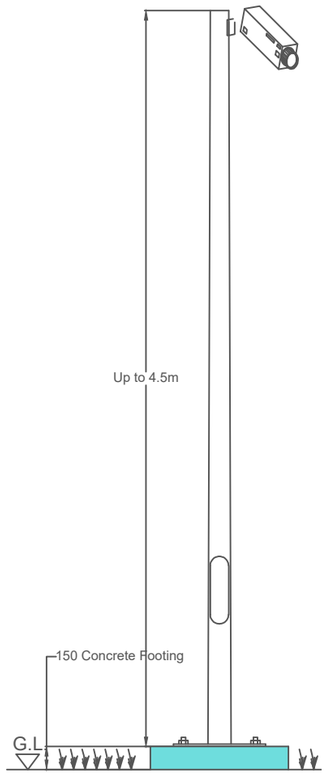
SHEET SIZE: A3

DRAWING NO:

SHEET NO: 01

REVISION: 1.0

UNIT: Millimeters



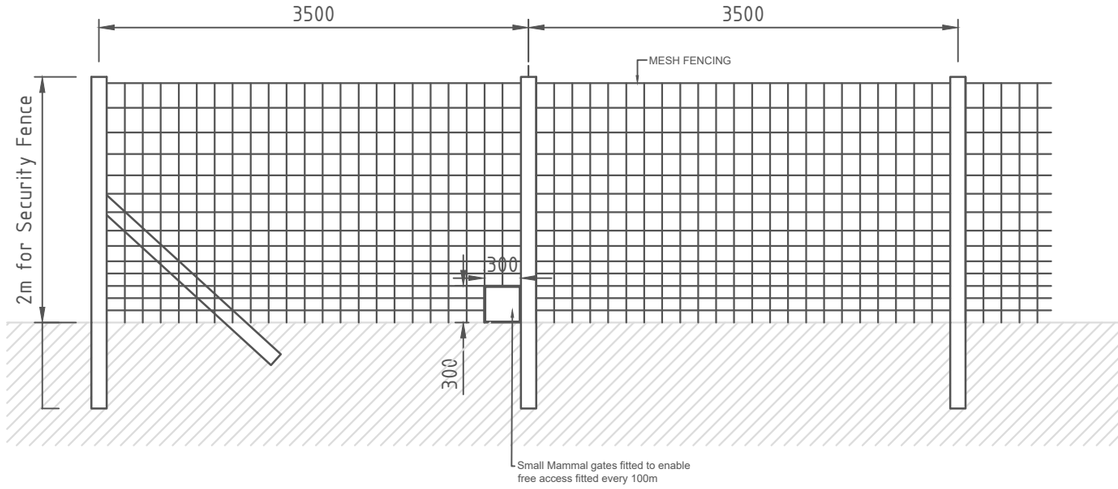
CCTV CAMERA

Scale 1:20

0 500 1000 Millimeters

TYPICAL SITE LIGHTING

Indicative motion-senor lights on boards only.
As per AS 4282-1997

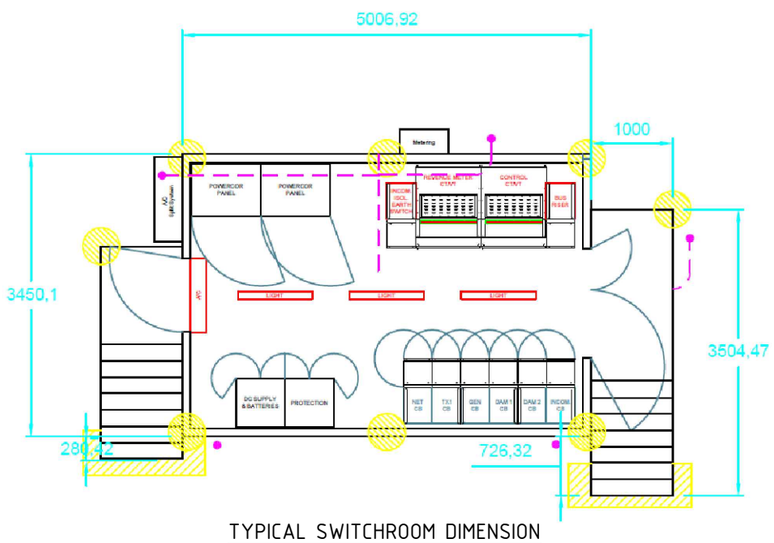


TYPICAL MESH FENCE ELEVATION

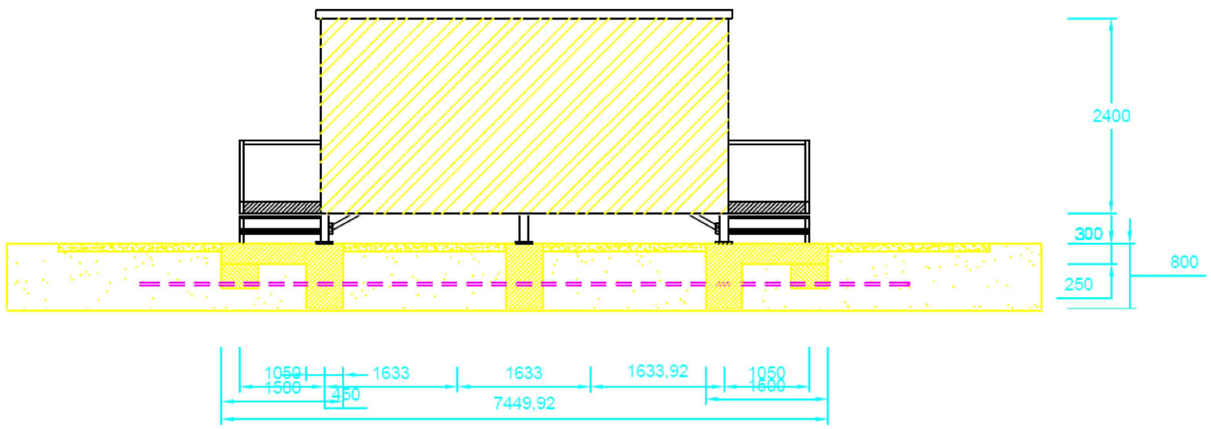
Scale 1:50

0 1000 2000 Millimeters

ADVERTISED PLAN



TYPICAL SWITCHROOM DIMENSION



TYPICAL SWITCHROOM ELEVATION

GENERAL NOTES

Not For Construction

PROJECT NAME:

DRAWING TITLE: Elevations

DRAWN BY: A. Lopes

CHECKED BY:

APPROVED BY:

DATE: 20/10/2022

Company:
BNRG Renewables Ltd.
Solar Projects Developer.

Unit 1b, Custom House Plaza 3,
Harbourmaster Place,Dublin 1
IRELAND.
CONTACT NO: +353 1 791 7882
E-MAIL : dmoloney@bnrg.ie

PROJECT NO:

SCALE: Noted

SHEET SIZE: A3

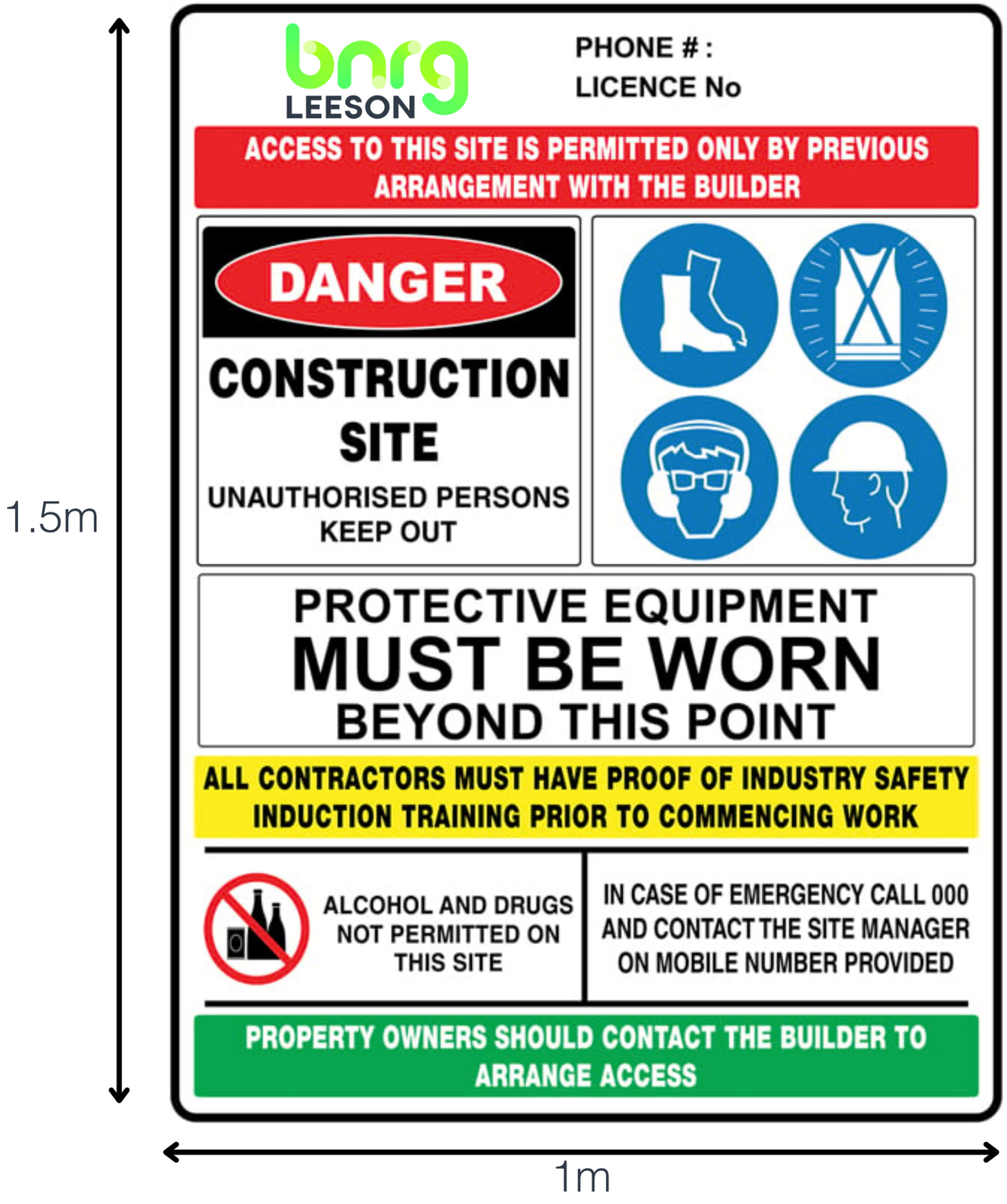
DRAWING NO: 003

SHEET NO: 01

REVISION: 1.0

UNIT: Millimeters unless noted

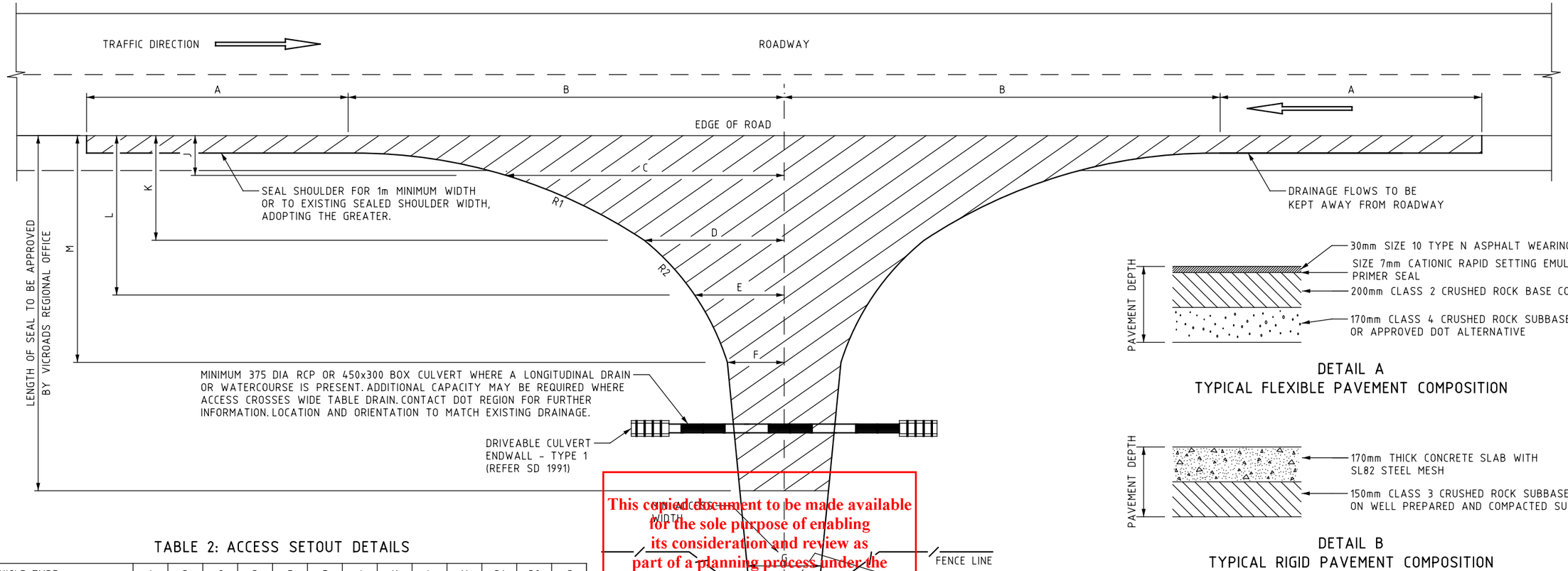
BNRG Leeson Solar Farm - Site Signage Dimensions



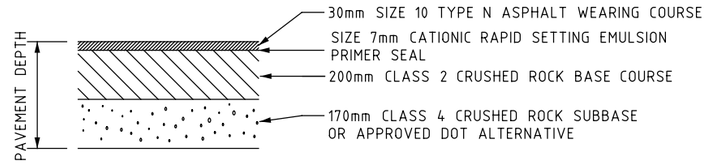
ADVERTISED PLAN

Note: Text is indicative.

ISSUE	APPROVED BY	DATE	AMENDMENT
A	M-RD&SSE	12/21	REVISED PAVEMENT DETAILS AND GENERAL NOTES 1, 2, 3, 4, & 5



PLAN - DRIVEWAY ACCESS LAYOUT



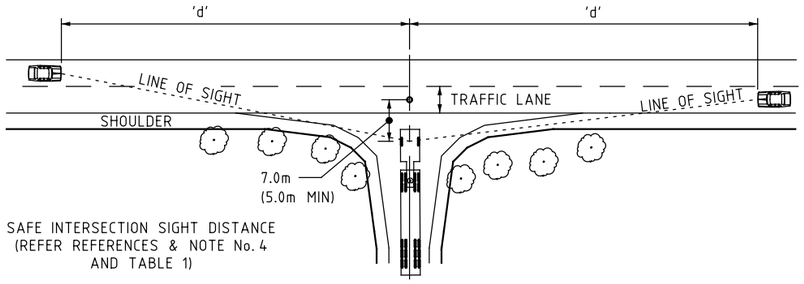
DETAIL A
TYPICAL FLEXIBLE PAVEMENT COMPOSITION

DETAIL B
TYPICAL RIGID PAVEMENT COMPOSITION

TABLE 2: ACCESS SETOUT DETAILS

VEHICLE TYPE	A	B	C	D	E	F	J	K	L	M	R1	R2	G
26m B-DOUBLE	15.0	30.3	20.4	11.0	6.1	3.7	2.1	5.3	9.4	15.3	45	13	4.3
19m SEMI TRAILER	15.0	24.6	17.2	10.3	5.2	3.0	1.9	4.6	9.3	15.7	30	14	4.2
ARTICULATED 19m BUS	15.0	21.9	14.4	7.5	4.4	2.9	2.1	5.4	9.6	14.7	26	15	4.0
12.5m SINGLE UNIT	15.0	20.1	12.9	6.4	4.1	3.0	2.2	5.6	9.7	16.3	23	18	4.0
TRUCK + 3 AXLE TRAILER	15.0	18.3	11.8	6.2	4.0	3.0	2.2	5.7	9.8	14.2	18	18	4.0
TRUCK + 4 AXLE TRAILER	15.0	19.2	12.2	6.0	4.0	3.0	2.3	5.9	9.8	14.0	20	17	4.0
8.8m SERVICE VEHICLE	15.0	12.6	8.7	5.4	4.1	3.5	1.8	4.1	6.7	9.6	10	13	4.0
PASSENGER VEHICLE	5.0	9.3	3.8	1.8	-	-	2.2	7.5	-	-	7.5	-	3.6

SETOUT DETAILS TO BE BASED ON THE DESIGN VEHICLE SELECTED.
CHECK VEHICLE MAY ENCROACH ON TO OPPOSING TRAFFIC LANE IN <80KM/H SPEED ZONE FOR LOW VOLUME ROADS WITHOUT A CENTRAL BARRIER.



MINIMUM VISIBILITY REQUIREMENTS
(NOT TO SCALE)

TABLE 1: SIGHT DISTANCES

DESIGN SPEED (Km/h)	'd' SAFE INTERSECTION SIGHT DISTANCE (m)	CORRECTION (m)							
		ROADWAY UPGRADE				ROADWAY DOWNGRADE			
		2%	4%	6%	8%	2%	4%	6%	8%
60	123	-2	-4	-6	-7	2	5	8	11
70	151	-3	-5	-8	-10	3	7	11	15
80	181	-4	-7	-10	-13	4	9	14	20
90	226	-5	-9	-13	-16	5	11	18	25
100	262	-6	-11	-16	-20	6	14	22	31
110	300	-7	-13	-19	-24	8	17	26	38

THE DESIGN SPEED IS ASSUMMED TO BE 10km/h GREATER THAN THE POSTED SPEED LIMIT FOR RURAL HIGHWAYS AND ROADS

GENERAL NOTES:

1. THE DIAGRAM IS A GUIDE FOR A TYPICAL LAYOUT OF A DRIVEWAY ACCESS FOR A RURAL PROPERTY FOR VEHICLES AS SPECIFIED IN TABLE 2. THIS GUIDE WAS DEVELOPED IN THE INTEREST OF ROAD SAFETY AND TO PROTECT THE ARTERIAL ROAD PAVEMENT AT THE ACCESS LOCATION.
2. SLIGHT VARIATIONS MAY OCCUR AFTER SITE INSPECTION, ANALYSIS AND APPROVAL OF THE LOCATION.
3. THE PAVEMENT COMPOSITION SHALL BE IN ACCORDANCE WITH THAT SHOWN IN DETAIL A. THE PAVEMENT TYPE SHOWN IN DETAIL B IS ONLY SUITABLE FOR INFREQUENT HEAVY VEHICLE TRAFFIC. AN ALTERNATIVE PAVEMENT COMPOSITION WILL REQUIRE APPROVAL BY THE DEPARTMENT OF TRANSPORT. NEW PAVEMENT MUST BE KEYED INTO EXISTING PAVEMENT AND CRACK SEALED.
4. ANY PROPOSED ALTERNATIVE PAVEMENT DESIGNS SHALL BE UNDERTAKEN IN ACCORDANCE WITH VICROADS CODE OF PRACTICE RC 500.22 SELECTION AND DESIGN OF PAVEMENTS AND SURFACINGS AND AUSTROADS GUIDE TO PAVEMENT TECHNOLOGY PART 2 PAVEMENT STRUCTURAL DESIGN.
5. PAVEMENT MATERIALS AND EARTHWORK LAYERS NEED TO BE IN ACCORDANCE WITH DOT STANDARD SECTIONS AND/OR LOCAL GOVERNMENT SPECIFICATION REQUIREMENTS.
6. A PLANNING PERMIT IS REQUIRED FOR A NEW ACCESS OR ALTERATION TO AN EXISTING DRIVEWAY AND MAY BE REQUIRED FOR THE REMOVAL OF NATIVE VEGETATION.
7. A TRAFFIC MANAGEMENT PLAN MUST COMPLY WITH THE ROAD MANAGEMENT ACT AND APPLICABLE CODES IN RELATION TO ANY WORKS UNDERTAKEN WITHIN THE ROAD RESERVE.
8. TRUCK WARNING SIGNS & GUIDE POSTS SHOULD BE INSTALLED IN ACCORDANCE WITH AUSTROADS GUIDE TO TRAFFIC MANAGEMENT & VICROADS SUPPLEMENTS.
9. THE DRIVEWAY ACCESS CONSTRUCTION AND MAINTENANCE IS THE RESPONSIBILITY OF THE PROPERTY OWNER. MAINTENANCE ALSO INCLUDES ASSOCIATED DRAINAGE WORKS.

SIGHT DISTANCE:

10. A DRIVER, WHEN LOCATED 7.0M (5.0M MIN) FROM THE CONFLICT POINT TAKEN AS THE CENTRE OF THE TRAFFIC LANE, NEEDS TO SEE A VEHICLE APPROACHING IN EITHER DIRECTION. REFER TABLE 1 FOR APPROPRIATE SIGHT DISTANCES.
11. TREE CANOPIES, BUSHES OR OTHER OBJECTS SHALL BE REMOVED TO PROVIDE GOOD VISIBILITY. ANY TREE CANOPIES OVERHANGING THE PATH OF A TRUCK SHALL BE A MINIMUM OF 5.0M ABOVE THE GROUND SURFACE.
12. SIGHT LINES MUST ACHEIVE THE MINIMUM SAFE INTERSECTION SIGHT DISTANCE BASED ON AN EYE HEIGHT OF 1.1M TO AN OBJECT HEIGHT OF 1.25M.

NOTES:

1. ALL DIMENSIONS ARE IN METRES, UNLESS SHOWN OTHERWISE
2. THIS DRAWING FORMS PART OF THE VRS TO AGRD PART 4 AND SHOULD BE READ IN CONJUNTION WITH THOSE REFERENCES

REFERENCES:

AUSTROADS GUIDE TO ROAD DESIGN PART 4
AUSTROADS GUIDE TO ROAD DESIGN PART 4A
AUSTROADS GUIDE TO ASSET MANAGEMENT PART 5
AUSTROADS GUIDE TO PAVEMENT TECHNOLOGY PART 2
AUSTROADS GUIDE TO TRAFFIC MANAGEMENT
VICROADS SUPPLEMENTS TO AUSTROADS GUIDES
VICROADS CODE OF PRACTICE RC 500.22
- SELECTION AND DESIGN OF PAVEMENTS AND SURFACINGS
SD 1991 DRIVEABLE CULVERT ENDWALLS (TYPE 1)

vicroads
GUIDELINE DRAWING

AGRD PART 4

TYPICAL ACCESS TO RURAL PROPERTIES

NOT TO SCALE	APPROVED	GD NO.	ISSUE
	M-SSE 07/2020	GD4010	A

VicRoads Drawing No. 720453

Appendix B Certificate of title

ADVERTISED PLAN

REGISTER SEARCH STATEMENT (Title Search) Transfer of Land Act 1958

VOLUME 10828 FOLIO 937

Security no : 124099079242A
Produced 19/07/2022 08:42 PM

LAND DESCRIPTION

Lot 6 on Title Plan 434281F (formerly known as Portion 126 Parish of Yowang).
PARENT TITLE Volume 10804 Folio 701
Created by instrument AD118605K 16/09/2004

REGISTERED PROPRIETOR

Estate Fee Simple
Sole Proprietor
STANLEY CHARLES DANIELS of 18 RUABON ROAD TOORAK VIC 3142
AD187135G 19/10/2004

ENCUMBRANCES, CAVEATS AND NOTICES

ADVERTISED PLAN

CAVEAT AV173111T 21/12/2021
Caveator
BL ANAKIE SOLAR NOMINEES PTY LTD ACN: 654205517
Grounds of Claim
OPTION TO LEASE WITH THE FOLLOWING PARTIES AND DATE.
Parties
THE REGISTERED PROPRIETOR(S)
Date
10/11/2021
Estate or Interest
EXECUTORY OR CONTINGENT INTEREST
Prohibition
ABSOLUTELY
Lodged by
LAWCREST
Notices to
SAMI SARA of LEVEL 11 456 LONSDALE STREET MELBOURNE VIC 3000

Any encumbrances created by Section 98 Transfer of Land Act 1958 or Section 24 Subdivision Act 1988 and any other encumbrances shown or entered on the plan set out under DIAGRAM LOCATION below.

DIAGRAM LOCATION

SEE TP434281F FOR FURTHER DETAILS AND BOUNDARIES

ACTIVITY IN THE LAST 125 DAYS

NIL

DOCUMENT END

Security No : 124099079257J Volume 10828 Folio 937
Produced 19/07/2022 08:45 PM

ACTIVITY IN THE LAST 125 DAYS

NIL

ADMINISTRATIVE NOTICES

NIL

STATEMENT END

Imaged Document Cover Sheet

The document following this cover sheet is an imaged document supplied by LANDATA®, Secure Electronic Registries Victoria.

Document Type	**Plan**
Document Identification	**TP434281F**
Number of Pages (excluding this cover sheet)	**2**
Document Assembled	**19/07/2022 20:45**

TITLE PLAN

EDITION 2

TP434281F

Location of Land

Parish: YOWANG
Township:
Section:
Crown Allotment:
Crown Portion: 121(PT), 122(PT), 123(PT), 124(PT), 125, 126, 127

LTO Base Record: DCMB
Last Plan Reference:
Title References: V. 5049 F. 774
Depth Limitation: NIL

Notations

LOT 1 FORMS PART OF CROWN PORTION 121
LOT 2 FORMS PART OF CROWN PORTION 122
LOT 3 FORMS PART OF CROWN PORTION 123
LOT 4 FORMS PART OF CROWN PORTION 124
LOT 5 FORMS THE WHOLE OF CROWN PORTION 125
LOT 6 FORMS THE WHOLE OF CROWN PORTION 126
LOT 7 FORMS THE WHOLE OF CROWN PORTION 127

ADVERTISED PLAN

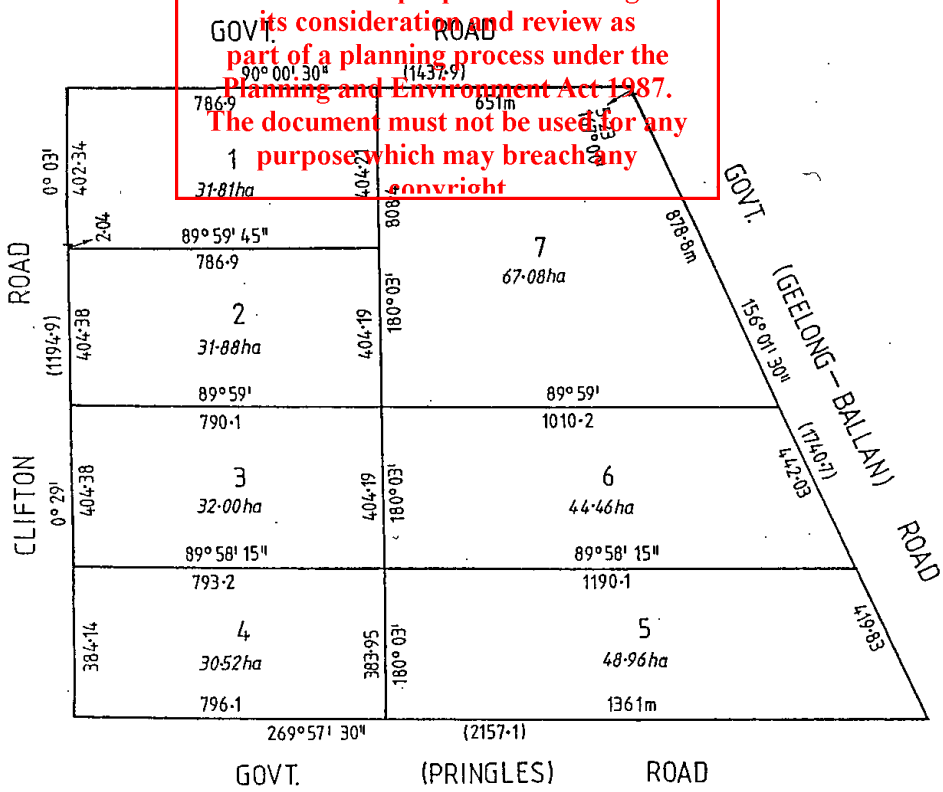
Easement Information

Easement Reference	Purpose / Authority	Width (Metres)	Origin	Land benefited / In favour of

THIS PLAN HAS BEEN PREPARED FOR LAND REGISTRY, LAND VICTORIA FOR TITLE DIAGRAM PURPOSES

Checked by .....

Date 29 / 4 / 2004
Assistant Registrar of Titles



LENGTHS ARE IN METRES	SCALE	SHEET SIZE A3	FILE NO: AC569452Y
LAND VICTORIA Melbourne	Drawn By:	DEALING CODE:	Sheet 1 of 1

MODIFICATION TABLE

RECORD OF ALL ADDITIONS OR CHANGES TO THE PLAN

WARNING: THE IMAGE OF THIS PLAN/DOCUMENT HAS BEEN DIGITALLY AMENDED.
NO FURTHER AMENDMENTS ARE TO BE MADE TO THE ORIGINAL PLAN/DOCUMENT.

PLAN NUMBER

TP 434281F

AFFECTED LAND/PARCEL	LAND/PARCEL IDENTIFIER CREATED	MODIFICATION	DEALING NUMBER	DATE	TIME	EDITION NUMBER	ASSISTANT REGISTRAR OF TITLES
		SEPARATE DIMENSIONS ADDED TO PLAN	AC569452Y	29/4/04		2	RJS

Appendix C Ecology report

Ecological Assessment

Anakie Solar Farm

October 2022

Project Number: 21-425

NSW • ACT • QLD • VIC
W. www.nghconsulting.com.au

Document verification

Project Title:	Anakie Solar Farm
Project Number:	21-425
Project File Name:	21-425 Anakie Solar Farm Detailed Ecology Assessment Final V1.1`

Revision	Date	Prepared by	Reviewed by	Approved by
Draft V 1.0	17/05/2022	D. Bambrick	Michelle Patrick	Michelle Patrick
Final V1.0	1/08/2022	Mark Cairns	Michelle Patrick	Michelle Patrick
Final V1.1	07/10/2022	D. Bambrick	Julie Gooding	Michelle Patrick

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T. (07) 3129 7633

SYDNEY REGION
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Surry Hills NSW 2010
T. (02) 8202 8333

CANBERRA - NSW SE & ACT
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(PO Box 62) Fyshwick ACT 2609
T. (02) 6280 5053

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Wagga Wagga NSW 2650
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T. (07) 3129 7633

WODONGA
Unit 2, 83 Hume Street
(PO Box 506) Wodonga VIC 3690
T. (02) 6067 2533

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W. www.nghconsulting.com.au
ABN 31 124 444 622 ACN 124 444 622

Table of contents

Figures

Tables

Appendices

Acronyms and abbreviations

Item	Definition
ASL	Above sea level
AWS	Automatic weather station
BOM	Australian Bureau of Meteorology
CaLP Act	*Catchment and Land Protection Act, 1994*
CEMP	Construction environmental management plan
Cwth	Commonwealth
CWD	Coarse Woody Debris
DELWP	Department of Environment, Land, Water and Planning
DoEE	(Cwth) Department of the Environment and Energy
DSE	Department of Sustainability and Environment
EPBC Act	(Cwth) *Environment Protection and Biodiversity Conservation Act 1999*
ESD	Ecologically Sustainable Development
EVC	Ecological Vegetation Community
FFG	*Flora and Fauna Guarantee Act, 1988*
ha	hectares
km	kilometres
m	Metres
MNES	Matters of National Environmental Significance
P&E Act	*Planning and Environment Act, 1987*
sp/spp	Species/multiple species
The guidelines	Guidelines for the removal, destruction or lopping of native vegetation
VBA	Victorian Biodiversity Atlas
VQA	Vegetation Quality Assessment

Executive Summary

BNRG Renewables Ltd and BL Anakie Solar Nominees are proposing the installation of a Sub-5 Mega Watt (MW) battery supported solar farm at 1435-1475 Ballan Road Anakie 3213 (Lot 6 TP434281).

The study area is located approximately 12 kms to the north-east of Geelong, Victoria. The study area encompasses one parcel (Lot 6 TP434281) and is located in the Greater Geelong City Local Government Area (LGA).

The study area is 44.41 ha, the development site is 11.07 ha

The zones and overlays are listed below.

- The property is completely covered by an Environmental Significance – ESO4 overlay.
- The property is completely covered by Designated Bushfire Prone Area overlay.

Under ESO4 no land and environmental management plan has been completed as a part of ecology assessment. This will be required as part of the planning permit application to meet the requirements of the Geelong Planning Scheme. However, the proposed native vegetation impacts will be offset and weed and pest animal management will occur as part of ongoing management for the development site. If approval for this project is supported the landscape plan may be able to address the requirements for this plan.

This ecological assessment addresses the planning permit application triggers under Clause 52.17 of the *Planning and Environment Act, 1987*. Under this Clause, there is a planning permit trigger for the removal, destruction or lopping of native vegetation.

A site assessment was completed on 15th December 2021 by an accredited NGH Senior Ecologist. The results of the site assessment determined 0.071 ha of EVC 55_61 Plains Grassy Woodland and one large tree was present within the Development Footprint. This native vegetation will need to be offset as per the requirements of Clause 52.17.

The following offset requirements needed in the offset strategy:

- General offset amount – 0.014 General Habitat Units
- Vicinity - Corangamite Catchment Management Authority (CMA) or Greater Geelong City Council
- Minimum strategic biodiversity value score – 0.288
- Large trees -1

If a permit is granted, a third party offset is to be secured, the next steps involves contacting Vegetation Link to enter into a purchase agreement.

There is no planning permit trigger or offset requirements for the planted trees and shrubs in the Development Footprint.

The threatened entities assessment included the study area and determined the following:

- *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)* Grassy Eucalypt Woodland in Victorian Volcanic Plains is present in the study area.
- The *Flora and Fauna Guarantee Act, 1988 (FFG Act)* listed vegetation community Western Basalt Plains (River Red Gum) Grassy Woodland is present on site.
- All FFG and EPBC listed flora species were determined to have a low likelihood to occur on site. The proposed development footprint will have minimal impact of threatened flora.

- Golden Sun Moth (*Synemon plana*) listed as Vulnerable under the *FFG Act* and Critically Endangered *EPBC Act has a* low-moderate likelihood of occurring on site. However, steps have been undertaken to avoid and minimise impacts to this species and the proposed native vegetation removal will have a negligible impact on these species.
- A habitat assessment for Striped Legless Lizard and Pink-tailed Worm Lizard was undertaken. The results of the survey results determined these species have a low likelihood of occurring on site.
- All other listed FFG and EPBC fauna species has a low likelihood of occurring on site.
- No further targeted survey will be required.

Any impact to EPBC Grassy Eucalypt Woodland in Victorian Volcanic Plains may require a EPBC referral. No areas of EPBC Grassy Eucalypt Woodland occur within the Development Footprint therefore there will be no requirement for an EPBC referral.

1. Introduction

NGH Pty Ltd has been engaged by BNRG Renewables Ltd and BL Anakie Solar Nominees to undertake an ecological assessment for the proposed solar farm at 1435-1475 Ballan Road Anakie 3213 (Lot 6 TP434281) installation of a Sub-5 Mega Watt (MW) battery supported solar farm. This ecological assessment will form part of the Appendix of the planning report.

The purpose of this ecological assessment includes addressing the following information:

- Undertake a desktop search of threatened species and communities listed under the *Flora and Fauna Guarantee Act, 1988 (FFG)* and the *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC)*
- Undertake a desktop assessment of the EVC modelling and aerial imagery to determine if there is any native vegetation within the defined Study Area.
- Determine any legislative requirements based on the assessments results background search results and EVC determination.
- Determine if any planning permit requirements are triggered under the *Planning and Environment Act, 1987* under Clause 52.17 – native vegetation.
- Undertake a site assessment to determine the extent of native vegetation and complete a habitat hectares assessment.
- Summarise findings in an Ecological Report including areas of native vegetation that will be impacted in the Development Footprint.
- Determine any offset requirements.

1.1 Locality

The study area is located approximately 12 kms to the north-east of Geelong, Victoria. The study area encompasses one parcel (Lot 6 TP434281) and is located in the Greater Geelong City Local Government Area (LGA).

The property is located directly west of Ballan Road and contains a rural dwelling. The study area is located in a rural landscape and it utilised for agricultural production.

The surrounding properties are small rural blocks with a mix of grazing and cropping. There are poultry farms to the north. The locality and landscape is suitable for a solar farm due to road access, minimal native vegetation impacts and located in a regional landscape that does not have a high number of dwellings and located in an area on a site with low visibility.

Figure 1-1 shows the study area.

1.1.1 Bioregion

Bioregions are determined by climate, geomorphology, soils and vegetation to classify the environment at a landscape scale (DELWP, 2021). Victoria has 28 bioregions.

The study area is located in the Victorian Volcanic Plain (VVP) Bioregion (DELWP, 2021). The geology in this bioregion is detailed by DELWP, 2021 as '*dominated by Cainozoic volcanic deposits',* these deposits form '*an extensive flat to undulating basaltic plain with stony rises, old lava flows,*

numerous volcanic cones and old eruption points…dotted with shallow lakes both salt and freshwater.'

(DELWP, 2021) define the soils in this bioregion as typically '*reddish-brown to black loams and clays, fertile, high in available phosphorous with dark saline around lake margins. Soil and vegetation types vary across the bioregion:*

- *Red friable earth and acidic texture contrast (ferrosols and Kurosols) on higher fertile plains supporting plains grassy woodland and grassland ecosystems.*
- *Calcareous sodic texture contrast soils grading to yellow acidic earths (chromosols and sodosols to dermosols) on intermediate rises supporting knoll shrublands, plains grassy woodland and plains grassy wetland ecosystems.*
- *Volcanic outcropping on story rises with stony earths (dermosols and tenosols) supporting foothill forest ecosystems. '*

1.1.2 Native vegetation in the locality

The main Ecological Vegetation Classes in the VVP Bioregion in this location are EVC 132 Plains Grassland and EVC 55 Plains Grassy Woodland. Both of these EVCs have been extensively cleared for agriculture. These two EVCs are highly fragmented and scattered from Geelong to western Victoria. Remnant patches can be found on road reserves and private land. The nearest reserves from the study area are the Brisbane Ranges National Park, You Yangs Regional Park and two smaller reserves at Bannockburn and Serendip Sanctuary.

The native vegetation on site is a representation of EVC 55 in a modified state, where scattered Eucalypts remain and a mix of native and exotic grassy understorey is present. The road reserve and the area selected for the proposed Solar Farm cover mainly exotic vegetation. There are planted rows of trees that include Australian native and exotic trees.

1.1.3 Waterways and wetlands

There are no ephemeral drainage lines/gullies or wetlands located within or flowing through the study area.

A range of wetland formations occur in the VVP bioregion including salt marshes, permanent and intermittent freshwater and saline/brackish lakes, permanent freshwater ponds and marshes and inland subterranean karst wetlands. River, creek and drainage systems occur throughout the region with an annual rainfall of 450-840mm.

1.2 Development proposal

The proposed solar farm is located in the northern part of Lot 6 TP434281.

This ecological assessment addresses the planning permit application, which is an application for the removal, destruction or lopping of native vegetation in Lot 6 TP434281.

The property boundary of Lot 6 TP434281 is study area for the proposed development. The study area is 44.41 ha, the Development Footprint is 11.07 ha. The aerial imagery shows planted vegetation in rows and scattered across the study area.

1.2.1 Site selection

The site assessment in December 2021 mapped and recorded native vegetation across the study area. The results of the vegetation present on the site followed the three-step approach to avoid and minimise impacts on native vegetation as much as possible within the study area. The following was determined:

- The solar farm layout was located in areas dominated by exotic vegetation
- Areas covered by native grasses were divided between two separate habitat zones based on percentage cover as follows:
    - 25-50% native grass cover. These areas qualify as the FFG listed community *Western Basalt Plains (River Red Gum) Grassy Woodland* in the form of EVC 55_61 (Habitat zone 1). Habitat Zone 1a-1k is highly modified with evidence of pasture improvement and continuous grazing. The shrub and Eucalypt layer is largely absent.
    - >50% cover where the grass cover qualifies as EPBC Act listed *Grassy Eucalypt Woodland of the Victorian Volcanic Plain* which includes Habitat Zones 2a-2d
- Further considerations included habitat assessment for Golden Sun Moth
- The road reserve is dominated by exotic vegetation and there are no impacts to native vegetation to connect the proposed Solar Farm to the existing grid connection. This connection also allows access to meet CFA requirements without impacting native vegetation.
- The internal fence design and layout has been considered as part of the native vegetation impact assessment.

The native vegetation impacts have been minimised to 0.071 hectares. This native vegetation has been offset.

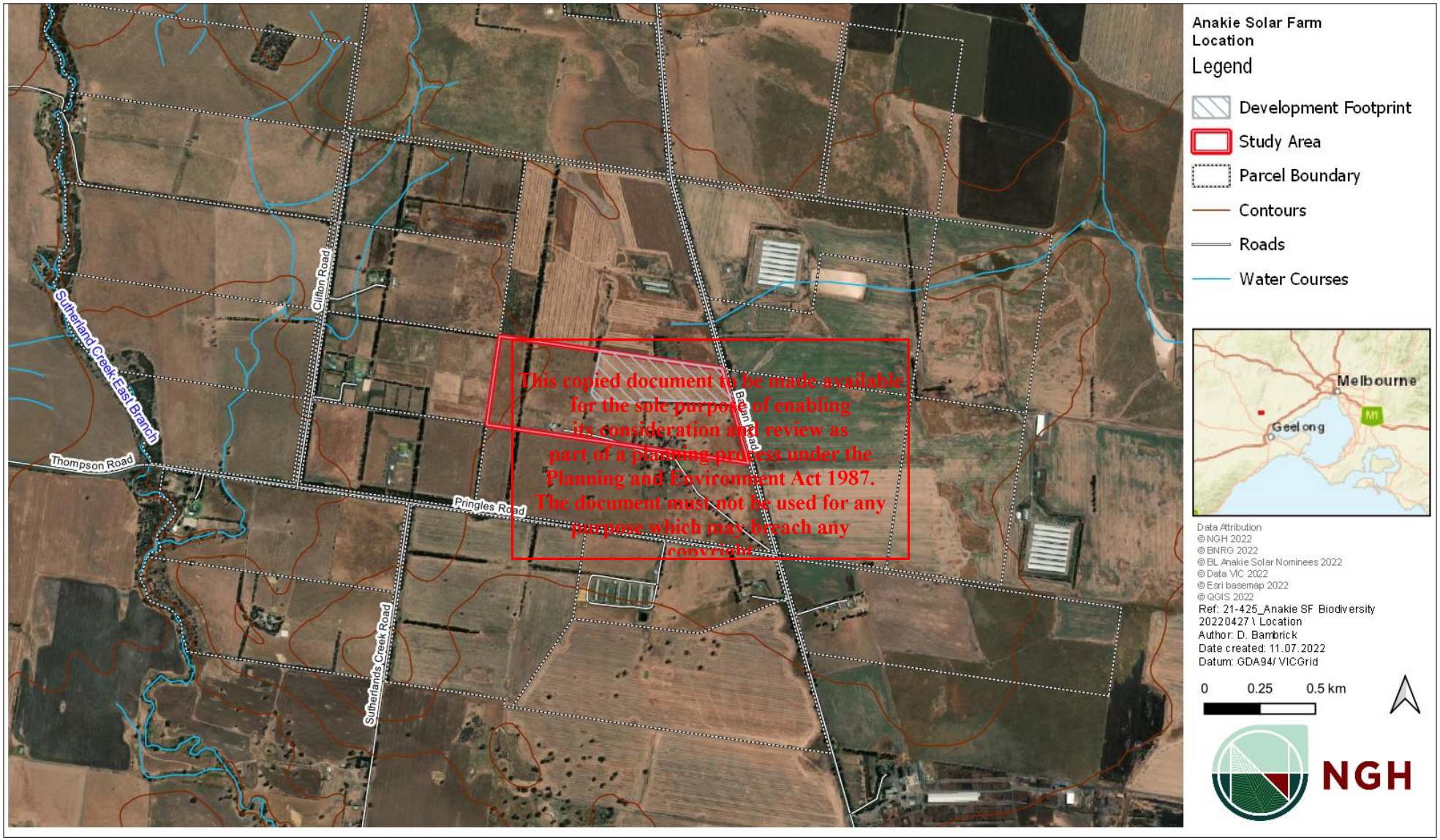

Figure 1-1 Location Map

2. Legislative Requirements

This section details the legislative requirements in relation to the assessment of the proposal. Table 2-1 details the legislation and the section of the report that addresses the legislation.

Table 2-1 Legislation requirements for the assessment of the proposal

Legislation	Requirements	Section of this Report
Commonwealth Environment Protection and Biodiversity Conservation Act, 1999 (EPBC)	Matters of National Environmental Significance for threatened entities and RAMSAR wetlands	Section 5.5
Victorian Planning and Environment Act, 1987 (P&E)	Municipal Planning Schemes including Planning Zones and Overlays Clause 52.17 – Native Vegetation	Section 2.2
Victorian Flora and Fauna Guarantee Amendment Act, 2019 (formerly Flora and Fauna Guarantee Act 1988) (FFGA)	Listed threatened species and communities, provision of Habitat Conservation Orders for critical habitat associated with list species/communities, and management of listed threatening processes.	Section 2.3
Victorian Wildlife Act 1975	Protection of native fauna	Section 2.4
Victorian Catchment and Land Protection Act 1994 (CaLP Act)	Declared noxious weeds and pest species	Section 2.5

2.1 Legislation

2.2 Planning and Environment Act, 1987

The *Planning and Environment Act* (P&E Act) was introduced in 1987. The purpose of this act is to establish a framework for planning the use, development, and protection of land in Victoria in the present and long-term interests of all Victorians. Each municipality has a Local Planning Scheme setting out policies and clauses specific to zones and overlays that relate to an area or parcel of land. The study area is in the Greater Geelong City Planning Scheme.

The zones and overlays are listed below.

- The property is completely covered by an Environmental Significance – ESO4 overlay.
- The property is completely covered by Designated Bushfire Prone Area overlay.

Other relevant overlays include a Heritage – HO overlay directly south of Lot 6 TP434281 in the adjacent lot.

2.2.1 Native vegetation assessment pathway

The Development Footprint is located in assessment pathway Locations 1. The native vegetation guidelines (DELWP 2017) identify assessment pathways as basic, intermediate, and detailed and these are divided into three location categories across the state of Victoria. These assessment pathways are determined to reduce overall impacts to Victoria's biodiversity. Table 3 (p. 19 of the guidelines; DELWP 2017) shows the assessment pathway and location category thresholds below. Less than 0.5 hectares is proposed to be removed alongside one large tree; therefore an intermediate assessment is required.

Table 2-2 Planning permit thresholds for native vegetation removal (Source: Table 3 from the Guidelines; DELWP 2017)

Extent of native vegetation	Location category		
	Location 1	Location 2	Location 3
Less than 0.5 hectares and not including any large trees	Basic	Intermediate	Detailed
Less than 0.5 hectares and including one or more large trees	Intermediate	Intermediate	Detailed
0.5 hectares or more	Detailed	Detailed	Detailed

2.2.2 Requirements of Clause 52.17

The requirements to remove native vegetation in Victoria must consider the following criteria in Table 2-3.

These criteria are addressed in Section 5.

Table 2-3 Planning permit requirements for native vegetation removal.

Criteria
Has the assessment pathway and reason for the assessment pathway been determined? Has the location category of the native vegetation proposed to be removed identified?
A description of the native vegetation to be removed
Maps showing the native vegetation
The offset requirement determined in accordance with section 5 of the Guidelines.
Topographic and land information relating to the native vegetation to be removed, showing ridges, crests and hilltops, wetlands and waterways, slopes of more than 20 percent, drainage lines, low lying areas, saline discharge areas, and areas of existing erosion, as appropriate.
Recent, dated photographs of the native vegetation.
Details of any other native vegetation approved to be removed, or that was removed without the required approvals, on the same property or on contiguous land in the same ownership as the applicant, in the five year period before the application for a permit is lodged.
An avoid and minimise statement. The statement describes any efforts to avoid the removal of and minimise the impacts on the biodiversity and other values of native vegetation, and how these efforts focussed on areas of native vegetation that have the most value.

Criteria
A copy of any Property Vegetation Plan contained within an agreement made pursuant to section 69 of the *Conservation, Forests and Lands Act 1987* that applies to the native vegetation to be removed
Where the removal of native vegetation is to create defendable space, a written statement explaining why the removal of native vegetation is necessary. This is not required when the creation of defendable space is in conjunction with an application under the Bushfire Management Overlay.
If the application is under Clause 52.16, a statement that explains how the proposal responds to the Native Vegetation Precinct Plan considerations at decision guideline 6.
An offset statement explaining that an offset that meets the offset requirements for the native vegetation to be removed has been identified and how it will be secured.
A site assessment report of the native vegetation to be removed, completed by an accredited native vegetation assessor.
Information about impacts on rare or threatened species habitat.

2.2.3 Zoning

The study area is in Farming (FZ) zone. The purpose of this Zone is to:

- To implement the Municipal Planning Strategy and the Planning Policy Framework.
- To provide for the use of land for agriculture.
- To encourage the retention of productive agricultural land.
- To ensure that non-agricultural uses, including dwellings, do not adversely affect the use of land for agriculture.
- To encourage the retention of employment and population to support rural communities.
- To encourage use and development of land based on comprehensive and sustainable land management practices and infrastructure provision.
- To provide for the use and development of land for the specific purposes identified in a schedule to this zone.

A planning report will be submitted to the Department of Environment, Land Water and Planning (DELWP) which will address the objectives of this zone and this ecology assessment does not need to address any permit triggers for this zone.

2.2.4 Environmental Significance Overlay (ESO4)

The Environmental Significance Overlay (ESO4) relates to the Grasslands within the Werribee Plains Hinterland.

The purpose of this overlay is to:

- To prevent a decline in the extent and quality of native vegetation and native fauna habitat of the Victorian Volcanic Plain.
- To enhance the environmental and landscape values of the area.
- To avoid the fragmentation of contiguous areas of native vegetation or native fauna habitat.
- To ensure that any use, development or management of the land is compatible with the long-term conservation, maintenance and enhancement of the grasslands.
- To avoid the destruction of habitat for native fauna resulting from the modification of landform and disturbance of surface soils and rocks.

- To enable areas of environmental significance, due to their native vegetation or habitat values, to be identified.

An application must be accompanied by:

- A description of any proposed disturbance of surface soil or rocks associated with the proposal.
- The total extent of vegetation on the property and the extent of native vegetation proposed to be removed, lopped or destroyed.
- A description of the steps that have been taken to avoid and minimise the removal of native vegetation including the practicality of alternative options which do not require removal of the native vegetation.

An application must also be accompanied by, as appropriate:

- A flora and fauna assessment of the land prepared by a suitably qualified and experienced person to the satisfaction of the responsible authority. The assessment must include:
  - A flora and fauna survey.
  - A habitat hectare assessment.
  - Identification of the vegetation and habitat significance of the property.
  - A description ~~of the effect of the proposed development~~ in relation to other areas of native vegetation or native fauna habitat, including any proposed conservation reserves, streams and waterways.
- A land and environmental management plan prepared by a suitably qualified person identifying, as appropriate:
  - Any proposals for revegetation, including proposed species, and ground stabilisation.
  - How any vegetation removal will be offset (an offset plan), in accordance with Victoria's Native Vegetation Management: A Framework For Action (Department of Natural Resources and Environment 2002).
  - Weed management, including species to be targeted and proposed management techniques.
  - Pest animal management, including species to be targeted and proposed management techniques.

A Flora and Fauna assessment has been completed for development site. There is native vegetation on the property and the offset calculation provided aims to meet the requirements of the Planning and Environment Act 1987 and this also meets the first part of this application requirement.

No land and environmental management plan has been completed as a part of ecology assessment. This will be required as part of the planning permit application to meet the requirements of the Greater Geelong Planning Scheme. However, the proposed native vegetation impacts will be offset and weed and pest animal management will occur as part of ongoing management for the development site. If approval for this project is supported the landscape plan may be able to address the requirements for this plan including the following:

- *Revegetation, including proposed species, and ground stabilisation.*
- *Weed management, including species to be targeted and proposed management techniques.*

- *Pest animal management, including species to be targeted and proposed management techniques.*

2.2.5 Bushfire Prone Area

The assessment and requirements for development in a bushfire prone area will discussed in other specialist reports and are not assessed as part of this ecology report.

2.3 *Flora and Fauna Guarantee Act 1988*

The flora and fauna conservation and management objectives of the *Flora and Fauna Guarantee Act 1988* (FFG) are:

a) to guarantee that all taxa of Victoria's flora and fauna, other than taxa specified in the excluded list, can persist, and improve in the wild and retain their capacity to adapt to environmental changes; and

b) to prevent taxa and communities of flora and fauna from becoming threatened and to recover threatened taxa and communities so their conservation status improves; and

c) to protect, conserve, restore and enhance biodiversity, including -

   a. flora and fauna and their habitats; and

   b. genetic diversity; and

   c. ecological communities; and

   d. ecological processes; and

d) to identify and mitigate the impacts of potentially threatening processes to address the important underlying causes of biodiversity decline; and

e) to ensure the use of biodiversity as a natural resource is ecologically sustainable; and

f) to identify and conserve areas of Victoria in respect of which critical habitat determinations are made.

An FFG listed vegetation community occurs on site. The FFG community is the Grassy Eucalypt Woodland of the Victorian Volcanic Plain. Threatened entities are discussed further in Section 5.

2.4 *Wildlife Act 1975*

Under the *Wildlife Act 1975* all native wildlife is protected in Victoria. It is an offence to kill, take, control or harm wildlife under the Wildlife Act 1975. It is also an offence to use poisons to kill, destroy or take wildlife. Severe penalties (including imprisonment and fines) apply to those found guilty of an offence under the Wildlife Act.

It is unlikely a wildlife permit will be required. If the proposal is approved the impact will be on wildlife habitat and not wildlife. If any wildlife is located within the habitat proposed for clearing; fauna salvage and relocation of such wildlife may be required as part of the planning permit. Any handling of wildlife must be undertaken by qualified wildlife handlers to ensure no wildlife are injured as a result of the proposed works.

2.5 *Catchment and Land Protection Act, 1994*

Under the *Catchment and Land Protection Act, 1994* (CaLP Act), control of declared noxious weeds and pest animals will be ongoing management requirement prior, during and post construction. Weed and pest animal management should consider best practice methods.

A weed management plan should consider any new and emerging weeds and any necessary prevention methods.

The weeds and pest animals recorded during the site assessment are addressed in Section 5.4.

2.6 Declared noxious weeds

In Victoria, the CaLP Act separates noxious weeds into four categories (Agriculture Victoria, 2020). The CaLP Act defines four categories of noxious weeds as:

- State Prohibited Weeds.
- Regionally Prohibited Weeds.
- Regionally Controlled Weeds.
- Restricted Weeds.

2.6.1 State prohibited weeds

State Prohibited Weeds may not occur in Victoria or any known infestations are very small. The Victorian Government is responsible for eradicating State Prohibited Weeds and all known infestations should be eradicated. These weeds are considered a significant threat if introduced (Agriculture Victoria, 2020).

2.6.2 Regionally prohibited weeds

Regionally prohibited weeds are capable of spreading across a region and the aim should be to eradicate them. Regionally prohibited weeds are not widely distributed so landowners must take all reasonable steps to eradicate these weeds to prevent them spreading further. Landowners (including public authorities) are responsible for the eradication of these weeds on their land (Agriculture Victoria, 2020).

2.6.3 Regionally controlled weeds

These regionally controlled weeds are usually widespread and highly invasive. Landowners need to take all reasonable steps to prevent the growth and spread of regionally controlled weeds on their land (Agriculture Victoria, 2020).

2.6.4 Restricted weeds

Restricted weeds cannot be traded, and this includes plants, seeds or propagules or contaminants. Restricted weeds are at risk of spreading within Victoria or other States or Territories of Australia. It is a landowner's responsibility to prevent the spread of these weeds (Agriculture Victoria, 2020).

3. Purpose of this assessment

The proposal must meet the requirements under Clause 52.17 – Native Vegetation under the P&E Act. This ecological assessment addresses the native vegetation requirements and threatened entities under this Clause.

3.1 Assessment pathway for proposal

As outlined in Section 2.2.1 the Development Footprint is located in assessment pathway Location 1 and Location 2. The assessment pathway was determined to be detailed due to:

- < 0.5 hectares and 1 large tree

A detailed assessment was undertaken that included a habitat hectares assessment by an accredited assessor (VQA).

The risk assessment pathway is shown in Figure 3-1.

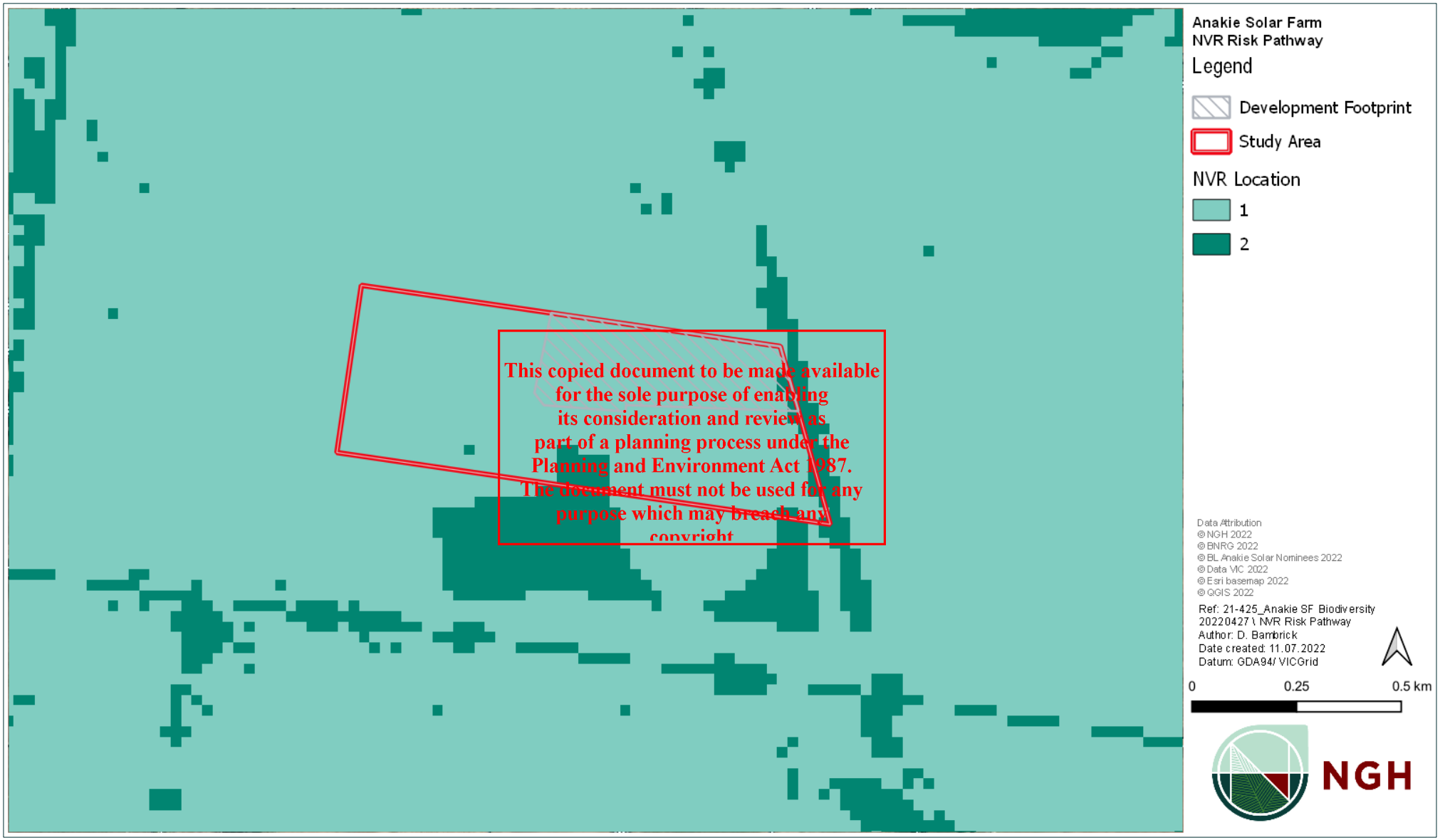

Figure 3-1. Risk Assessment Pathway

4. Methods

4.1 Desktop searches

The background searches included:

- A desktop search for threatened species using the Victorian Biodiversity Atlas (VBA). The VBA search included the study area and a buffer area of 5 km.
- An assessment of the threatened communities (FFG listed)
- A Matters of National Significance (MNES) desktop search with a 10 km buffer for nationally threatened flora, fauna and vegetation communities.

4.1.1 Assessment of threatened species and vegetation communities

Based on the background search results, the likelihood of occurrence (Table 4-1) is a broad way to categorise the likelihood of threatened flora and fauna presence based on the MNES results, VBA records and habitat features observed on site.

Table 4-1 Likelihood of threatened species being observed on site.

Likelihood of Occurrence	Reasoning
Low	Considered unlikely to occur due to older records, unsuitable or degraded habitat.
Moderate	Potential habitat occurs on site. Low record numbers or species not recorded in the area for many years. Considered that the species may occur infrequently.
High	Important habitat occurs onsite (i.e., nesting sites, suitable habitat).
Recorded	Recorded on site previously or observed on site during assessment.

4.2 Site assessment

The site assessment was completed by a NGH Senior Accredited Ecologist, on 15th December 2021. An additional site assessment was completed by a NGH Senior Ecologist on the 14th – 15th June 2022 to conduct a habitat assessment of the EPBC Act listed Ecological Communities for the Golden Sun Moth (*Synemon plana*), Pink-tailed Worm Lizard (*Aprasia parapulchella*), and Striped Legless Lizard (*Delma impar*). The site assessment method and results are outlined in the following sections.

The weather and climate statistics recorded from the Sheoaks weather station (Station number 087168), around 5km from the survey site, for the date of the survey are detailed in Figure 4-1.

Sheoaks, Victoria
December 2021 Daily Weather Observations

Date	Day	Temps Min °C	Temps Max °C	Rain mm	Evap mm	Sun hours	Max wind gust Dir	Max wind gust Spd km/h	Max wind gust Time local	9 am Temp °C	9 am RH %	9 am Cld 8th	9 am Dir	9 am Spd km/h	9 am MSLP hPa	3 pm Temp °C	3 pm RH %	3 pm Cld 8th	3 pm Dir	3 pm Spd km/h	3 pm MSLP hPa
15	We	11.9	18.1	0			ESE	19	15:55	13.6	93		SSE	4	1013.8	16.6	74		ESE	11	1014.5

Sheoaks, Victoria
June 2022 Daily Weather Observations

Date	Day	Temps Min °C	Temps Max °C	Rain mm	Evap mm	Sun hours	Max wind gust Dir	Max wind gust Spd km/h	Max wind gust Time local	9 am Temp °C	9 am RH %	9 am Cld 8th	9 am Dir	9 am Spd km/h	9 am MSLP hPa	3 pm Temp °C	3 pm RH %	3 pm Cld 8th	3 pm Dir	3 pm Spd km/h	3 pm MSLP hPa
14	Tu	4.0	11.7	0			NNW	65	23:45	5.7	96		N	2	1021.9	10.0	67		N	17	1018.0
15	We	5.7	12.5	0			NNW	70	00:01	9.6	73		N	30	1012.0	11.2	77		NNW	24	1010.1

Figure 4-1 Weather and climate data site assessment

4.2.1 Flora

The flora survey was completed on foot. The flora survey includes using the random meander method as well as the habitat hectares methodology. The entire study area was assessed (as required under Clause 52.17 – Native Vegetation), to determine patches of native vegetation, scattered trees and any revegetation areas.

Further information about the native vegetation assessment methods is included in each section below.

Native vegetation assessment

The native vegetation assessment was undertaken based on the Guidelines of Clause 52.17 of the P&E Act for the removal, destruction or lopping, of native vegetation, (DELWP, 2017). The guidelines state native vegetation is assessed to ensure it meets the following criteria:

- An area of vegetation where at least 25 per cent of the total perennial understorey plant cover is native; or
- Any area with three or more native canopy trees where the drip line of each tree touches the drip line of at least one other tree, forming a continuous canopy; or
- Any mapped wetland included in the current wetlands map, available in Department of Environment, Land, Water and Planning (DELWP) systems and tools.

During the site assessment, the habitat hectare method was applied to any native vegetation patch determined to have greater than 25% perennial ground cover.

Results of the assessment are described in Section 5.

Scattered and large trees within a habitat zone

Based upon the criteria in the guidelines (DELWP, 2017), a scattered tree is defined as a tree that is indigenous to the area which is:

- A native canopy tree (large or small in size) that does not form part of a patch; or

- A large, scattered tree that is greater than or equal to the diameter at breast height (DBH) as determined by the EVC benchmark.

All large trees within a habitat zone were recorded where the tree was greater than the EVC benchmark DBH. All stags (dead canopy trees) were recorded if they were greater than 40 cm DBH. Within the habitat zone, only tree stags that are greater than the EVC benchmark DBH are recorded.

For each scattered tree, large tree or stag the following information was recorded:

- Plant species identified (including scientific and common name).
- Location recorded using a handheld GPS.
- DBH measured and recorded.
- Tree health.
- Presence of habitat features such as hollows or nests.

4.2.2 Ecological Vegetation Classes (EVC)

The vegetation communities found in the Victorian Volcanic Plain Bioregion are termed Ecological Vegetation Classes (EVCs). These EVCs were mapped by the Victorian Government based on landscape attributes to determine the pre-European native vegetation extent (DSE, 2004). Each Bioregion consists of a number of EVCs. Each EVC has pre-determined benchmarks which are used in the habitat hectare assessment to determine the site condition score.

The Ecological Vegetation Classes identified in the study area are in Section 5.1.1.

4.2.3 EVC Conservation Status

Each EVC has a Bioregional Conservation Status based on the extent cleared or remaining since European settlement. Table 4-2 lists the criteria for the conservation status for Ecological Vegetation Classes (DELWP, 2021).

The conservation status for each EVC found onsite is listed in Section 4.2.3.

Table 4-2 Criteria for the conservation status for Ecological Vegetation Classes (DELWP, 2021)

Category	Status Code	Criteria
Presumed Extinct	X	Probably no longer present in the bioregion (the accuracy of this assumption is limited by the use of remotely - sensed 1:100 000 scale woody vegetation cover mapping to determine depletion - grassland, open woodland and wetland types are particularly affected).
Endangered	E	Contracted to less than 10% of former range; OR Less than 10% pre-European extent remains; OR Combination of depletion, degradation, current threats and rarity is comparable overall to the above: • 10 to 30% pre-European extent remains and severely degraded over a majority of this area; or

Category	Status Code	Criteria
		• naturally restricted EVC reduced to 30% or less of former range and moderately degraded over a majority of this area; or • rare EVC cleared and/or moderately degraded over a majority of former area.
Vulnerable	V	10 to 30% pre-European extent remains; OR Combination of depletion, degradation, current threats and rarity is comparable overall to the above: • greater than 30% and up to 50% pre-European extent remains and moderately degraded over a majority of this area; or • greater than 50% pre-European extent remains and severely degraded over a majority of this area; or • naturally restricted EVC where greater than 30% pre-European extent remains and moderately degraded over a majority of this area; or • rare EVC cleared and/or moderately degraded over a minority of former area.
Depleted	D	Greater than 30% and up to 50% pre-European extent remains; OR Combination of depletion, degradation and current threats is comparable overall to the above; and: • greater than 50% pre-European extent remains • and moderately degraded over a majority of this area.
Rare	R	Rare EVC (as defined by geographic occurrence) but neither depleted, degraded nor currently threatened to an extent that would qualify as Endangered, Vulnerable or Depleted.
Least Concern	LC	Greater than 50% pre-European extent remains and subject too little to no degradation over a majority of this area.

4.2.4 Habitat hectares methodology

The habitat hectare methodology compares the EVC benchmark with site attributes and landscape components to determine the vegetation site condition (DELWP, 2017b).

Each area defined as native vegetation, where the perennial ground cover is more than 25% or three or more canopy trees driplines touch forming a canopy, a habitat hectares assessment is required to be undertaken. These areas are defined as habitat zones and are identified throughout the study area. The habitat zones are divided by similarities in their habitat components and vegetation condition.

The habitat hectares results are included in Section 5.1.3.

4.3 Fauna

During the initial site assessment, incidental fauna observations were recorded. These observations included habitat features observed on site such hollows, logs and rocky areas as well fauna activity

such as sightings, scats, burrows, and warrens. No targeted surveys were undertaken as a part of this ecological assessment. Pest animal activity or sightings were included in this assessment.

During the additional second site assessment specific habitat requirements for three threatened species were assessed with any other fauna observations recorded. Details to specific habitat requirement assessment is outlined in further detail in section 4.3.1.

4.3.1 Threatened Fauna Habitat Assessment

A additional survey for threatened fauna habitat was undertaken to assess the extent of specific habitat within the project area. This assessment provides the basis to the need to undertake any additional targeted fauna surveys. Habitat requirements for each species are outlined below in Table 4-3.

Table 4-3 Threatened fauna habitat assessment requirements.

Species	Preferred habitat requirements
Pink-tailed Worm Lizard	Assessment focus on location of preferred habitat requirements included: • Areas containing native grasses dominated by Kangaroo Grass *Themeda australis* • areas preferred native grasses interspersed/intersected by rocky outcropping and/or scattered patches of partially embedded rocks
Striped Legless Lizard	Assessment focus on the location of preferred habitat requirements included: • Areas that are dominated by tussock forming native grasses • Areas that contain some surface rock that may be partially embedded • Areas of soil type that provide cracking soil refugia
Golden Sun Moth	Assessment focus on the location of preferred habitat requirements included: • Areas containing high proportion of tussock forming Wallaby Grass *Rytidosperma sp.*, Speargrass *Austrostipa sp.,* Kangaroo Grass *Themeda australis*, or secondary exotic tussock forming Chilean Needle Grass *Nasella neesiana.* • Areas with tussock forming grasses with a distinct existing inter tussock spacing.

4.4 Mapping

Assessment features were mapped on site using a Samsung Android Geographic Information System (GIS) device through use of 'QField' a GIS collection program. ESRI aerial imagery base map was utilised for the field assessment. All data layers were sourced from the layers publicly available from the Victorian Government or provided from the client. Mapping accuracy is within 3 metres. All layers collected were georeferenced to Geographic Datum of Australia (GDA) 94 VICGrid.

5. Results

The results of the site assessment are summarised below.

5.1 Flora

5.1.1 Ecological Vegetation Classes (EVCs) on site

The EVC on site was EVC 55_61 Plains Grassy Woodland. The description of this EVC in the Victorian Volcanic Plain bioregion is described by (DSE, 2004) as *'An open, eucalypt woodland to 15 m tall. Occupies poorly drained, fertile soils on flat or gently undulating plains at low elevations. The understorey consists of a few sparse shrubs over a species-rich grassy and herbaceous ground layer. This variant occupies areas receiving approximately 500 – 700 mm annual rainfall.'*

Habitat Zone 1a-1k

This habitat zone is comprised of several small areas (HZ1a-HZ1k) of EVC 55_61 Plains Grassy Woodland covering 5.27 ha within the study area. These habitat zones are recolonising native grasses interspersed with exotic pasture grasses. The native grass cover within this zone was between 25-50%. There is an absence of trees, shrubs, recruitment, and logs.

The zone was dominated by Wallaby Grasses (*Rytidosperma sp.*), Speargrass (*Austrostipa sp*.), Dock (*Rumex sp.*), Windmill Grass (*Chloris truncata*), Stonecrop (*Crassula sieberiana*), Wood Sorrel (*Oxalis perennans*). Exotic species identified within this zone included – Clover (**Trifolium repens*.), Rat Tail Fescue (**Vulpia sp.*), Ryegrass (**Lolium perenne.*), Catsear (**Hypochaeris radicata*), Barley Grass (**Hordeum marinum*), Cocksfoot (**Dactylis glomerata*), Sow thistle (**Sonchus oleraceus*) and Giant Brome (**Bromus diandrus*).

Figure 5-1. EVC 55_61 Plains Grassy Woodland.

Habitat 2a-2d

This habitat zone is comprised of three areas (HZ2a – HZ2d) of EVC 55_61 Plains Grassy Woodland covering 13.5 ha. These habitat zones are native grasses interspersed with exotic pasture grasses. The native grass cover within this zone was >50%. There were 2 River Red Gums (*Eucalyptus camaldulensis*), some stags and large logs scattered throughout these areas. There was absence of recruitment and shrubs.

The native grasses and herbs included Wallaby Grasses (*Rytidosperma sp.*), Speargrass (*Austrostipa sp*.), Dock (*Rumex sp.*), Windmill Grass (*Chloris truncata*), Stonecrop (*Crassula sieberiana*), Wood Sorrel (*Oxalis perennans*), Kidney Weed (*Dichondra repens*) and Common Everlasting (*Chrysocephalum apiculatum*). Exotic species identified within this zone included – Clover (**Trifolium repens*.), Rat Tail Fescue (**Vulpia sp.*), Ryegrass (**Lolium perenne.*), Catsear (**Hypochaeris radicata*), Barley Grass (**Hordeum marinum*), Cocksfoot (**Dactylis glomerata*), Sow thistle (**Sonchus oleraceus*) and Giant Brome (**Bromus diandrus*).

Figure 5-2. EVC 55_61 Plains Grassy Woodland.

A flora species list from the site assessment can be found in Appendix A.

5.1.2 Large scattered trees

One large scattered tree is located within the Development Footprint. The large tree is a stag (dead tree) with a DBH of 129cm. The large tree is hollow bearing containing 1 large, 1 medium and 1 small hollow. The large tree would be impacted by the proposed works and therefore, requires an offset.

There were several scattered trees across the study area. However, through detailed design these were avoided by the proposal Solar Farm.

Figure 5-3. Large tree stag in Development Footprint.

5.1.3 Habitat hectare results

Table 5-1 presents the habitat hectare results for habitat zone 1 and 2.

Table 5-1 Habitat hectare scores for habitat zones 1 and 2.

Habitat Components	Score	Habitat Zone 1a-1k	Habitat Zone 2a-2d
Site Condition Score			
EVC		**55_61**	**55_61**
Large Trees	**10**	0	0
Tree Canopy Cover	**5**	0	0
Understorey	**25**	5	5
Lack of Weeds	**15**	6	9
Recruitment	**10**	0	0
Organic Litter	**5**	3	3
Logs	**5**	0	5
Standardiser	**1**	1	1
Site Condition Score Total		14	22
Landscape Context Score			
Patch Size	**10**	1	1
Neighbourhood	**10**	0	0
Distance to Core Area	**5**	1	1
Final Habitat Score		16	24
Percentile Score		0.16	0.24
Area (hectares) Study Area		**5.27**	**13.5**
Area (ha) Development Footprint		**0.001**	**0.00**

5.1.4 Planted Vegetation

Planted vegetation was identified to the across the study area. The planted vegetation was Sugar Gum (*Eucalyptus cladocalyx*), Radiata Pine (*Pinus Radiata*), Peppercorn (*Schinus molle*), Spotted Gum (*Corymbia maculata*) and mixed native and exotic shelter belts between the dwelling and the historic shearing shed.

The Spotted Gum (*Corymbia maculata*) is planted on boundary of Ballan-Geelong Road (inside the fence boundary). A section of this will be impacted for the entrance to the proposed Solar Farm, however no offset is required for this vegetation removal.

The remaining planted vegetation will not be impacted by the proposed Solar Farm and therefore, do not require offset.

The planted vegetation is shown in Figure 5-4.

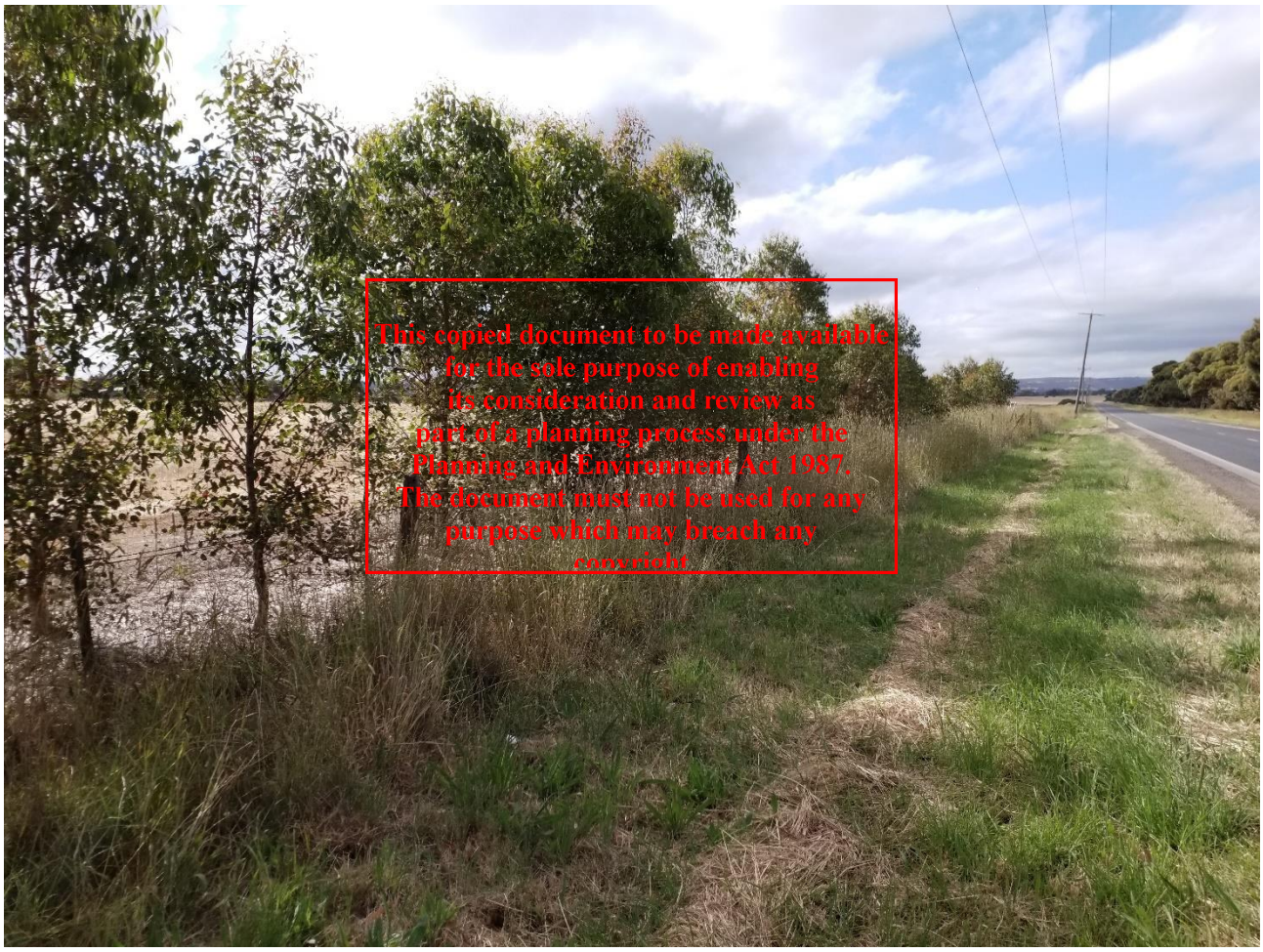

Figure 5-4. Planted Eucalypts on boundary of Geelong Ballan Road.

5.1.5 Exotic pasture grasses

Majority of the Development Footprint was comprised of exotic vegetation, where the existing Development Footprint has been utilised for grazing of livestock. The exotic vegetation occurs in the form of grassland and was dominated by Cocksfoot (**Dactylis glomerata*), Barley Grass (**Hordeum sp.*), Giant Brome (**Bromus diandrus*) and Ryegrass (**Lolium perenne*). Less than 25% of this area was identified as containing native species. Some native species including Wallaby Grasses (*Rytidosperma sp.*) and Spear grass (*Austrostipa sp.*) occurred in low densities.

Figure 5-5. Exotic pastures.

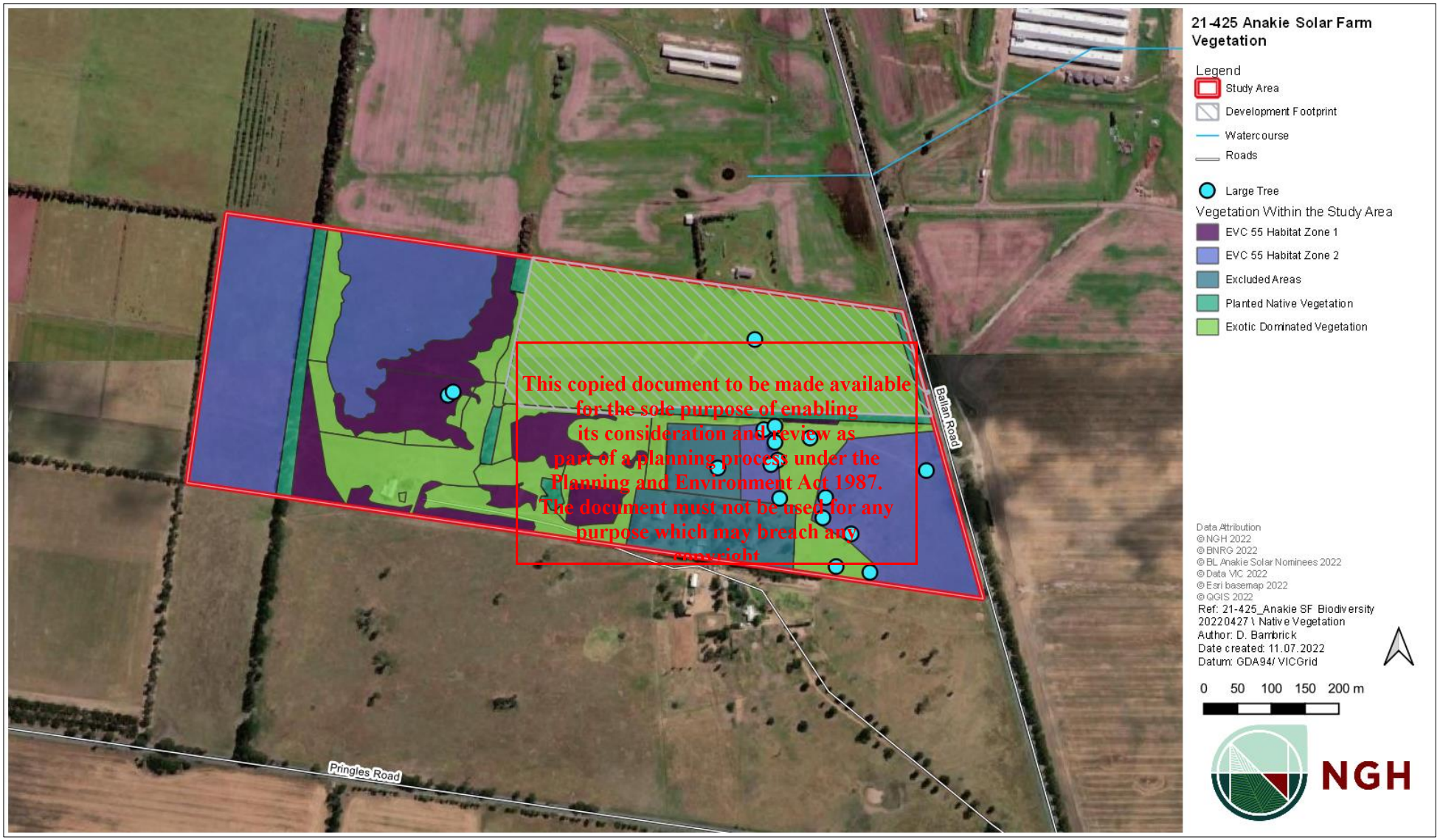

Figure 5-6. Vegetation in the study area

5.1.6 Threatened Flora

No threatened flora were identified during the site assessment. However, due to the season, climatic conditions and timing of the site assessment, not all threatened flora species may have been present or identifiable.

A list detailing all flora species identified during the site assessment is located within Appendix A. It is important to note that, to determine a comprehensive flora list for the Development Footprint, multiple surveys over different seasons, climatic conditions and timeframes throughout the year would be required.

5.1.7 Threatened flora records

A search of the Victorian Biodiversity Atlas found seven flora within 5kms of the proposal area. These were:

- Fragrant Saltbush *Rhagodia parabolica* FFG – Vulnerable
- Giant Honey-myrtle *Melaleuca armillaris subsp. Armillaris* FFG – Endangered
- Gum-barked Bundy *Eucalyptus goniocalyx subsp. laxa* FFG – Endangered
- Melbourne Yellow-Gum *Eucalyptus leucoxylon subsp. connata* FFG – Endangered
- Snowy Mint-Bush *Prostanthera inversa var. nivea* FFG – Vulnerable
- Swamp Bush-pea *Pultenaea weindorferi* FFG – Endangered
- Velvet Daisy-bush *Olearia pannosa subsp. cardiophylla* FFG – Endangered
- Wiry Bossiaea *Bossiaea cordigera* FFG – Endangered

A search of the EPBC Act Protected Matters Search Tool (PMST) with a 5km buffer from the proposal area would an additional 17 threatened flora species with the potential to occur within the proposal area.

An assessment of threatened flora species was completed within Appendix B.

5.2 Threatened communities

Each EVC has a bioregional conservation status. Within the Victorian Volcanic Plain bioregion, EVC 55_61 Plains Grassy Woodland is listed as Endangered.

The FFG listed community *Western Basalt Plains (River Red Gum) Grassy Woodland* occurred on site in the form of EVC 55_61 Habitat zones 1 and 2. Habitat Zone 1a-1k is highly modified with evidence of pasture improvement and continuous grazing. The shrub and Eucalypt layer is largely absent. Habitat zones 2a-2d contained 1 River Red Gum *Eucalypt camaldulensis* higher cover of native grasses (>50%). There was evidence of historic Eucalypt cover with stags and large logs.

Any areas impacted by this proposal will be offset and this is covered in Section 6.

Habitat Zones 2a-2d are likely to form part of the EPBC Act listed *Grassy Eucalypt Woodland of the Victorian Volcanic Plain.* The EPBC assessment is covered in more detail in Section 5.5.1.

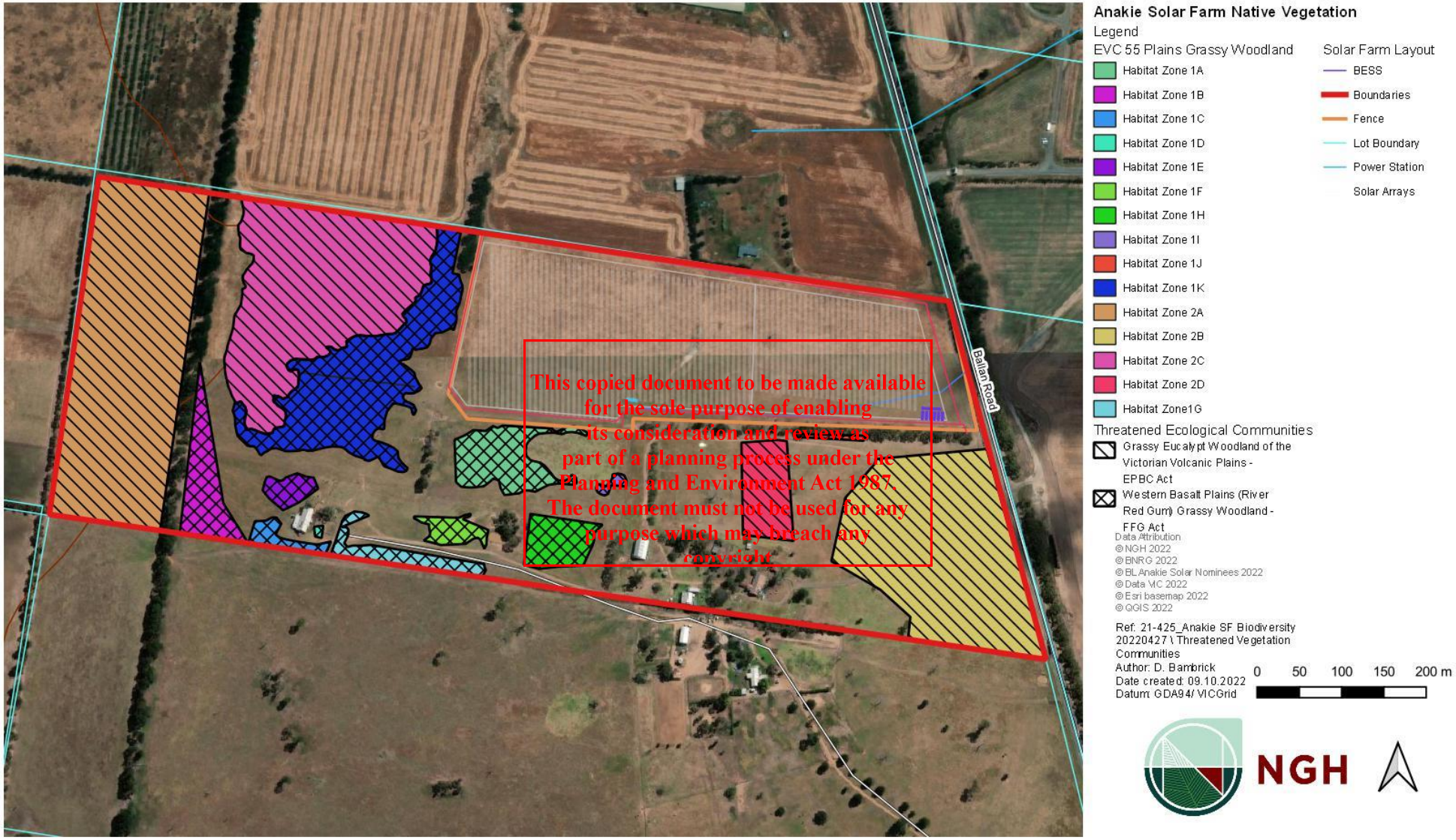

Figure 5-7 Threatened Communities within the Study Area

5.3 Fauna

Seven avian species were observed during the site assessment. The results of the incidental fauna observations, collected whilst on site, are listed in the Table 5-2 below.

Table 5-2 Incidental fauna observed during site visit.

Scientific Name	Common Name	Status
Threskiornis spinicollis	Straw-necked Ibis	Least Concern
Corvus sp.	Raven	Least Concern
Cacatua galerita	Sulphur-crested Cockatoo	Least Concern
Eolophus roseicapilla	Galah	Least Concern
Anthochaera carunculata	Red Wattlebird	Least Concern
Rhipidura leucophrys	Willy Wagtail	Least Concern
Gymnorhina tibicen	Australian Magpie	Least Concern

5.3.1 Fauna habitat features

Within the Development Footprint, the following fauna habitat features were identified:

- Native grassland
- Exotic grassland
- Depressions
- Rocky habitat (very limited natural areas – small number artificial created rock piles)
- Fallen timber and hollow logs
- Stag (dead) hollow-bearing tree (HBT)
- Planted native woodland

Native and exotic grasslands provide foraging resources for fauna species. Native grasses hold a higher foraging resource value for fauna species than exotic grasses.

Depressions can be seen within the satellite imagery; these areas can retain water during prolonged wet periods or seasonal downfalls. Depressions, when retaining water can provide drinking resources for most fauna species, breeding resources for amphibious species and foraging resources for wetland birds.

Rocky habitat provides a heat source for reptile species, as well as shelter and foraging locations. Many reptile species are dependent on or frequently utilise rocky habitat.

Fallen timber and hollow logs are utilised for foraging by a range of fauna species including ground foraging birds and reptiles. Fallen timber provides habitat for invertebrate species which are a key foraging resource for many fauna species. Hollow logs are used for shelter and breeding by fauna species.

Tree hollows are cavities formed in the trunk or branches of a live or dead tree. Hollows usually take a long time to form, and in particular, large hollows may only occur in very large, old trees

(100 – 150 years plus in age). Hollow-bearing trees provide resources for wildlife for foraging, shelter, roosting and nesting. However, trees which contain hollows are particularly important for those species of animals, including many threatened species, which specifically require such hollows for shelter and nesting. These animals are termed 'hollow-dependent' in that they require hollows as a key component of their habitat either on a daily or seasonal basis (DoEE, 2007).

Planted woodland provides foraging and breeding resources for woodland species. Planted woodland aids in re-connecting patches of remnant woodland, increasing connectivity within the landscape. Many species, especially birds, utilise woodland for nesting. Eucalyptus trees, provide nectar when in flower. Insect species, such as lerps, are known to occur on these trees and are utilised for foraging by many bird species. Sap of eucalyptus trees is used as a foraging resource by mammal species such as gliders and possums. Depending upon the preferred tree species leaves are a food source for Koalas.

5.3.2 Threatened fauna records

A search of the Victorian Biodiversity Atlas found, there were 17 species that were either recorded within 5km of the study area or are likely to occur in the locality. All these species were avian and included one migratory bird.

Of these 17 threatened fauna species, it was determined that three threatened fauna species have a low-moderate likelihood of being impacted by the proposal based on the habitat suitability on site and the surrounding cropped paddocks. Further habitat assessment was undertaken on site by an NGH Senior Ecologist and the results are outlined below.

No fauna species were considered moderate or high likelihood of occurring on site. No threatened fauna species were recorded during the site assessment.

The likelihood of all threatened fauna species occurring at the site is evaluated in Appendix B.

5.3.3 Threatened Fauna Habitat Survey Results

An assessment was completed on the 14th-15th June 2022 to determine potential habitat for Golden Sun Moth, Pink-tailed Worm Lizard and Striped Legless Lizard in areas identified as EVC 55_61 Plains Grassy Woodland in the area surrounding the Development Footprint.

The habitat assessment was undertaken to ensure any threat for these three species was identified and steps to avoid or minimise any unnecessary any impacts to these species.

The threated fauna habitat areas identified correspond with habitat zones of EVC 55 shown as Habitat Zones 1a, 1k and 2c in Figure 5-7 in the immediate vicinity of the proposed development footprint.

Pink-tailed Worm Lizard (PtWL)

The additional site assessment for the PtWL found no areas of Kangaroo dominated native grassland and/or area of native grassland interspersed with naturally occurring rock outcrop or partially embedded patches of surface rock. Only individual fully embedded surface rocks were located in the northwest section of the study area outside the current proposal development footprint.

No suitable habitat exists for the Pink-tailed Worm Lizard within the proposed development footprint therefore no PtWL habitat would be impacted.

Striped Legless Lizard (SLL)

EVC 55 Habitat zone 2c (refer Figure 5-7) are considered by default as suitable habitat for the SLL, based on their higher proportional of native grasses. EVC 55 habitat zones 1a and 1k contain only minimum threshold of 25% native grasses that are heavily dominated by introduced pasture grass species. These areas are not considered to be SLL habitat. No suitable naturally/ or artificially partially buried rock was found within any the mapped habitat zones or within the development footprint. The only individual fully embedded surface rock occurred the northwest section of the study area outside the current proposal development footprint.

SLL habitat is only considered to be present in Habitat Zone 2c all of which have been avoided and are outside the proposed development footprint. No suitable habitat exists for the Striped Legless Lizard within the proposed development footprint therefore no SLL habitat would be impacted.

Golden Sun Moth (GSM)

Habitat Zone 2c (refer to Figure 5-7) was by default considered to be suitable habitat for the GSM based on the higher proportion of native grasses that contained both Wallaby Grass *Rytidosperma sp.* and Speargrass *Austrostipa sp.* Habitat zones 1a and 1k were found to be only marginal habitat for the Golden Sun Moth given their minimum 25% cover of native grasses (primarily Wallaby Grass (*Rytidosperma sp.)* with no inter-tussock spacing and dominated by annual pasture grass species. Only 0.001 ha (i.e., 6m^2) of mapped Golden Sun Moth marginal habitat within Habitat Zone 1a would be impacted.

The GSM has not been recorded within or in immediate vicinity of the study area. Further Targeted surveys for the Golden Sun Moth are not required. Significant changes to detailed design has been able to avoid all identified suitable and marginal habitat for the Golden Sun Moth with the exception of a very small 0.001 ha (6m^2) area of marginal habitat that will be impacted. This very small area did not register any potential impact or offset requirement in the NVR report (refer to Appendix D). Similarly, marginal habitat was attributed to areas that, while they may have contained 25% of native grasses (mostly regenerated Wallaby Grass) *Rytidosperma sp.)*) with no inter-tussock spacing the area of 6m^2 of marginal habitat could not support a population of Golden Sun Moth.

5.3.4 Further targeted surveys

No further targeted surveys for threatened fauna area required. The area that met the threshold for the EBPC listed community by default represents suitable habitat for Golden Sun Moth, Pink-tailed Legless Lizard and Striped Legless Lizard. The proposal has avoided any impact to this area therefore no target surveys for these species are required.

5.4 Declared weeds and pest animals

5.4.1 Noxious weeds identified on site

The noxious weeds found on site are listed in Table 5-3.

Table 5-3 Declared noxious weeds in the study area.

Scientific Name	Common Name	Status
Hypericum perforatum	St Johns Wort	Regionally Controlled
Marrubium vulgare	Horehound	Regionally Controlled

Carthamus lanatus	Saffron Thistle	Regionally Controlled	
Cirsium vulgare	Spear thistle	Restricted	
Nassella trichotoma	Serrated Tussock	Regionally Controlled	
Nassella neesiana	Chilean Needle Grass	Restricted	

5.4.2 Declared pest animals

There was no evidence of declared pest animals observed on site. However, it is likely that the Red Fox (*Vulpes vulpes*) and European Rabbit (*Oryctolagus cuniculus*) are present within the area.

5.5 Matters of National Environmental Significance

Under *the Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), actions that have, or are likely to have, a significant impact on a Matter of National Environmental Significance require approval from the Australian Government Minister for the Environment (the Minister). The Minister will decide whether assessment and approval is required under the EPBC Act.

The nine matters of national environmental significance protected under the EPBC Act are:

a) *world heritage properties*
b) *national heritage places*
c) *wetlands of international importance (listed under the Ramsar Convention)*
d) *listed threatened species and ecological communities*
e) *migratory species protected under international agreements*
f) *Commonwealth marine areas*
g) *the Great Barrier Reef Marine Park*
h) *nuclear actions (including uranium mines)*
i) *a water resource, in relation to coal seam gas development and large coal mining development*

The matter relevant to the site is (d) listed threatened species and ecological communities. These matters are discussed below.

5.5.1 Threatened communities

There were five threatened ecological communities identified in the Matters of National Significance search. These communities are listed in Table 5-4 below.

Table 5-4 MNES search results for Threatened Communities

Community Name	Threatened Status	Occurrence	Study Area	Development Footprint
Grassy Eucalypt Woodland of the Victorian Volcanic Plain	CE	Community known to occur within area	Present in the study area. See Figure 5-7.	Absent

White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	CE	Community likely to occur within area	Absent	Absent
Natural Temperate Grassland of the Victorian Volcanic Plain	CE	Community likely to occur within area	Absent	Absent
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains	CE	Community likely to occur within area	Absent	Absent

5.5.2 Further survey work

If any EPBC vegetation communities are proposed to be impacted an EPBC referral may be required. The proposed design does not impact any area of EPBC Act listed vegetation community therefore does not require an EPBC referral.

5.5.3 RAMSAR wetlands

The Port Phillip Bay (western shoreline) and Bellarine Peninsula RAMSAR wetland is identified within the PMST report as 'within 10km' of the proposal area. This RAMSAR site is not within the 5km search of the proposed works.

5.5.4 Threatened flora

The MNES search shows there were 17 flora species found within the 5 km buffer. None of these species were recorded on site. One species, the Matted Flax-lily *Dianella amoena*, was determined to have a low-moderate likelihood of occurring on site.

5.5.5 Threatened fauna

From the MNES search results, the following records of nationally threatened fauna are:

- Birds – 13
- Fish – 3
- Amphibians – 1
- Invertebrates –1
- Mammals – 3
- Reptiles – 3
- Migratory – 12

Three EPBC Act listed species (Striped Legless Lizard, Golden Sun Moth and Pink-tailed Legless Lizard) were determined to have a potential habitat as occurring on site. The findings of this survey results are outlined in 5.3.3. Habitat for these species is restricted to the western section of EPBC listed community and is not impacted by the proposal. Golden Sun Moth was determined to be the only fauna species with a low-moderate likelihood of occurring on site.

Appendix B includes the likelihood of these species occurring within the study area. All other MNES fauna species are considered to have a low likelihood of being impacted by the proposal.

6. Proposed native vegetation removal

6.1 Proposed native vegetation assessment pathway

The native vegetation impact assessment determines the offset requirements for the vegetation loss that cannot be avoided or minimised due to the proposed development. Table 6-1 outlines the assessment pathway for the native vegetation impacts to meet the requirements of Clause 52.17 for a planning permit application.

Table 6-1 Planning permit requirements for native vegetation removal

Criteria	Assessment Pathway		Scattered trees or large trees in a patch	Report Section
	Basic/ Intermediate Pathway	Detailed Pathway		
Has the assessment pathway and reason for the assessment pathway been determined? Has the location category of the native vegetation proposed to be removed been identified?	Location is 1 and 2, <0.5ha is to be removed and one large tree.	No	N/A	This section
A description of the native vegetation to be removed	Yes	N/A	N/A	Section 5.1
Maps showing the native vegetation	Yes	N/A	N/A	Section 5.1
The offset requirement determined in accordance with section 5 of the Guidelines.	Yes	N/A	N/A	Section 6.4
Topographic and land information relating to the native vegetation to be removed, showing ridges, crests and hilltops, wetlands and waterways, slopes of more than 20 percent, drainage lines, low lying areas, saline discharge areas, and areas of existing erosion, as appropriate.	Yes	N/A	N/A	Figure 1-1
Recent, dated photographs of the native vegetation.	Yes	N/A	N/A	Section 5.1
Details of any other native vegetation approved to be removed, or that was removed without the required approvals, on the same property or on contiguous land in the same ownership as the applicant, in the five year period before the application for a permit is lodged.	No recent planning permit application to remove of native vegetation	No recent planning permit application to remove of native vegetation	No recent planning permit application to remove of native vegetation	NA
An avoid and minimise statement. The statement describes any efforts to avoid the removal of and minimise the impacts on the biodiversity and other values of native vegetation, and how these efforts focussed on areas of native vegetation that have the most value.	Yes	N/A	N/A	Section 6.2
A copy of any Property Vegetation Plan contained within an agreement made pursuant to section 69 of the *Conservation, Forests and Lands Act 1987* that applies to the native vegetation to be removed	N/A	N/A	N/A	N/A

Criteria	Assessment Pathway		Scattered trees or large trees in a patch	Report Section
	Basic/ Intermediate Pathway	Detailed Pathway		
Where the removal of native vegetation is to create defendable space, a written statement explaining why the removal of native vegetation is necessary. This is not required when the creation of defendable space is in conjunction with an application under the Bushfire Management Overlay.	N/A	N/A	N/A	N/A
If the application is under Clause 52.16, a statement that explains how the proposal responds to the Native Vegetation Precinct Plan considerations at decision guideline 6.	N/A	N/A	N/A	N/A
An offset statement explaining that an offset that meets the offset requirements for the native vegetation to be removed has been identified and how it will be secured.	Yes	N/A	N/A	Section 6.4
A site assessment report of the native vegetation to be removed, completed by an accredited native vegetation assessor.	Yes	N/A	N/A	This report
Information about impacts on rare or threatened species habitat.	Yes	N/A	N/A	Section 5

6.2 Avoid and minimise statement

Steps to avoid and minimise unnecessary impacts on native vegetation within the study area include:

- The proposed Development Footprint was modified and reduced to avoid native vegetation.
- The impact area is confided to the Development Footprint. This includes all areas within the 'project fence line' and access road to the 'project fence line'.
- The boundary plantings will be retained.
- 'Extent of Works' fencing during construction or erect signage to say 'no-go zones' tree protection areas.
- Mitigation measures to minimise the biodiversity loss includes:
  - Take steps necessary to avoid harm or injury to wildlife.
  - Fauna salvage prior to tree removal.
  - A suitably qualified ecologist or wildlife handler on site during tree removal or removal of the vegetation, habitat features (e.g., logs and rocky habitat), and HBT.
  - Two-factor HBT removal protocol to be established.
  - Implement an unexpected threatened species find protocol prior to and during construction works.

6.3 Native vegetation removal report

The impacted native vegetation includes 0.001 hectares for the proposed installation of a Sub-5 Mega Watt (MW) battery supported solar farm.

A native vegetation removal report was completed on 13/07/2022. As this is a detailed assessment, the native vegetation removal report must be submitted to DELWP using scenario testing software called EnSym. DELWP release the Native Vegetation Removal Report which provided the following assessment pathway information in Table 6-2 and the offset requirements in Table 6-3.

The information provided in Table 6-3 outlines the offset requirements for the offset strategy. The offset strategy is discussed in the next section.

Figure 6-1 shows the native vegetation proposed to be removed.

Table 6-2 Assessment pathway

Assessment Pathway	Basic Assessment Pathway
Extent of native vegetation removal	0.071 (hectares)
Extent of past removal	0 (hectares)
Extent of proposed removal	0.071 (hectares)
Number of large trees	1
Location category	Location 1

Table 6-3 Offset Requirements

Offset Items	Offset Requirements
General offset amount	0.014 General Habitat Units
Vicinity	Corangamite Catchment Management Authority (CMA) or Greater Geelong City Council
Minimum strategic biodiversity value score	0.288
Large trees	1

6.4 Offset strategy

As part of the planning permit application, evidence must be shown to the responsible authority that steps have been undertaken to ensure an offset is secured. Offsets for native vegetation removal in Victoria can be secured in two ways - first party offset or a third-party offset. The first party offset involves setting up the offset on private property i.e., the same property where the proposed removal is occurring. The requirements are outlined in Section 6.4.1.

Third party offsets are purchased through a broker and this is outlined in Section 6.4.2.

6.4.1 First party offsets

No first party offset will be undertaken for this proposal.

6.4.2 Third party offsets

A third party offset can be purchased through a credited broker (in the form of a third offset quote) and provided to the responsible authority as part of a planning permit application.

As identified in Table 6-3 the offset requirements for 0.014 General Habitat Units must be located in the Corangamite Catchment Management Authority (CMA) or Greater Geelong City Council and have a minimum strategic biodiversity value score of 0.288.

A third party offset quote was obtained from Vegetation Link and this is included in Appendix F.

If approval is granted for the native vegetation removal, the third party offset quote must be secured and the credit extract provided to the responsible authority i.e., the credit extract is provided to the applicant once the quote has been purchased.

Further information about accredited credit brokers can be found here:

https://www.environment.vic.gov.au/native-vegetation/native-vegetation/offsets-for-the-removal-of-native-vegetation/i-need-to-secure-an-offset

Figure 6-1. Native Vegetation Requiring Offset

7. Mitigation measures

The following mitigation measures are recommended prior to construction to reduce impacts to biodiversity.

The mitigation measures include:

- The impact area is confined to the Development Footprint. This includes all areas within the 'project fence line' and access road to the 'project fence line'.
- No areas outside the Development Footprint will be impacted, including vehicle movements. Any increase to the Development Footprint would require re-assessment of offset impacts and ecological impacts.
- The boundary plantings will be retained.
- 'Extent of Works' fencing during construction or erect signage to say 'no-go zones' tree protection areas.
- Mitigation measures to minimise the biodiversity loss includes:
    - Take steps necessary to avoid harm or injury to wildlife.
    - Fauna salvage prior to tree removal.
    - A suitably qualified ecologist or wildlife handler on site during tree removal or removal of the vegetation, habitat features (e.g., logs and rocky habitat), and HBT.
- An unexpected threatened species finds protocol should be implemented. If a species is identified during the construction phase that is suspected of being a threatened species, all works would stop to allow assessment of the species by a suitability qualified person prior to continuation.
- No stockpile locations for imported material outside of the defined Development Footprint were identified as part of the assessment scope. No stockpiling of any materials would occur outside the Development Footprint.
- All machinery and plant equipment will be cleaned using a high-pressure washer (or other suitable device) prior to entering work sites.
    - Any exotic plant material containing seed heads, including topsoil containing weed propagules, will be disposed of at an appropriate waste management facility or otherwise properly treated to prevent weed spread.
- Herbicides will be used in accordance with the requirements on the label. Any person undertaking herbicide application will be trained to do so and have the proper certificate of completion/competency or statement of attainment issued by a registered training organisation.
- Any fallen timber encountered on site will be left in situ wherever possible or relocated to a suitable place nearby.
    - Fallen timber will not be 'pushed' into surrounding vegetation and would be 'lifted' and 'placed' to avoid unnecessary disturbance.
    - Any Coarse Woody Debris (CWD) created from the proposed works would be placed in surrounding vegetation.
    - Any CWD mulched would be spread thinly <100mm deep in surrounding vegetation.
- Erosion and run-off control works, as well as rehabilitation and stabilisation measures, would be undertaken where necessary.

8. Conclusion

The proposed native vegetation removal requiring offsets includes 0.071 hectares of EVC 55_61 Plains Grassy Woodland for the proposed installation of a Sub-5 Mega Watt (MW) battery supported solar farm.

The following offset requirements needed in the offset strategy:

- General offset amount – 0.014 General Habitat Units
- Vicinity - Corangamite Catchment Management Authority (CMA) or Greater Geelong City Council
- Minimum strategic biodiversity value score – 0.288
- Large trees -1

If a permit is granted, the next step involves securing third party offset and contacting Vegetation Link to enter into a purchase agreement.

In consideration of the native vegetation removal mitigation measures should be considered during construction.

Under ESO4, no land and environmental management plan has been completed as a part of ecology assessment. Under this ESO, the proposed native vegetation impacts will be offset and weed and pest animal management will occur as part of ongoing management for the development site. If approval for this project is supported the landscape plan may be able to address the requirements for this plan.

There is currently no impact proposed to the EPBC Grassy Eucalypt Woodland in Victorian Volcanic Plains and therefore no EPBC referral is required.

At total of 0.001 ha of marginal habitat for the Golden Sun Moth would be impacted by the proposed works. No targeted survey for the Golden Sun Moth is required, however an unexpected finds protocol is to be implemented as part of the recommended mitigation measures. There is no further requirement recommended for targeted survey for either the Striped Legless Lizard and Pink-tailed Worm Lizard.

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Appendix A Flora Species List

E – Exotic; P- Planted, N – Native;

Scientific Name	Common Name	Status	CaLP weed listing status
Eucalyptus camaldulensis	River Red Gum	N	
Crassula sieberiana	Stonecrop	N	
Dichondra repens	Kidney Weed	N	
Microlaena stipoides	Weeping Grass	N	
Nassella neesiana	Chilean Needle Grass	E	Restricted
Chrysocephalum apiculatum	Common Everlasting	N	
Hypochaeris radicata	Catsear	E	
Dactylis glomerata	Cocks foot	E	
Setaria sp.	Bristle Grass	E	
*Bromus dian*drus	Giant Brome	E	
Solanum nigrum	Black Nightshade	E	
Carthamus lanatus	Saffron Thistle	E	Regionally Controlled
Urtica dioica	Stinging Nettle	E	
Hypericum perforatum	St John's Wort	E	Regionally Controlled
Oxalis perennans	Grassland Wood-sorrel	N	
Rytidosperma sp.	Wallaby Grass	N	
Austrostipa sp.	Spear Grass	N	
Hordeum leporinum	Barley grass	E	
Cirsium vulgare	Spear thistle	E	Restricted
Sonchus oleraceus	Sow thistle	E	
Trifolium sp.	Clover	E	
Chloris truncata	Windmill Grass	N	
Rumex sp.	Dock	N	
Vulpia sp.	Fescue	E	
Lolium perennans	Rye Grass	E	
Marrubium vulgare	Horehound	E	Regionally Controlled
Nassella trichotoma	Serrated Tussock	E	Regionally Controlled

Appendix B Threatened Species

Presence of Habitat

Present	Potential or known foraging, roosting, nesting, refuge, movement corridor (including movement of genetic material) or other habitat is present within the study area
Marginal	Limited habitat with some features that may be used by species within the study area
Absent	No potential foraging, roosting, nesting or other habitat is present within the study area.

Likelihood of Occurrence

Low	It is unlikely that the species inhabits the study area and has not been recorded recently in the locality (10km). It may be an occasional visitor, but habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the study area, or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.
Moderate	Potential habitat is present in the study area. Species unlikely to maintain sedentary populations, however, may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
High	It is highly likely that a species inhabits the study area and is dependent on identified suitable habitat (i.e., for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (5km) and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the study area during regular seasonal movements or migration.
Recorded	Species was recorded during the field investigations or has recorded previously

Impacts

Low	The proposal would not impact this species or its habitats.
Moderate	The proposal could impact this species or its habitats however the impacts are considered manageable such that no direct or indirect impacts are likely.
High	The proposal is likely to impact this species or its habitats.

B.1 Threatened Flora

Scientific Name	Common Name	FFG Act	EPBC ACT	Habitat	No of Records	Presence of habitat	Likelihood of Occurrence	Possible Impact
Flora								
Amphibromus fluitans	Floating Swamp Wallaby-grass		V	Grows mostly in permanent swamps. The species needs wetlands which are at least moderately fertile, and which have some bare ground, conditions which are produced by seasonally fluctuating water levels. Habitats in south-western NSW include swamp margins in mud, dam, and tank beds in hard clay and in semi-dry mud of lagoons with *Potamogeton* and *Chamaeraphis* species. The species is virtually aquatic, often with only the flower heads above the water. It has been recorded recently in lagoons beside the Murray River near Cooks Lagoon (Shire of Greater Hume), Mungabarina Reserve, East Albury, at Ettamogah, Thurgoona (Charles Sturt University Campus), near Narrandera, and also further west along the Murray River (near Mathoura) and in Victoria. There is a recent record of this species near Lake Cargelligo in Upper Lachlan Shire. It is also found in Victoria and in Tasmania.		Absent	Low Not recorded in the locality, no suitable habitat present.	Low
Caladenia ornata	Ornate Pink Fingers	E	V	Ornate Pink Fingers occurs sporadically at Portland, Cherrypool, Lake Fynes and Stawell in south-west Victoria. This species also occurs in the south-east of South Australia. It is known from approximately 500 individuals in 19 populations. This species occurs within the Glenelg Hopkins (Victoria) and South East (South Australia) Natural Resource Management Regions. Ornate Pink Fingers grow in heathlands, woodlands and heathy woodlands in seasonally moist sand and clay loams. This species has been previously recorded from Grampians National Park (NP), Little Desert NP, Lower Glenelg NP, Mt Richmond NP, Padthaway Conservation Park, Black Range State Park, Three Jacks Flora and Fauna Reserve and Deep Lead Nature Conservation Reserve.		Marginal	Low Not recorded in the locality, some marginal habitat present. Species not considered likely to occur.	Low
Caladenia pumila	Dwarf Spider-orchid	CE	CE	Two Dwarf Spider-orchid plants were found in a Parks Victoria reserve in the greater Geelong region in late 2009. In an attempt to protect the plants, their location is being kept confidential by the Victorian Government. Prior to 2009, the Dwarf Spider-orchid was considered extinct and had not been		Marginal	Low Not recorded in the locality, some marginal habitat present. Species not considered	Low

Scientific Name	Common Name	FFG Act	EPBC ACT	Habitat	No of Records	Presence of habitat	Likelihood of Occurrence	Possible Impact
				observed since 1926. It was discovered in 1922 at Bannockburn, approximately 22 km north-west of Geelong, Victoria. It was very localised in its distribution, having been recorded from only one district in Victoria. Bishop's (1996) description of the species occurring, near Murtoa and west of Inglewood, is in error.			likely to occur.	
Dodonaea procumbens	Trailing Hopbush		V	Found in the dry areas of the Monaro, between Michelago and Dalgety. Here it occurs mostly in Natural Temperate Grassland or Snow Gum Eucalyptus pauciflora Woodland. Grows in open bare patches where there is little competition from other species. Found on sandy-clay soils, usually on or near vertically tilted shale outcrops. There is one population at Lake Bathurst (the northern-most occurrence of the species). Here it occurs in adjacent to the lake bed in grassland dominated by Corkscrew Grass Austrostipa scabra and Curly Sedge *Carex bichenoviana*. Also occurs in South Australia and Victoria.		Marginal	Low Not recorded in the locality, some marginal habitat present. Species not considered likely to occur.	Low
Lepidium aschersonii	Spiny Peppercress	E	V	Found on ridges of gilgai clays dominated by Brigalow (*Acacia harpophylla*), Belah (*Casuarina cristata*), Buloke (*Allocasuarina luehmannii*) and Grey Box (*Eucalyptus microcarpa*). In the south has been recorded growing in Bull Mallee (*Eucalyptus behriana*). Often the understorey is dominated by introduced plants. The species grows as a component of the ground flora, in grey loamy clays. Vegetation structure varies from open to dense, with sparse grassy understorey and occasional heavy litter. Occurs in the marginal central-western slopes and north-western plains regions of NSW (and potentially the south western plains).		Marginal	Low Not recorded in the locality, some marginal habitat present. Species not considered likely to occur.	Low
Lachnagrostis adamsonii	Adamson's Blown grass	E	E	Adamson's Blown grass is endemic to south-west Victoria, from Clifton Springs near Geelong to near Coleraine (350 km west of Melbourne). The northernmost populations are at Gatum (20 km north-west of Cavendish), near Maroona (20 km north-east of Willaura), Lake Goldsmith (15 km south of Beaufort) and just south of Chepstowe. Southernmost populations are at Caramut, just north of Derrinallum and Lismore, and near Barunah (15 km west of Shelford). Adamson's Blown grass was previously known from 68		Present	Low Some species is mapped as occurring in south-west Victoria. Not recorded within the locality.	Low

Scientific Name	Common Name	FFG Act	EPBC ACT	Habitat	No of Records	Presence of habitat	Likelihood of Occurrence	Possible Impact
				locations but has declined or been lost from many locations since 1990. Over 90% of the species' locations occur on the Volcanic Plains in the south-west of Victoria. Highest concentrations of populations lie to the north-west of Cavendish, to the south of Glenthompson and Wickliffe, and in the Willaura/Maroona area. The extent of occurrence is approximately 15 000 km$^{2.}$				
Leucochrysum albicans subsp. tricolor	Hoary Sunray	E	E	Occurs in a wide variety of grassland, woodland, and forest habitats, generally on relatively heavy soils. Can occur in modified habitats such as semi-urban areas and roadsides. Highly dependent on the presence of bare ground for germination. Endemic to south-eastern Australia. In NSW it currently occurs on the Southern Tablelands adjacent areas in an area roughly bounded by Albury, Bega and Goulburn, and volcanic plains grassland of western Victoria.		Marginal	Marginal Dese grassy paddock and habitat, no real bare ground present. Species not recorded in locality.	Low
Pimelea spinescens subsp. spinescens	Plains Rice-flower	CE	CE	Spiny rice-flower is endemic to Victoria, where it occurs in the central west of the state, predominantly in the Victorian Volcanic Plain, Victorian Midlands and Riverina IBRA (Interim Biogeographic Regionalisation for Australia) Bioregions. Based on entries in the spiny rice-flower state-wide database, approximately 88 000 plants are estimated to occur in 208 (and possibly up to 275) wild sites. Historically, the species was undoubtedly much more widespread and abundant within the region where it currently occurs. Populations are now substantially fragmented and depleted due to land clearance for settlement, industry and agriculture. Many populations consist of a small number of plants (55 percent of sites with population counts have fewer than 100 plants), with most occurring in tiny patches of remnant habitat (59 percent of sites with extent estimates are smaller than 1ha) such as on roadsides and rail easements. However, the spiny rice-flower database includes many old and imprecise records and these figures are likely to be an overestimate of the actual situation. Some large populations occur on private property where grazing impacts are high.		Marginal	Marginal No recorded in the locality, in other populations has been recorded in grazed paddocks.	Low
Glycine latrobeana	Clover Glycine	V	V	Occurs mainly in grassland and grassy woodland habitats, less often in dry forests, and rarely in heathland. Populations occur from sea level to c. 1,200 m. In Victoria, plants grow in a		Marginal	Marginal No recorded in the locality, some	Low

Scientific Name	Common Name	FFG Act	EPBC ACT	Habitat	No of Records	Presence of habitat	Likelihood of Occurrence	Possible Impact
				range of soil types including alluvial soils, and those derived from sandstones, mudstones, granite, and basalt. Soils are usually clay but may have high loam content. Tasmanian populations occur on a well-drained basalt, dolerite, or sandstone substrates (Lynch 1994). The NSW population is in subalpine grassland (at about 1300 m asl).			marginal habitat present.	
Lepidium hyssopifolium	Aromatic Peppercress	E	E	Known to have occurred in both woodland with a grassy understorey and in grassland, the species may be a disturbance opportunist, as it was discovered at the most recently discovered site (near Bungendore) following soil disturbance.		Marginal	Marginal No recorded in the locality, some marginal habitat present.	Low
Thelymitra epipactoides	Metallic Sun-orchid	E	E	Confined to a range of heathland communities usually near the coast. It is primarily located in sandy duplex soils which are waterlogged in winter and in which the pH varies between 5.6 and 7.5. Currently found in south-eastern South Australia and western Victoria		Absent	Low No suitable habitat present likely to support this species, not recorded within the locality.	Low
Xerochrysum palustre	Swamp Everlasting	CE	V	Grows in swamps and bogs which are often dominated by heaths, and at the edges of bog margins on peaty soils with a cover of shrubs or grasses. Found in Kosciuszko National Park and the eastern escarpment south of Badja. Also found in eastern Victoria.		Marginal	Low Some marginal e habitat present, not likely to support this species, not recorded within the locality.	Low
Pterostylis cucullata	Leafy Greenhood	E	V	In Victoria, important populations include 18 populations in the Alpine National Park, eight in Wilsons Promontory National Park, six in Mornington Peninsula National Park, and single populations in Cape Otway National Park, Eildon National Park, Mt Eccles and Point Nepean. Eight populations occur on private property (Cape Schank, Bridgewater Lakes, Cape Otway, Rye and Tootgarook), two on roadsides (unknown land tenure at Cape Schank and Cape Bridgewater) and three on unknown land tenure in the Strathbogie Ranges, Winkie Creek and Tootgarook. In Victoria, one population occurs in Belair National Park, one in Lobethal (Adelaide Hills Council) and one on private property at Cherry Gardens.		Absent	Low No suitable habitat present likely to support this species, not recorded within the locality.	Low

Scientific Name	Common Name	FFG Act	EPBC ACT	Habitat	No of Records	Presence of habitat	Likelihood of Occurrence	Possible Impact
Rutidosis leptorhynchoides	Button Wrinklewort	E	E	Button Wrinklewort occurs in south-eastern Australia, from Goulburn in the Southern Tablelands of NSW to Wickliffe on the plains west of Melbourne, Victoria. The NSW and ACT populations are markedly disjunct from the Victorian populations. Evidence suggests that the species was formerly widespread in south-eastern NSW from near Michelago to near Goulburn. In Victoria the species occurred across the Victorian Volcanic Plain, north to Casterton and as far east as Newry in Gippsland but is now restricted to tiny refugia in the south-west, occurring on the outskirts of Melbourne, Bannockburn, Rokewood, Wickliffe and between Beaufort and Ararat. The species is not known to occur naturally in any conservation reserve in Victoria although it is sympathetically managed at the Yalla-y-Poora Recreation Reserve.		Present	Low Some Species is mapped as occurring in south-west Victoria. Not recorded within the locality.	Low
Senecio macrocarpus	Large-fruit Fireweed		V	In Victoria, Large-fruit Fireweed occurs most commonly in grasslands on red-brown earth soils. It may also occur in grassy woodlands and open woodlands.		Present	Marginal Outside of the mapped distribution of this species. No records in locality.	Low
Dianella amoena	Matted Flax-lily	CE	E	In Victoria, the Matted Flax-lily occurs most commonly in lowland grasslands, grassy woodlands, valley grassy forest and creek lines of herb-rich woodland. Typically, the species occurs on well drained to seasonally wet fertile sandy loams to heavy cracking clays derived from Silurian or Tertiary sediments, or from volcanic geology. Sites are dominated by a grassy understorey with Kangaroo Grass (*Themeda triandra*) and Blackwood (*Acacia melanoxylon*) as a common understorey tree. Other grass species present include Wallaby Grass (*Austrodanthonia racemosa* var. *racemosa*), Common Wheat Grass (*Elymus scaber* var. *scaber*), Weeping Grass (*Microlaena stipoides* var. *stipoides*), Common Tussock-grass (*Poa labillardierei*) and Grey Tussock-grass (*Poa sieberiana*). A tree canopy may not be present on basalt escarpments (e.g., Coburg, Merri Creek). In grassy woodland, where the Matted Flax-lily occurs, tree species include Snow Gum (*Eucalyptus pauciflora* subsp. *pauciflora*), Swamp Gum (*E. ovata*), River Red Gum (*E. camaldulensis*), Long-leaved Box (*E. goniocalyx*), Red Box (*E. polyanthemos* subsp. *vestita*),		Present	Low. Some suitable habitat present, not recorded within the locality, but within mapped distribution of species.	Low

Scientific Name	Common Name	FFG Act	EPBC ACT	Habitat	No of Records	Presence of habitat	Likelihood of Occurrence	Possible Impact
				Red Stringy Bark (*E. macrorhyncha* subsp. *macrorhyncha*) and Yellow Box (*E. melliodora*). Most sites contain a high cover of introduced species such as Large Quaking Grass (*Briza maxima*), Yorkshire Fog Grass (*Holcus lanatus*), Cat's Ear (*Hypochaeris radicata*), Plantain (*Plantago lanceolata*), Onion Grass (*Romulea rosea*), Sweet Vernal Grass (*Anthoxanthum odoratum*), Cocksfoot (*Dactylis glomerata*), Little Quaking Grass (*Briza minor*), Phalaris (*Phalaris aquatica*), Paspalum (*Paspalum* spp.) and Bent grass (*Agrostis* spp.).				
Rhagodia parabolica	Fragrant Saltbush	V		Grows in poor soils of the semi-arid or areas of higher rainfall. Can Grow in rocky hillsides and creek banks.	2	Marginal	Low Species not recorded during the site assessment, habitat is marginal and not considered likely to occur on site although recorded within locality.	Low
Eucalyptus goniocalyx subsp laxa	Gum-barked Bundy	E		*Eucalyptus goniocalyx* is a small to medium sized tree species found on tablelands and hills from the Northern Tablelands of New South Wales to central-western Victoria, also in South Australia in the Mt Lofty and Flinders Ranges, occurring as a mallee in the driest areas. A Victorian endemic abundant on Mount Arapiles and also occurring in the northern Grampians at Mount Zero, near Halls gap, the northern Serra Range, and Red Rock in the Victoria Range.	1	Marginal	Low Species not recorded during the site assessment, habitat is marginal and not considered likely to occur on site although recorded within locality.	Low
Eucalyptus leucoxylon subsp. connata	Melbourne Yellow Gum	E		This eucalypt species is found in Victoria, south-eastern South Australia and far south-western New South Wales. All six subspecies occur in Victoria. Broad habitat range. Grassy woodland on moderately fertile loamy or alluvial soils.	11	Marginal	Low Species not recorded during the site assessment, habitat is marginal and not	Low

Scientific Name	Common Name	FFG Act	EPBC ACT	Habitat	No of Records	Presence of habitat	Likelihood of Occurrence	Possible Impact
							considered likely to occur on site although recorded within locality.	
Prostanthera nivea var nivea	Snowy Mint-bush	V		Grows in sclerophyll forest and woodland on rocky slopes and ridges, in shallow sandy soils; widespread.	1	Absent	Low Habitat not considered likely to support this species, recorded within the locality, however not expected to occur on site.	Low
Pultenaea weindorferi	Swamp Bush-pea	E		The Swamp Bush-pea (*Pultenaea weindorferi*), is a threatened shrub species, found in drainage lines and swamps around Kinglake and Bunyip. This species has had a spectacular response to the Black Saturday bushfires in 2009, with one patch of the burnt area in Bunyip State Park now estimated to contain 250,000 plants.	1	Marginal	Low Species not recorded during the site assessment, habitat is marginal and not considered likely to occur on site although recorded within locality.	Low
Olearia pannosa subsp cardiophylla	Velvet Daisy-bush	E		Velvet Daisy-bush occurs in dry open forest, on shallow rocky soils where the mean annual rainfall ranges from 450 to 650 millimetres. Populations of the Velvet Daisy-bush have been found in Lowland Forest, Heathy Dry Forest and Grassy Dry Forest associated with Red Stringybark (*Eucalyptus macrorhyncha*), Messmate (*Eucalyptus obliqua*), Golden Wattle (*Acacia pycnantha*) and Austral Grass-tree (*Xanthorrhoea australis*). At Wedderburn, the Velvet Daisy-bush site is dominated by Blue Mallee (*Eucalyptus polybractea*), Broombush (*Melaleuca uncinata*), Wallowa (*Acacia euthycarpa*), and Rough Spear-grass (*Austrostipa scabra*), while the Rushworth site occurs in Grey Box (*Eucalyptus microcarpa)* / Red Ironbark (*Eucalyptus tricarpa*) open forest (Foreman unpub. data). The species is found on a range of surfaces and substrates from Ordovician slates and	1	Marginal	Low Species not recorded during the site assessment, habitat is marginal and not considered likely to occur on site although recorded within locality.	Low

Scientific Name	Common Name	FFG Act	EPBC ACT	Habitat	No of Records	Presence of habitat	Likelihood of Occurrence	Possible Impact
				sandstones with sandy loam, silty loam or loamy topsoils, to Tertiary sediments with sand topsoils over sheet ironstone or topsoils of ironstone gravel.				
Bossiaea cordigera	Wiry Bossiaea	E		Moist well drained soils in heathy open forests. Frost tolerant. Semi shade. Rare in Victoria with few known populations within the Shire. Common in most of those sites. Wiry bossiaea grows in open forest, often in moist places and occurs between Portland and Healesville in southern Victoria.	1	Marginal	Low Species not recorded during the site assessment, habitat is marginal and not considered likely to occur on site although recorded within locality.	Low
Threatened Ecological Communities								
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland			CE	White Box Yellow Box Blakely's Red Gum Woodland (commonly referred to as Box-Gum Woodland) is an open woodland community (sometimes occurring as a forest formation), in which the most obvious species are one or more of the following: White Box *Eucalyptus albens*, Yellow Box *E. melliodora* and Blakely's Red Gum *E. blakelyi*. Intact sites contain a high diversity of plant species, including the main tree species, additional tree species, some shrub species, several climbing plant species, many grasses, and a very high diversity of herbs. The community also includes a range of mammal, bird, reptile, frog, and invertebrate fauna species. Intact stands that contain diverse upper and mid-storey and ground layer are rare. The Australian Government listing of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland is slightly different to the NSW listing. Areas that are part of the Australian Government listed ecological community must have either; an intact tree layer and predominately native ground layer; or an intact native ground layer with a high diversity of native plant species but no remaining tree layer. Box-Gum Woodland is found from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and		Absent	Absent No characteristic species present	Low

Scientific Name	Common Name	FFG Act	EPBC ACT	Habitat	No of Records	Presence of habitat	Likelihood of Occurrence	Possible Impact
				western slopes of NSW.				
Grassy Eucalypt Woodland of the Victorian Volcanic Plain			CE	The Grassy Eucalypt Woodland of the Victorian Volcanic Plain is a type of eucalypt woodland that is restricted to Quaternary basalt soils. It occurs on flat to gently undulating plains and associated stony knolls, generally at elevations up to 500 metres above sea level. The canopy is typically dominated by Eucalyptus camaldulensis (River Red Gum) though other eucalypt species may become prominent at wetter or drier sites. The understorey comprises a sparse shrub layer and a species-rich ground layer of grasses and herbs. The ecological community includes patches of derived grassland where the tree canopy is known to have been removed but a native ground layer remains.		Present	Present EVC 55 present. Remnant River Red Gum with native grassland species present.	Low – the current deign avoids all area of this threatened community.
Western Basalt Plains (River Red Gum) Grassy Woodland		Listed		This grassy woodland community has a clearly recognizable structure made up of an open canopy of River Red Gum (*Eucalyptus camaldulensis*), a middle layer chiefly of scattered wattles such as Golden Wattle (*Acacia pycnantha*) and Hedge Wattle (*A. paradoxa*) but including a few other shrubs as well, such as Tree Violet (*Hymenanthera dentata* = *Melicytus dentatus*) and a ground layer dominated by grasses. In its least disturbed state, the ground layer is predominantly tussock grasses such as Common Tussock Grass (*Poa labillardierei* = *P. labillardierei var. labillardierei*) and Wallaby Grass (*Rytidosperma spp*.), together with Kangaroo Grass (*Themeda triandra*) and various forbs in the spaces between the tussocks. The composition of the ground layer varies from site to site, being heavily influenced locally by the amount of tree cover, soil characteristics and the site's grazing and fire histories. More disturbed sites have a high proportion of introduced grasses and forbs in the ground layer.		Present	Present EVC 55 present. Remnant River Red Gum with native grassland species present.	High -present in low condition, where 0.001 ha would be impacted. This patch of native vegetation will be offset.
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains			CE	Isolated, freshwater wetlands that are usually inundated on a seasonal basis through rainfall, then dry out, so surface water is not permanently present. They occur on the lowland plains of temperate south-eastern Australia and have a vegetation structure that is open, i.e., woody cover is absent to sparse, and the ground layer is dominated by herbs (grasses, sedges		Absent	Absent No characteristic species present	Low

Scientific Name	Common Name	FFG Act	EPBC ACT	Habitat	No of Records	Presence of habitat	Likelihood of Occurrence	Possible Impact
				and forbs).				
Natural Temperate Grassland of the Victorian Volcanic Plain			CE	This community is dominated by a ground layer of native tussock-forming perennial grasses interspersed with a variety of herbs. Large shrubs and trees are absent to sparse. The ecological community is limited to the basalt plain of Victoria that extends from Melbourne, west to about Hamilton. Usually dominated by one or more of the following native tussock-forming grasses: kangaroo grass (*Themeda triandra*), wallaby grasses (*Austrodanthonia spp.),* spear grasses (*Austrostipa spp*.) and/or tussock grasses (*Poa spp*.).		Absent	Absent No characteristic species present	Low

B.2 Threatened Fauna

**Near threatened species are not currently listed under the FFG Act. However, do appear in threatened species searches but may be re-assessed at a later stage and their status under FFG changes*.

Scientific Name	Common Name	FFG Act	EPBC ACT	Habitat	No of Records	Presence of habitat	Likelihood of Occurrence	Possible Impact
Aves								
Actitis hypoleucos	Common Sandpiper	V	M	Found along all coastlines of Australia and in many areas inland. The population that migrates to Australia breeds in the Russian far east. Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves. The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is most often found around muddy margins or rocky shores and rarely on mudflats. The Common Sandpiper has been recorded in estuaries and deltas of streams, as well as on banks farther upstream, around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow and may be steep. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags. The species is known to perch on posts, jetties, moored boats, and other artificial structures, and to sometimes rest on mud or 'loaf' on rocks.		Absent	Low No habitat present on site that would support this species.	Low
Anthochaera phrygia	Regent Honeyeater	CE	CE	Inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak, that inhabit woodlands that support a significantly high abundance and species richness of bird species, and have large numbers of mature trees, high canopy cover and abundance of mistletoes. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the central coast and occasionally on the upper north coast. Recently recorded in urban areas around Albury where woodlands tree species such as Mugga Ironbark and Yellow Box were planted		Present	Marginal Some woodland habitat present, mostly in the form of planted eucalyptus.	Low Habitat to be removed is not considered likely to support this species. Pre-clear protocols would occur.

				20 years ago. A generalist forager, although mainly feeds on the nectar from a relatively small number of eucalypts that produce high volumes of nectar e.g., Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany. Other tree species may be regionally important e.g., Lower Hunter Spotted Gum forests support regular breeding events. Flowering of associated species such as *Eucalyptus eugenioides* and other Stringybark species, and *E. fibrosa* can also contribute important nectar flows at times. Nectar and fruit from *Amyema miquelii, A. pendula* and *A. cambagei* are also utilised. When nectar is scarce, lerp and honeydew can comprise a large proportion of the diet. The species breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River Sheoak. Nests in horizontal branches or forks in tall mature eucalypts, usually near River Sheoaks. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands.				
Apus pacificus	Fork-tailed Swift		M	The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. In Australia, they mostly occur over inland plains but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches and also over islands and sometimes well out to sea. They also occur over settled areas, including towns, urban areas, and cities. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland, or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland, and inland and coastal sand-dunes. The sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines (Higgins 1999). They forage aerially, up to hundreds of metres above ground, but also less than 1 m above open areas or over water. They often occur in areas of updraughts, especially around cliffs. They are said to search along edges of low-pressure systems, which assist flight. Low-		Absent	Low No habitat present on site that would support this species. Species is predominately aerial, preferring to utilise higher altitude habitat.	Low

				flying Swifts are said to be precursors of unsettled weather, possibly because insect prey fly at a lower altitude when the air is humid and when the air density is low (Cameron 1952). They sometimes feed aerially among tree-tops in open forest (Higgins 1999). They probably roost aerially but are occasionally observed to land (Higgins 1999). They were once recorded roosting in trees, using a bare exposed branch emergent above the foliage (Newell 1930). Sometimes they loaf in the air, by allowing strong winds to support them (Boehm 1939). There have been rare records of loafing elsewhere including Swifts briefly resting on ground (Campbell 1900) and alighting on wire netting of a tennis court (Wheeler 1959). Once, one was seen attempting to land on the wall of a lighthouse (Scarff 1990).				
Botaurus poiciloptilus	Australasian Bittern	CE	E	Requires permanent freshwater wetlands with tall, dense vegetation, particularly *Typha* spp. and *Eleocharis*. Hides during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and small birds. Feeding platforms may be constructed over deeper water from reeds trampled by the bird; platforms are often littered with prey remains. Breeding occurs in summer from October to January; nests are built in secluded places in densely vegetated wetlands on a platform of reeds; there are usually six olive-brown eggs to a clutch. Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges.		Absent	Low No habitat present on site that would support this species.	Low
Calidris ferruginea	Curlew Sandpiper	CE	CE	Generally, occupies littoral and estuarine habitats, and in NSW is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes, and lagoons on the coast and sometimes inland. It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed. Roosts on shingle, shell, or sand beaches; spits or islets on the coast or in wetlands; or sometimes in salt marsh, among beach-cast seaweed, or on rocky shores. Feeds on worms, molluscs, crustaceans, insects, and some seeds.		Absent	Low No habitat present on site that would support this species.	Low

				Distributed around most of the Australian coastline (including Tasmania). It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Inland records are probably mainly of birds pausing for a few days during migration.				
Calidris melanotos	Pectoral Sandpiper		M	In NSW, it is widespread, but scattered. Records exist east of the Great Divide, from Casino and Ballina, south to Ulladulla. West of the Great Divide, the species is widespread in the Riverina and Lower Western regions. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains, and artificial wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. It prefers wetlands that have open fringing mudflats and low, emergent, or fringing vegetation, such as grass or samphire. The species has also been recorded in swamp overgrown with lignum.		Absent	Low No habitat present on site that would support this species.	Low
Circus assimilis	Spotted Harrier	*Near threatened		Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland, and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn). Preys on terrestrial mammals (e.g., bandicoots, bettongs, and rodents), birds and reptile, occasionally insects and rarely carrion. Occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania.	1	Present	Marginal Some woodland habitat present, mostly in the form of planted eucalyptus. Species known to forage over farmland.	Low -Moderate Reduction of farmland foraging habitat would occur. Species recorded within the locality.
Melanodryas cucullata	Hooded Robin	V		Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Perches on low dead stumps and fallen timber or on low-hanging branches. Territories range from	2	Present	Marginal Some woodland habitat present, mostly in the form of planted eucalyptus.	Low Habitat to be removed is not considered likely to support this species. Pre-clear protocols would

				around 10 ha during the breeding season, to 30 ha in the non-breeding season. Nest is a small, neat cup of bark and grasses bound with webs, in a tree fork or crevice, from less than 1-5 m above the ground. Widespread across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. Considered a sedentary species, but local seasonal movements are possible. The south-eastern form (subspecies *cucullata*) is found from Brisbane to Adelaide and throughout much of inland NSW, with the exception of the extreme north-west, where it is replaced by subspecies picata.				occur.
Lewinia pectoralis	Lewin's Rail	V		Coastal saltwater areas, also freshwater wetlands and swamps.	2	Absent	Low No habitat present on site that would support this species.	Low
Lophochroa leadbeateri	Pink Cockatoo	CE		Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water. Feeds mostly on the ground, especially on the seeds of native and exotic melons and on the seeds of species of saltbush, wattles and cypress pines. Normally found in pairs or small groups, though flocks of hundreds may be found where food is abundant. Nesting, in tree hollows, occurs throughout the second half of the year; nests are at least 1 km apart, with no more than one pair every 30 square kilometres. Found across the arid and semi-arid inland, from south-western Queensland, south to north-west Victoria, through most of South Australia, north into the south-west Northern Territory and across to the west coast between Shark Bay. In NSW it is found regularly as far east as about Bourke and Griffith, and sporadically further east.	1	Present	Low One HBT present with hollow suitable in size for this species. Species recorded in the locality. Local records for this species should be considered with caution given that it is so far out of their normal range and possibly an aviary escape.	Low
Biziura lobata	Musk Duck	V		Musk Duck lives in deep freshwater lagoons, with dense vegetation on shores and thick reed beds. After breeding season, this species may be found in more open waters, such as sheltered bays or estuaries	2	Absent	Low No habitat present on site that would support this species.	Low

Callocephalon fimbriatum	Gang-gang Cockatoo		E	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. May also occur in sub-alpine Snow Gum (*Eucalyptus pauciflora*) woodland and occasionally in temperate rainforests. In NSW, it is distributed from the south-east coast to the Hunter region, inland to the Central Tablelands and south-west slopes, and regularly in the ACT. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee.		Present	Moderate One HBT present with hollow suitable in size for this species. Species not recorded in the locality however within known distribution of this species.	Low
Falco hypoleucos	Grey Falcon	V		Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast, and near wetlands where surface water attracts prey. Preys primarily on birds, especially parrots and pigeons, using high-speed chases and stoops; reptiles and mammals are also taken. Utilises old nests of other birds of prey and ravens, usually high in a living eucalypt near water or a watercourse; peak laying season is in late winter and early spring. Sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Believed to be extinct in areas with more than 500mm rainfall in NSW.		Marginal	Low Some marginal habitat present, not recorded in locality. Species usually present in more arid and semi-arid regions.	Low Species not likely to occur.
Falco subniger	Black Falcon	CE		The Black Falcon is found along tree-lined watercourses and in isolated woodlands, mainly in arid and semi-arid areas. It roosts in trees at night and often on power poles by day.	1	Marginal	Marginal Habitat present not preferred for this species; some preferred habitat present within the locality. Species recorded within locality.	Low Habitat to be removed is not considered likely to support this species. Pre-clear protocols would occur.

Antigone rubicunda	Brolga	E		Often feed in dry grassland or ploughed paddocks or even desert claypans, they are dependent on wetlands too, especially shallow swamps, where they will forage with their head entirely submerged. They feed using their heavy straight bill as a 'crowbar' to probe the ground or turn it over, primarily on sedge roots and tubers. They will also take large insects, crustaceans, molluscs and frogs. The nest comprises a platform of grasses and sticks, augmented with mud, on an island or in the water. Was formerly found across Australia, except for the south-east corner, Tasmania and the south-western third of the country. It is still abundant in the northern tropics, but very sparse across the southern part of its range.	2	Absent	Low No habitat present on site that would support this species.	Low
Gallinago hardwickii	Latham's Snipe		M	Usually inhabit open, freshwater wetlands with low, dense vegetation (e.g., swamps, flooded grasslands or heathlands, around bogs and other water bodies). Known to occur in the upland wetlands of the New England Tablelands and Monaro Plateau.		Absent	Low No habitat present on site that would support this species.	Low
Grantiella picta	Painted Honeyeater	V	V	Nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema.* Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.		Present	Marginal Some woodland habitat present, mostly in the form of planted eucalyptus.	Low Habitat to be removed is not considered likely to support this species. Pre-clear protocols would occur.
Hieraaetus morphnoides	Little Eagle	V		The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. Occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland or open woodland, Sheoak or Acacia woodlands, and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs	2	Present	Marginal Some woodland habitat present, mostly in the form of planted eucalyptus.	Low Habitat to be removed is not considered likely to support this species. Pre-clear protocols would

				build a large stick nest in winter.				occur.
Hirundapus caudacutus	White-throated Needletail	V	M	Arrive in Australia from their breeding grounds in the northern hemisphere in about October each year and leave somewhere between May and August. Are non-breeding migrants in Australia. Breeding takes place in northern Asia.	1	Marginal	Low No habitat present on site that would support this species. Species is predominately aerial, preferring to utilise higher altitude habitat.	Low
Chlidonias leucopterus	White-winged Black Tern		M	A non-breeding migrant to Australia, where it is widespread and common along south-western, northern and central-eastern coasts, with only scattered records of small numbers along the coasts elsewhere in southern Australia.	1	Absent	Low No habitat present on site that would support this species.	Low
Lathamus discolor	Swift Parrot	CE	CE	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. Migrates to the Australian south-east mainland between March and October. No breeding in NSW. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*.	1	Present	Marginal Some woodland habitat present, mostly in the form of planted eucalyptus.	Low Habitat to be removed is not considered likely to support this species. Pre-clear protocols would occur.
Motacilla flava	Yellow Wagtail		M	Occupies a range of damp or wet habitats with low vegetation, from damp meadows, marshes, waterside pastures, sewage farms and bogs to damp steppe and grassy tundra. In the north of its range, it is also found in large forest clearings. Breeds from April to August, although this varies with latitude.		Absent	Low No habitat present on site that would support this species.	Low
Myiagra cyanoleuca	Satin Flycatcher		M	Found along the east coast of Australia in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests. Nests in loose colonies of two to five pairs nesting at intervals of		Marginal	Low Some woodland habitat present, mostly in the form	Low Habitat to be removed is not considered

				about 20-50 m apart. It builds a broad-based, cup-shaped nest of shredded bark and grass, coated with spider webs and decorated with lichen. The nest is placed on a bare, horizontal branch, with overhanging foliage, about 3-25 m above the ground.			of planted eucalyptus, may be used by this species during migration however unlikely to support population of this species.	likely to support this species. Pre-clear protocols would occur.
Ninox strenua	Powerful Owl	V		Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. Breeds and hunts in open or closed sclerophyll forest or woodlands and in open habitats. Roosts by day in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and eucalypt species. Prey items are medium-sized arboreal mammals, mainly Greater Glider, Common Ringtail Possum, Sugar Glider, and Flying Foxes. Most prey species require hollows and a shrub layer, these are important habitat components. Owls may need up to 4000 ha. Nests in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. Nesting occurs from late autumn to mid-winter.	2	Present	Moderate One HBT present with hollow suitable in size for this species. Species recorded in the locality.	Low
Pyrrholaemus sagittatus	Speckled Warbler	E		Has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. Lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area.	2	Present	Marginal Some woodland habitat present, mostly in the form of planted eucalyptus.	Low Habitat to be removed is not considered likely to support this species. Pre-clear protocols would occur.

Numenius madagascariensis	Eastern Curlew	CE	CE, M	In NSW, occurs across the entire coast but is mainly found in estuaries such as the Hunter River, Port Stephens, Clarence River, Richmond River and ICOLLs of the south coast. Generally, occupies coastal lakes, inlets, bays and estuarine habitats, and in NSW is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. Forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed. Roosts on sandy spits and islets, especially on dry beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. May also roost on wooden oyster leases or other similar structures. Is carnivorous, mainly eating crustaceans.		Absent	Low No habitat present on site that would support this species.	Low
Pedionomus torquatus	Plains Wanderer	CE	CE	Live in semi-arid, lowland native grasslands that typically occur on hard red-brown soils. These grasslands support a high diversity of plant species, including a number of state and nationally threatened species. Habitat structure appears to play a more important role than plant species composition. Preferred habitat typically comprises 50% bare ground, 10% fallen litter, and 40% herbs, forbs and grasses. Most grassland habitat is <5 cm high, but some vegetation up to a maximum of 30 cm is important for concealment, as long as grass tussocks are spaced 10-20 cm apart. During prolonged drought, the denudation of preferred habitats may force birds into marginal denser and taller grassland habitats that become temporarily suitable. Average home range of a single bird is about 12 ha. Breeding pairs have overlapping home ranges that total approximately 18 ha. Is a ground-dwelling grassland bird, which is cryptic and very difficult to observe during the day. Can only be properly surveyed at night using spotlighting techniques. 99% of records in NSW in the past 30 years come from an area of the western Riverina bounded by Hay and Narranderra on the Murrumbidgee River in the north, the Cobb		Absent	Low No habitat present on site that would support this species. Grassland present however not suitable species and structure for this species.	Low

				Highway in the west, the Billabong Creek in the south, and Urana in the east. The amount of high-quality habitat in the Riverina drops to 1-2% during very wet or dry years when grasslands become too dense or are grazed too bade.				
Sternula nereis nereis	Australian Fairy Tern	CE	V	The Fairy Tern (Australian) nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The subspecies has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline. The bird roosts on beaches at night.		Absent	Low No habitat present on site that would support this species.	Low
Rhipidura rufifrons	Rufous Fantail		M	Found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground. During migration, it may be found in more open habitats or urban areas. Builds a small compact cup nest, of fine grasses bound with spider webs, that is suspended from a tree fork about 5 m from the ground. The bottom of the nest is drawn out into a long stem.		Marginal	Low Some woodland habitat present, mostly in the form of planted eucalyptus, may be used by this species during migration however unlikely to support population of this species.	Low Habitat to be removed is not considered likely to support this species. Pre-clear protocols would occur.
Stagonopleura guttata	Diamond Firetail	V		Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum *Eucalyptus pauciflora* Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). Usually encountered in flocks of between 5-40 birds, occasionally more. Groups separate into small colonies to breed, between August and January. Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. Appears to be sedentary, though some populations move locally, especially those in the south. Has been recorded in some towns and near farm houses. Endemic to	2	Present	Marginal Some woodland habitat present, mostly in the form of planted eucalyptus.	Low Habitat to be removed is not considered likely to support this species. Pre-clear protocols would occur.

				south-eastern Australia, extending from central Queensland to the Eyre Peninsula in South Australia. It is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina.				
Tringa nebularia	Common Greenshank	E	M	Does not breed in Australia, however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia. In NSW, the species has been recorded in most coastal regions. It is widespread west of the Great Dividing Range, especially between the Lachlan and Murray Rivers and the Darling River drainage basin, including the Macquarie Marshes, and north-west regions.		Absent	Low No habitat present on site that would support this species.	Low
Amphibians								
Litoria raniformis	Southern Bell Frog	V	V	Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys. They are also found in irrigated rice crops, particularly where there is no available natural habitat. Breeding occurs during the warmer months and is triggered by flooding or a significant rise in water levels. Known to breed anytime from early spring through to late summer/early autumn (Sept to April) following a rise in water levels. During the breeding season animals are found floating amongst aquatic vegetation (especially cumbungi or Common Reeds) within or at the edge of slow-moving streams, marshes, lagoons, lakes, farm dams and rice crops. Tadpoles require standing water for at least 4 months for development and metamorphosis to occur but can take up to 12 months to develop. Outside the breeding season animals disperse away from the water and take shelter beneath ground debris such as fallen timber and bark, rocks, grass clumps and in deep soil cracks.		Absent	Low No habitat present on site that would support this species.	Low

Mammals								
Dasyurus maculatus maculatus	Spotted-Tailed Quoll (South-Eastern Mainland Population)	E	E	The Spot-tailed Quoll has a preference for mature wet forest habitat, especially in areas with rainfall 600 mm/year. Unlogged forest or forest that has been less disturbed by timber harvesting is also preferable. This subspecies has been recorded from a wide range of habitats, including: • temperate and subtropical rainforests in mountain areas • wet sclerophyll forest • lowland forests • open and closed eucalypt woodlands • inland riparian and River Red Gum (*Eucalyptus camaldulensis*) forests • dry rain shadow woodland • sub-alpine woodlands • coastal heathlands • occasional sightings from open country, grazing lands, rocky outcrops and other treeless areas The Spot-tailed Quoll is predominantly nocturnal and rests during the day in dens. Habitat requirements include suitable den sites such as hollow logs, tree hollows, rock outcrops or caves. Individuals also require an abundance of food, such as birds and small mammals, and large areas of relatively intact vegetation through which to forage. This subspecies is moderately arboreal and approximately 11% of travelling is done in trees.		Absent	Low Habitat present is not likely to support this species, not recorded within the locality.	Low
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps		Present	Marginal Some woodland habitat present, mostly in the form of planted eucalyptus. Flying fox camp recorded	Low Habitat to be removed is not considered likely to support this species. Pre-clear

				may have tens of thousands of animals and are used for mating, giving birth and rearing young. Annual mating commences in January and a single young is born in October or November. Site fidelity to camps is high; some camps have been used for over a century. Can travel up to 50km from the camp to forage; commuting distances are more often <20 km. Feed on the nectar and pollen of native trees, in particular *Eucalyptus, Melaleuca* and *Banksia,* and fruits of rainforest trees and vines. Also forage in cultivated gardens and fruit crops.			in Maffra and near Lake Glen Maggie in 2014.	protocols would occur. Not breeding or roosting location.
Petaurus australis australis	Yellow-bellied Glider		V	Found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar. Live in small family groups of two - six individuals and are nocturnal. Den, often in family groups, in hollows of large trees. Very mobile and occupy large home ranges between 20 to 85 ha to encompass dispersed and seasonally variable food resources.		Present	Moderate One HBT present with hollow suitable in size for this species, however species not recorded within locality and no woodland connected to HBT. Habitat on site unlikely to support this species.	Low Species unlikely to use stag tree to be removed, in open paddock more than 75 metres from nearest tree or vegetation patch.
Fish								
Galaxiella pusilla	Dwarf Galaxias	E	V	Eastern Dwarf Galaxias has broad habitat requirements and occurs in slow flowing and still, shallow, permanent and temporary freshwater habitats such as swamps, drains and the backwaters of streams and creeks, often (but not always) containing dense aquatic macrophytes and emergent plants. In large pools, the species is usually found amongst marginal vegetation. Some wetlands where it occurs may partially or		Absent	Low No habitat present on site that would support this species.	Low

				completely dry up during summer and such wetlands rely on seasonal flooding plus linkages to other sites where the species occurs, for recolonization. Wetlands connected to a more permanent waterbody (such as river or creek) may also be vital to their long-term survival (particularly during extended dry conditions) and must therefore be considered as part of the habitat requirement critical to survival. The Eastern Dwarf Galaxias are known to occupy a wide range of habitats; however, the species' specific (or 'preferred') habitat requirements are not well known. The national recovery plan lists the determination of the species habitat use at different life history stages and across total range as a key objective of the plan. The determination would include the development of a predictive habitat model and the development of management strategies to maintain enhance or restore essential habitat requirements.				
Nannoperca obscura	Yarra Pygmy Perch	V	V	The Yarra Pygmy Perch typically occurs in lakes, ponds and slow-flowing rivers, but prefers small-medium sized, relatively shallow (1-2 m) freshwater streams with moderate to high flow. It is a demersal species that completes its life cycle in freshwater. It is usually associated with large amounts of aquatic vegetation (particularly emergent vegetation) and log snags in clear, fresh to slightly brackish water. The distributional range of the Yarra Pygmy Perch coincides with Victoria's ancient volcanic region; most streams in this area are notably alkaline and have a high mineral content. The species occurs in Deep Creek, which is a clear, slow to steady flowing creek with a silt or solid rock substrate. In winter, the average depth is around 0.5-1.5 m. summer water levels are greatly reduced, with little if any water flow. Typical winter water temperatures are 7-9 °C and summer water temperature averages 17-19 °C. Water chemistry is pH 7.6-7.8. In artificial ponds this species has survived minimum and maximum water temperatures of 5 °C and 35 °C, respectively.		Absent	Low No habitat present on site that would support this species.	Low

Prototroctes maraaena	Australian Grayling		V	Is diadromous, spending part of its lifecycle in freshwater and at least part of the larval and/or juvenile stages in coastal seas. Adults (including pre spawning and spawning adults) inhabit cool, clear, freshwater streams with gravel substrate and areas alternating between pools and riffle zones such as the Tambo River, which is also known to have granite outcrops. Also associated with clear, gravel-bottomed habitats in the Mitchell and Wonnangatta Rivers (Victoria) and in a muddy-bottomed, heavily silted habitat in the Tarwin River (Victoria). Has been found over 100 km upstream from the sea. Currently, occurs in streams and rivers on the eastern and southern flanks of the Great Dividing Range, from Sydney, southwards to the Otway Ranges of Victoria and in Tasmania. Found in fresh and brackish waters of coastal lagoons, from Shoalhaven River in NSW to Ewan Point in South Australia. Absent from the inland Murray-Darling system. In Victoria in the 1980s, this species had been most frequently collected in the Tambo, Barwon, Mitchell and Tarwin River systems. In NSW, there are many sightings from the Deua River that cover all year classes, usually in small shoals containing a number of individuals.		Absent	Low No habitat present on site that would support this species.	Low
Reptiles								
Aprasia parapulchella	Pink-tailed Worm-lizard	E	V	Known from the Central and Southern Tablelands, and the South Western Slopes. A concentration of populations in the Canberra/Queanbeyan Region, Cooma, Yass, Bathurst, Albury and West Wyalong. Inhabits sloping, open woodland areas with predominantly native grassy ground layers, particularly those dominated by Kangaroo Grass (*Themeda triandra*). Sites are typically well-drained, with rocky outcrops or scattered, partially buried rocks. Commonly found beneath small, partially embedded rocks and appear to spend considerable time in burrows below these rocks; the burrows have been constructed by and are often still inhabited by small black ants and termites. Feeds on the larvae and eggs of the ants		Absent	Low Habitat on site not considered likely to support this species. Not recorded within the locality. One small area of rocky habitat present. Not likely to support this species.	Low

				with which it shares its burrows.				
Delma impar	Striped Legless Lizard	E	V	Occurs in the Southern Tablelands, the South West Slopes, the Upper Hunter and possibly on the Riverina. Populations are known in the Goulburn, Yass, Queanbeyan, Cooma, Muswellbrook and Tumut areas. Also occurs in the ACT, Victoria and south-eastern South Australia. Found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo Grass *Themeda triandra*, spear-grasses *Austrostipa* spp., Poa tussocks *Poa* spp., and occasionally wallaby grasses *Austrodanthonia* spp. Sometimes present in modified grasslands with a significant content of exotic grasses. Sometimes found in grasslands with significant amounts of surface rocks, which are used for shelter. Sometimes utilises dried cowpats for shelter. Actively hunts for spiders, crickets, moth larvae and cockroaches.		Marginal	Moderate Some marginal habitat (exotic dominated grassland and native grassland) present, however species not recorded within the locality. However, within an area mapped where species may occur.	Low No suitable habitat to be impacted
Tympanocryptis pinguicolla	Grassland Earless Dragon	CE	E	The grassland earless dragon is a native grassland specialist inhabiting natural temperate grasslands. This habitat is best described in the endangered ecological community description for natural temperate grasslands of the Southern Tablelands. Burrows of the wolf spider (*Lycosa* spp.) and wood cricket (*Cooraboorama canberrae*), embedded surface rocks and tussocks are habitat components critical to this species survival. Natural temperate grassland with actual or potential connectivity value is also habitat critical to this species survival.		Absent	Low No habitat on site considered likely to support this species, not recorded within locality and not within the mapped distribution of this species.	Low
Invertebrates								
Synemon plana	Golden Sun Moth	V	CE	NSW populations are found in the area between Queanbeyan, Gunning, Young and Tumut. Historical distribution extended from Bathurst (central NSW) through the NSW Southern Tablelands, through to central and western Victoria, to Bordertown in eastern South Australia.		Marginal	Marginal Some potentially suitable habitat present. However not recorded in the locality and not	Low – Moderate Suitable habitat identified. A small area, 0.001 ha

				Occurs in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which ground layer is dominated by wallaby grasses *Rytidosperma* spp. Grasslands dominated by wallaby grasses are typically low and open - the bare ground between the tussocks is thought to be an important microhabitat feature, as it is typically these areas on which the females are observed displaying to attract males. Habitat may contain several wallaby grass species, which are typically associated with other grasses particularly spear-grasses *Austrostipa* spp. or Kangaroo Grass *Themeda triandra*. Larvae feed on the roots of the wallaby grass plant.			within the mapped distribution of this species.	proposed for removal.

Appendix C MNES Search Results

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 28-Apr-2022

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	40
Listed Migratory Species:	12

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	19
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	1
Regional Forest Agreements:	1
Nationally Important Wetlands:	None
EPBC Act Referrals:	5
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands)		[Resource Information]
Ramsar Site Name	Proximity	Buffer Status
Port phillip bay (western shoreline) and bellarine peninsula	Within 10km of Ramsar site	In feature area

Listed Threatened Ecological Communities			[Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Grassy Eucalypt Woodland of the Victorian Volcanic Plain	Critically Endangered	Community known to occur within area	In feature area
Natural Temperate Grassland of the Victorian Volcanic Plain	Critically Endangered	Community likely to occur within area	In feature area
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains	Critically Endangered	Community likely to occur within area	In buffer area only
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community likely to occur within area	In feature area

Listed Threatened Species			[Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour may occur within area	In feature area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Callocephalon fimbriatum Gang-gang Cockatoo [768]	Endangered	Species or species habitat likely to occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pedionomus torquatus Plains-wanderer [906]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area	In buffer area only
FISH			
Galaxiella pusilla Eastern Dwarf Galaxias, Dwarf Galaxias [56790]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Nannoperca obscura			
Yarra Pygmy Perch [26177]	Vulnerable	Species or species habitat known to occur within area	In feature area
Prototroctes maraena			
Australian Grayling [26179]	Vulnerable	Species or species habitat may occur within area	In feature area
FROG			
Litoria raniformis			
Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828]	Vulnerable	Species or species habitat likely to occur within area	In feature area
INSECT			
Synemon plana			
Golden Sun Moth [25234]	Vulnerable	Species or species habitat known to occur within area	In feature area
MAMMAL			
Dasyurus maculatus maculatus (SE mainland population)			
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area	In feature area
Petaurus australis australis			
Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Pteropus poliocephalus			
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
PLANT			
Amphibromus fluitans			
River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Caladenia ornata			
Ornate Pink Fingers [76213]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Caladenia pumila			
Dwarf Spider-orchid [4155]	Critically Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Dianella amoena Matted Flax-lily [64886]	Endangered	Species or species habitat likely to occur within area	In feature area
Dodonaea procumbens Trailing Hop-bush [12149]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Glycine latrobeana Clover Glycine, Purple Clover [13910]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Lachnagrostis adamsonii Adamson's Blown-grass, Adamson's Blowngrass [76211]	Endangered	Species or species habitat likely to occur within area	In feature area
Lepidium aschersonii Spiny Pepper-cress [10976]	Vulnerable	Species or species habitat may occur within area	In feature area
Lepidium hyssopifolium Basalt Pepper-cress, Peppercress, Rubble Pepper-cress, Pepperweed [16542]	Endangered	Species or species habitat likely to occur within area	In feature area
Leucochrysum albicans subsp. tricolor Hoary Sunray, Grassland Paper-daisy [89104]	Endangered	Species or species habitat likely to occur within area	In feature area
Pimelea spinescens subsp. spinescens Plains Rice-flower, Spiny Rice-flower, Prickly Pimelea [21980]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Pterostylis chlorogramma Green-striped Greenhood [56510]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Pterostylis cucullata Leafy Greenhood [15459]	Vulnerable	Species or species habitat may occur within area	In feature area
Rutidosis leptorhynchoides Button Wrinklewort [67251]	Endangered	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Senecio macrocarpus Large-fruit Fireweed, Large-fruit Groundsel [16333]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Thelymitra epipactoides Metallic Sun-orchid [11896]	Endangered	Species or species habitat may occur within area	In buffer area only
Xerochrysum palustre Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat may occur within area	In feature area
REPTILE			
Aprasia parapulchella Pink-tailed Worm-lizard, Pink-tailed Legless Lizard [1665]	Vulnerable	Species or species habitat may occur within area	In feature area
Delma impar Striped Legless Lizard, Striped Snake-lizard [1649]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Tympanocryptis pinguicolla Grassland Earless Dragon [66727]	Endangered ADVERTISED PLAN	Species or species habitat may occur within area	In feature area

Listed Migratory Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area	In feature area
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding known to occur within area overfly marine area	In feature area
Neophema chrysostoma Blue-winged Parrot [726]		Species or species habitat known to occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area	In feature area

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State	Buffer Status
Durdidwarrah B.R.	Natural Features Reserve	VIC	In buffer area only

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

RFA Name	State	Buffer Status
West Victoria RFA	Victoria	In feature area

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Geelong Bypass Sections 1 & 2	2005/2097	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed	In feature area
Power Station	2001/239	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

Appendix D Native Vegetation Removal Report

Native vegetation removal report

This report provides information to support an application to remove, destroy or lop native vegetation in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation*. The report **is not an assessment by DELWP** of the proposed native vegetation removal. Native vegetation information and offset requirements have been determined using spatial data provided by the applicant or their consultant.

Date of Issue: 13/07/2022
Time of Issue: 4:27 pm

Report ID: NGH_2022_008

Project ID	21-425_Anakie_SF_Ensym_20220708_V5

Assessment pathway

Assessment pathway	**Intermediate Assessment Pathway**
Extent including past and proposed	0.071 ha
Extent of past removal	0.000 ha
Extent of proposed removal	0.071 ha
No. Large trees proposed to be removed	
Location category of proposed removal	**Location 1** The proposed removal is not mapped as an endangered Ecological Vegetation Class (as per the statewide EVC map), sensitive wetland or coastal area. Removal of less than 0.5 hectares in this location will not have [illegible] or threatened species

1. Location map

VICTORIA State Government | Environment, Land, Water and Planning

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Native vegetation removal report

Offset requirements if a permit is granted

Any approval granted will include a condition to obtain an offset that meets the following requirements:

General offset amount[1]	0.014 general habitat units
Vicinity	Corangamite Catchment Management Authority (CMA) or Greater Geelong City Council
Minimum strategic biodiversity value score[2]	0.288
Large trees	1 large tree

NB: values within tables in this document may not add to the totals shown above due to rounding

Appendix 1 includes information about the native vegetation to be removed

Appendix 2 includes information about the rare or threatened species mapped at the site.

Appendix 3 includes maps showing native vegetation to be removed and extracts of relevant species habitat importance maps

1 The general offset amount required is the sum of all general habitat units in Appendix 1.

2 Minimum strategic biodiversity score is 80 per cent of the weighted average score across habitat zones where a general offset is required

70%

Native vegetation removal report

Next steps

Any proposal to remove native vegetation must meet the application requirements of the Intermediate Assessment Pathway and it will be assessed under the Intermediate Assessment Pathway.

If you wish to remove the mapped native vegetation you are required to apply for a permit from your local council. Council will refer your application to DELWP for assessment, as required. **This report is not a referral assessment by DELWP.**

This *Native vegetation removal report* must be submitted with your application for a permit to remove, destroy or lop native vegetation.

Refer to the *Guidelines for the removal, destruction or lopping of native* vegetation (the Guidelines) for a full list of application requirements This report provides information that meets the following application requirements:

- The assessment pathway and reason for the assessment pathway
- A description of the native vegetation to be removed (met unless you wish to include a site assessment)
- Maps showing the native vegetation and property
- The offset requirements determined in accordance with section 5 of the Guidelines that apply if approval is granted to remove native vegetation.

Additional application requirements must be met including:

- Topographical and land information
- Recent dated photographs
- Details of past native vegetation removal
- An avoid and minimise statement
- A copy of any Property Vegetation Plan that applies
- A defendable space statement as applicable
- A statement about the Native Vegetation Precinct Plan as applicable
- An offset statement that explains that an offset has been identified and how it will be secured.

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Authorised by the Victorian Government, 8 Nicholson Street, East Melbourne.

For more information contact the DELWP Customer Service Centre 136 186

www.delwp.vic.gov.au

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Page 3

Appendix 1: Description of native vegetation to be removed

All zones require a general offset, the general habitat units each zone is calculated by the following equation in accordance with the Guidelines:

General habitat units = extent x condition x general landscape factor x 1.5, where the general landscape factor = 0.5 + (strategic biodiversity value score/2)

The general offset amount required is the sum of all general habitat units per zone.

Native vegetation to be removed

Information provided by or on behalf of the applicant in a GIS file							Information calculated by EnSym					
Zone	Type	BioEVC	BioEVC conservation status	Large tree(s)	Partial removal	Condition score	Polygon Extent	Extent without overlap	SBV score	HI score	Habitat units	Offset type
1-a	Patch	vvp_0055_61	Endangered	0	no	0.210	0.001	0.001	0.320		0.000	General
2-a	Scattered Tree	vvp_0055_61	Endangered	1	no	0.200	0.070	0.070	0.360		0.014	General

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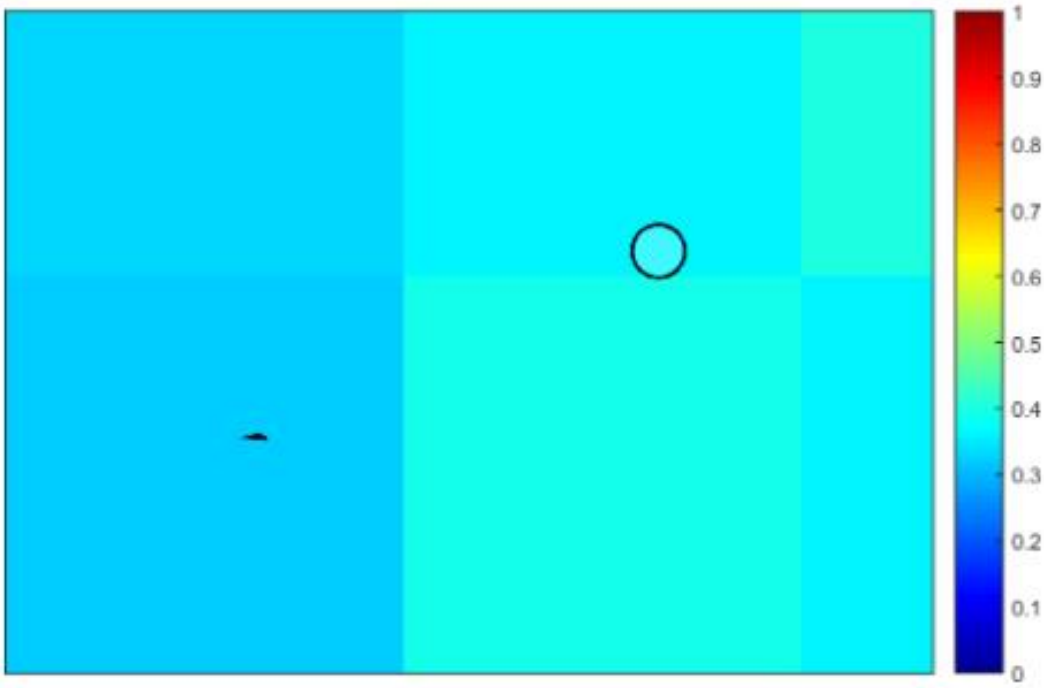
Appendix 2: Information about impacts to rare or threatened species' habitats on site

This is not applicable in the Intermediate Assessment Pathway.

Appendix 3 – Images of mapped native vegetation

2. Strategic biodiversity values map



3. Aerial photograph showing mapped native vegetation

4. Map of the property in context

Yellow boundaries denote areas of proposed native vegetation removal.

Appendix E Third Party Offset Quote

vegetationlink

Our reference: VLQ-8287
Your reference: Anakie Solar Farm

14 July 2022

Dimity Bambrick
NGH Consulting
Dimity.B@nghconsulting.com.au

Dear Dimity

RE: Quotation for the supply of native vegetation credits

Vegetation Link is an accredited offset provider with the Department of Environment, Land, Water & Planning (DELWP). We offer a specialised brokerage service to enable permit holders and developers to identify suitable native vegetation credits to meet their planning permit offset requirements.

Based on the information you have provided, I understand you require the following native vegetation offset:

Offset type	Vicinity	General habitat units (GHU)	Min. strategic biodiversity value (SBV)	Large trees
General	Corangamite CMA	0.014	0.288	1

To meet your offset requirements, you can purchase native vegetation credits from a third party as per the option quoted below[1]. This quotation is valid for 14 days, subject to credit availability and landholder pricing.

CTA pathway – offset site located in the Colac Otway Shire area (approx. 4-6 week turnaround from acceptance of quote)	
Cost of native vegetation credits – **invoiced by Credit Owner**	$2,040.00
Transaction fees – **invoiced by Vegetation Link**	$1,280.00
Total (ex. GST)	**$3,320.00**
Total (inc. GST)	**$3,652.00**

If you would like to purchase credits, let us know that you accept the quote and return the attached **purchaser details form** by email. Upon receipt of the form, we will begin the trade process. Further details of the process for credit allocation is in the FAQ below.

Should you have any queries, please do not hesitate to contact us on 1300 VEG LINK (1300 834 546) or email offsets@vegetationlink.com.au.

Sincerely,

Tesha Mahoney
Biodiversity Offset Broker

[1] *Note that the transaction fee includes DELWP NVOR transfer and allocation fees and a Vegetation Link fee*

Vegetation Link Pty Ltd
ABN: 92 169 702 032
www.vegetationlink.com.au
1300 VEG LINK (1300 834 546) | offsets@vegetationlink.com.au | PO Box 10 Castlemaine VIC 3450

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vegetationlink

What happens if I don't have a permit yet?

When people are buying credits before a permit is issued, the following three options are most common:

- You can pay for the offsets before the planning permit is available, and then the offsets are allocated to the permit when it is available. This will incur an additional $50 fee from DELWP. When considering this option, it is important to realise that your estimated offset requirements may be different than the actual permit requirements.
- You can wait for the planning permit to be approved first and then request a quote to meet the requirements in your permit. Should credits be available, you can then start the offset purchase process. We then use the planning permit number for allocating the credits. Allocating credits to the permit is evidence that you have purchased your offset.
- You can request a quote to confirm availability and to get an idea of the cost of offsetting before you apply for a permit. Once you receive the planning permit you can request an updated quote. It is at this point that you can then go through the offset purchase process.

We cannot guarantee credit availability until a) contracts are executed, or b) credits have been held via a pending trade lodged with DELWP Native Vegetation Offset Register.

We cannot guarantee price until a) a quote has been accepted within 14 days, and b) a Credit Trading Agreement is signed within 21 days, and c) the invoice for the credits is paid within 28 days of the date the invoice is issued.

If I sign the contract, does that mean I MUST pay for the credits?

Yes, you have entered into a contract agreeing to pay for the offset credits therein and are required to pay for those credits. The credits must be paid for within 28 days of the date of the invoice.

Can you hold the credits for me, as I want to pay later?

We are unable to hold credits for later payment. Please also see 'What happens if I don't have a permit yet?' above.

For further information, see our website or the DELWP website.

vegetationlink

FAQs

What is a third party offset?

A third party offset is an offset site owned by another landowner who manages and protects native vegetation on their land. Landowners who establish these offset sites are required to:

- Enter into a Landowner Agreement for the specified offset site. A landowner agreement is in perpetuity and is binding upon the current and future landowners of the site. It permanently restricts use of the site for many purposes.
- Implement a detailed 10-year Management Plan endorsed by the DELWP Native Vegetation Offset Register to manage and improve the biodiversity values of the site.

How is the price of native vegetation offset credit (GHUs, GBEUs etc.) determined?

Landowners who own offset sites set their own price for native vegetation credits. They determine the price based on numerous factors. This includes but not limited to site establishment, the cost to manage the site in perpetuity (e.g., maintain fencing, control pest species), foregone use cost, and administrative costs. Depending on how the site is registered, the credit fee may be paid to either DELWP or directly to the landowner.

Further information about the work some of our landowners are doing can be found on the Vegetation Link website.

What is the process after I accept the quote?

After you accept the quote and return the purchaser table, the following steps will be undertaken:

1. We will set up a contract between the parties involved and send the contract out for signing by all parties.
2. Once the contract is signed by all parties, invoices will be issued for the fees listed in the quotation. We will send you two invoices, one for our transaction fee invoiced by Vegetation Link and one for the credit fee, usually to be paid to DELWP or the landowner. We recommend providing remittances for your payments.
3. Once payments are received, Vegetation Link will send you an allocated credit extract from the Native Vegetation Offset Register and your executed contract as evidence that you have purchased the offset.

How long will the process take? When will I get my credits?

Generally, the process from quote acceptance to having evidence of allocated credits takes between 2-6 weeks. This is dependent on a range of factors including the type of landholder agreement, contract types and organisational workflows. We work as quickly as possible to get your credits to you within this time period.

We note that you **cannot** remove vegetation until you have been given permission by the Responsible Authority (usually the council that has issued your permit).

Appendix D Traffic impact assessment

Amber

Traffic & Transportation Direction

Anakie Solar Farm

1435-1475 Ballan Road, Anakie

Traffic Impact Assessment

May 2022

Reference: 389 rep 220504 final

Anakie Solar Farm

1435-1475 Ballan Road, Anakie

Traffic Impact Assessment

Prepared for: NGH Pty Ltd

Status: Final report

Date: 4 May 2022

Reference: 389 rep 220504 final

Contact

Website: www.amberorg.com.au E: info@amberorg.com.au Phone: 1800 022 363

Amber

Table of Contents

1. Background

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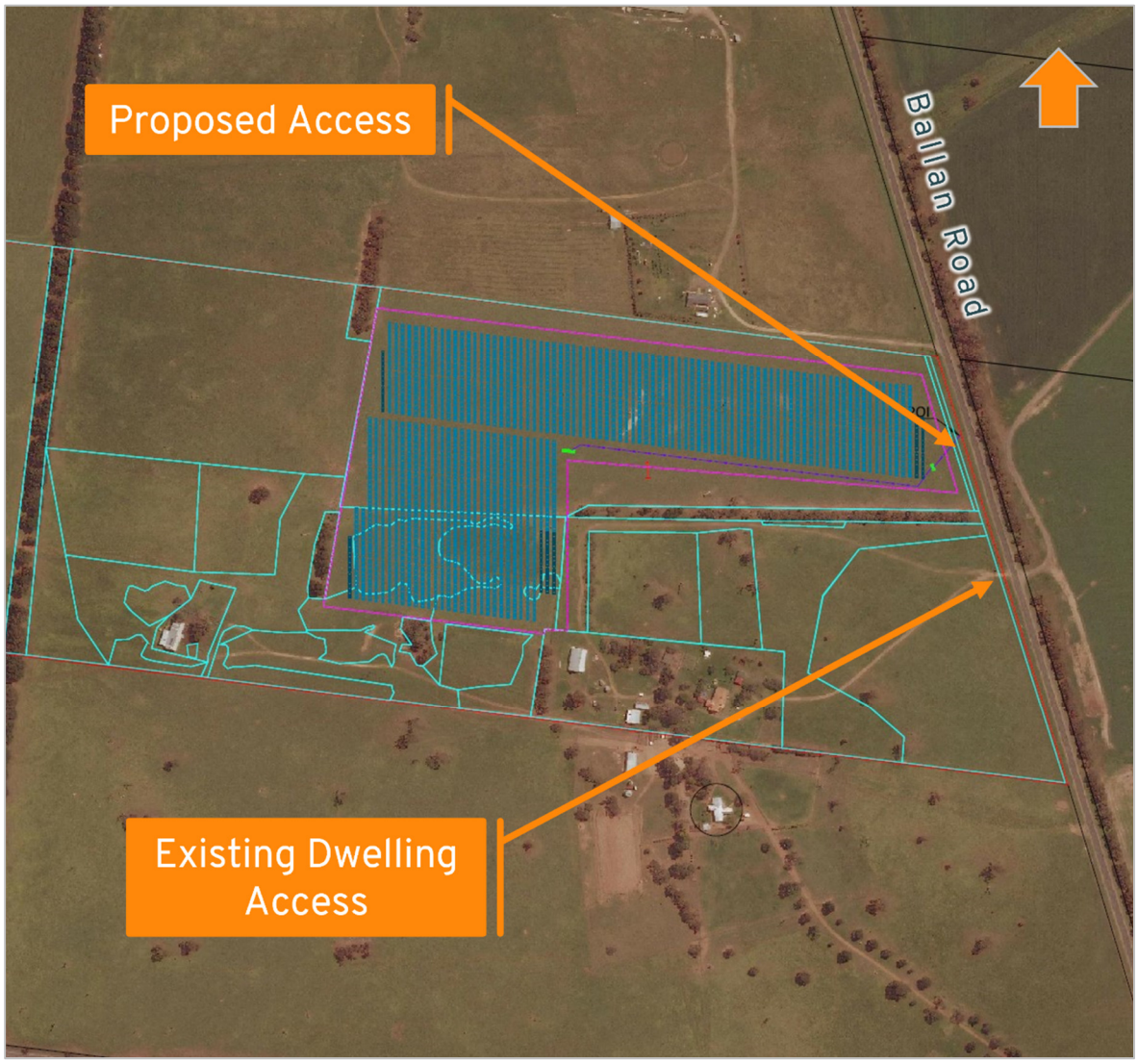
1.1 Background

Amber Organisation Pty Ltd has been engaged by NGH Pty Ltd to conduct a review of the traffic implications of the Anakie Solar Farm and prepare a Traffic Impact Assessment.

The solar farm is located approximately 6km south of Anakie and is proposed to have a capacity of 4.95MW. Access to the site is proposed via a new access to Ballan Road at the northern end of the site. Staff are expected to primarily be located in Anakie and Geelong with all plant expected to be delivered from GeelongPort.

Figure 1 shows the proposed layout of the site in relation to the road network, access locations and existing infrastructure.

Figure 1: Site Layout



Source: NGH Pty Ltd

1.2 Purpose of Document

This Traffic Impact Assessment has been prepared to assess the construction and operational traffic impacts, and the access arrangements of the solar farm. The assessment details how road impacts of the project traffic, particularly from heavy vehicle use and oversize and overmass vehicles, will be avoided or managed using road-use management strategies.

More specifically, the report addresses the following key matters:

- Details of both light and heavy vehicle traffic volumes and proposed transport routes;
- An assessment of the potential traffic impacts of the project on road network function and safety;
- An assessment of the capacity of the existing road network to accommodate the type and volume of traffic generated by the project;
- Details of measures to mitigate and / or manage potential impacts, including construction traffic control, road dilapidation surveys and measures to control soil erosion and dust generated by traffic volumes; and
- Details of access roads and how these connect to the existing road network and ongoing operational maintenance.

The traffic assessment has been undertaken in conjunction with consultation with Department of Transport and City of Greater Geelong. It also responds to the requirements outlined within the *Department of Environment, Land, Water and Planning Solar Energy Facilities Design and Development Guideline 2019.*

2. Existing Conditions

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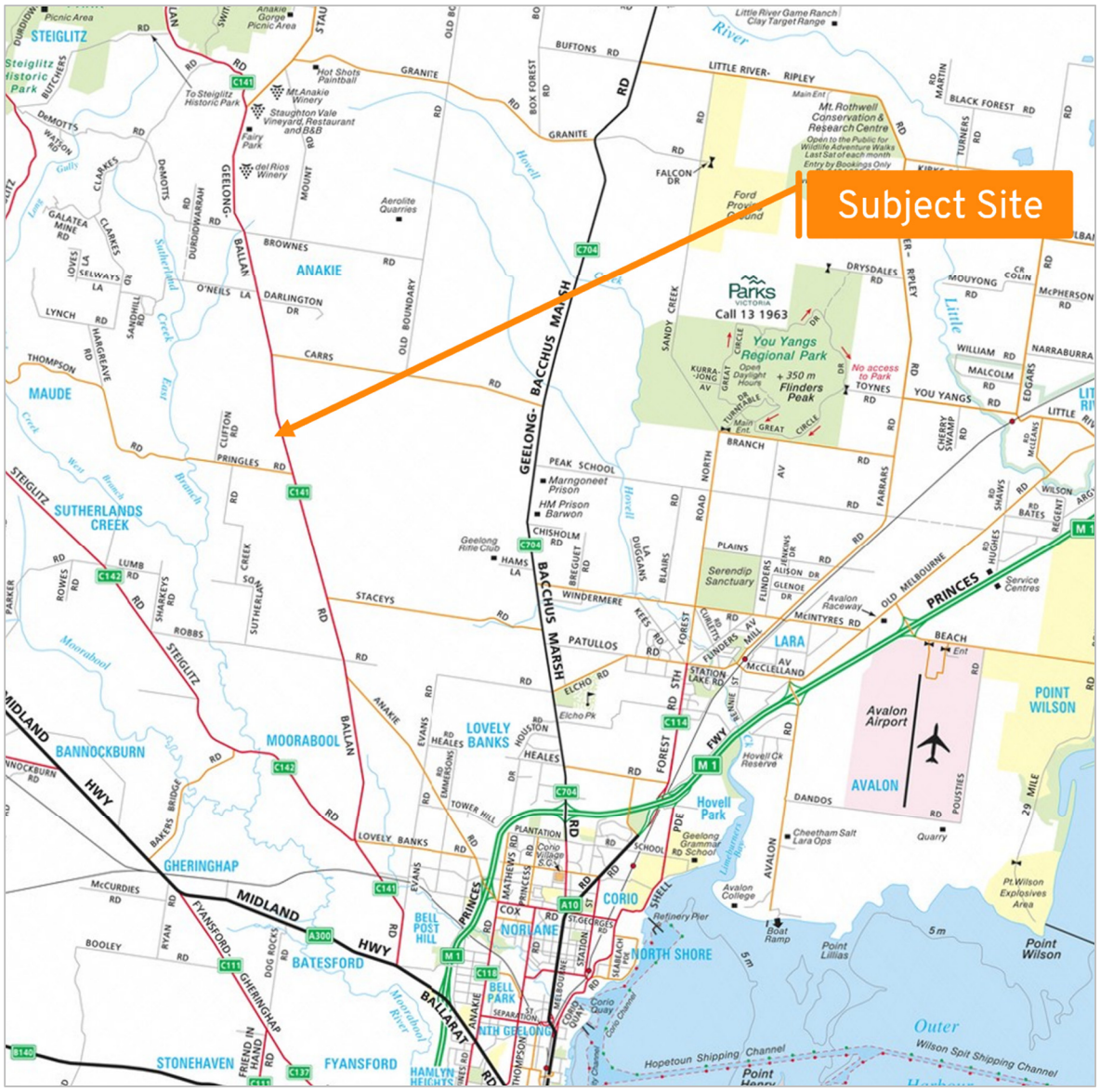
2.1 Site Location

The site forms Lot 6 TP434281 and is located approximately 6km south of Anakie on the western side of Ballan Road. Figure 2 shows the location of the site in relation to the surrounding transport network.

Figure 2: Site Location



Source: Melways

The site is zoned as Farming Zone (FZ) and is occupied by a dwelling and agricultural land. Access to the dwelling is currently provided via a single-width access to Ballan Road.

2.2 Road Network

Ballan Road is a Secondary State Arterial Road under the care and management of Department of Transport and is classified as a TRZ2 Principal Road Network Zone. It runs in a general northwest-southeast alignment between Western Freeway and Midland Highway. Within the vicinity of the site, it has a carriageway width of approximately 6.0 metres accommodating one lane of traffic in each direction and has unsealed shoulders. It adopts the default speed limit of 100km/hr for non-built-up areas.

2.3 Traffic Volumes

Traffic volume data for Ballan Road was obtained from the DoT traffic volume database. The closest available data suggests that Ballan Road currently carries in the order of 1,100 vehicle movements per day and 110 vehicle movements in each of the peak hours. The vehicle movements are relatively evenly distributed between north and southbound movements. Accordingly, Ballan Road currently accommodates a low level of traffic.

2.4 Public Transport Services

No public transport services are provided within the vicinity of the site.

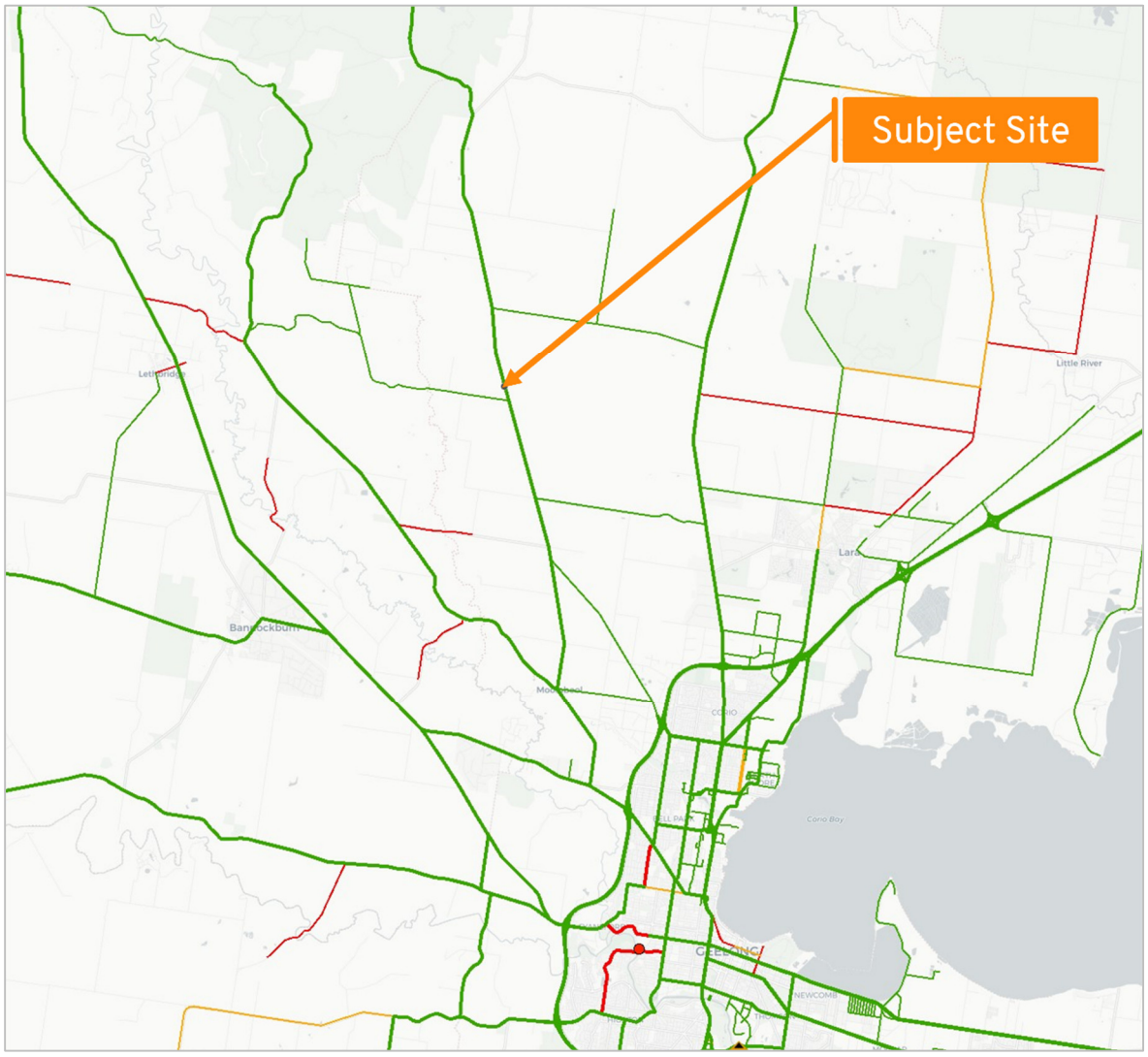
2.5 Crash History

Amber has conducted a review of the DoT Crashstats database for all injury crashes within 2 kilometres of the site. The crash database provides the location and severity of all injury and fatal crashes for the five-year period from 2015 to 2019. The crash search revealed one serious injury crash at the intersection of Ballan Road and Pringles Road. Given the road classification and associated traffic volumes, it is concluded that the road network is currently operating in a relatively safe manner.

2.6 Restricted Vehicle Access

The DoT Gazetted Roads for B-Doubles Map for the surrounding area is provided within Figure 3. The green lines indicate B-Double declared roads while the orange lines represent conditionally approved roads. As can be seen from the figure, Ballan Road is a B-Double declared road.

Figure 3: DoT Gazetted Roads for B-Doubles Map



Source: VicRoads Gazetted Roads for B-Doubles Map

3. Traffic Assessment

3.1 Traffic Generation

3.1.1 Construction

The solar farm construction is expected to take approximately 6 months, with the peak construction period expected to take 1-2 months. Construction activities would be undertaken during standard daytime construction hours, as follows:

- Monday to Friday: 7am – 6pm
- Saturday: 7am – 1pm
- No work on Sundays or public holidays.

Any construction outside of these normal working hours would only be undertaken with prior approval from relevant authorities.

A maximum of 50 staff will be on-site during peak construction periods. It is understood that shuttle buses will be provided that can accommodate the majority of staff, with the remaining staff to access the site using private vehicles.

Construction traffic generated by the solar farm can broadly be separated into the following three categories:

- Light vehicles associated with transporting staff to/from the site, including shuttle buses and personal vehicles;
- Medium and Heavy Rigid Trucks (MRV and HRV as defined within AS 2890.2:2018) will be used to deliver raw materials and smaller plant; and
- Articulated Vehicles and B-Doubles (AV and B-Double as defined within AS 2890.2:2018) will be used to transport larger plant.

Restricted Access Vehicles / oversized and overmass (OSOM) vehicles will be required for the delivery of larger plant to the site such as the substation transformer and are subject to separate permit applications and regulations. The impacts of the OSOM vehicles are discussed within Section 4 with the following assessment focusing on the impacts of the light and heavy vehicles which generate the bulk of the traffic and represent the typical traffic impact of the project on a day-to-day basis.

The construction traffic volumes for the project have been provided by the Applicant. It is anticipated that during peak construction the site could generate up to 38 heavy and 108 light vehicle movements per day. It is noted that a vehicle movement is classified as a vehicle travelling in one direction (i.e. a truck accessing the site would generate one movement towards the site and one movement away from the site when it departs).

Table 1 summarises the traffic movements generated during the construction period of the solar farm.

Table 1: Traffic Generation During Peak Construction Periods

Vehicle Type	Average Vehicle Movements per Day		Peak Vehicle Movements per Day	
	Daily (vpd)	Peak Hour (vph)	Daily (vpd)	Peak Hour (vph)
Light Vehicle (car / 4WD)	30	15	100	50
Shuttle Bus	4	2	8	2
MRV/HRV	6	1	8	2
AV	4	1	20	2
B-Double	4	1	10	1
Total	**48**	**20**	**146**	**57**

Overall, the site is expected to generate approximately 57 vehicle movements during the morning and evening peak hours during the peak construction period, which will reduce to 20 vehicle movements over the typical construction periods.

3.1.2 Operational Traffic

During operation the solar farm is expected to generate a minimal level of traffic associated with maintenance and operation services. The solar farm is expected to be operated by up to 5 staff resulting in a traffic generation of up to 10 vehicle movements per day which would result in a negligible change to the traffic environment.

3.1.3 Decommissioning Traffic

At the end of the operational life of the project all above ground infrastructure will be dismantled and removed from the project site. Internal roads, if not required for ongoing farming purposes or fire access, would be removed and the site reinstated as close as possible to its original state.

Traffic generation during decommissioning would be similar to traffic generation during the average construction period. A comprehensive Construction Traffic Management Plan would be prepared prior to the decommissioning phase in conjunction with the relevant road authorities. This would aim to ensure adequate road safety and road network operations are maintained.

3.2 Traffic Distribution

Traffic accessing the site will do so via Ballan Road which is a Secondary State Arterial Road. Staff will primarily be located in Anakie and Geelong with all plant expected to be delivered from the GeelongPort.The following provides a breakdown of the access distribution for each of the vehicle classifications outlined within Table 1:

- Light Vehicles: It is anticipated that most staff will be local within Anakie and Geelong, with 90% of staff travelling from the south and 10% travelling from the north.
- MRV/HRV: These vehicles will predominantly be water trucks and vehicles transporting materials such as concrete and fencing supplies which will be sourced within the surrounding area. The Applicant has advised that 90% will be travelling from the south and 10% travelling from the north.

- AV/B-Double: Plant will be transported from GeelongPort to the site along Ballan Road from the south.

Accordingly, the majority of vehicle movements are expected to access the site from the south.

The peak hour for the solar farm will occur at the start and end of the day when staff are transported to/from the site. During the morning peak all vehicle movements will be towards the site and in the evening peak all vehicle movements will be away from the site. Heavy vehicle movements will be distributed throughout the day and will be split evenly between inbound and outbound movements.

3.3 Traffic Assessment

Ballan Road is currently estimated to be carrying in the order of 110 vehicles per hour in the peak hour. During peak construction the traffic volumes would increase to approximately 167 vehicles movements per hour at peak times. The traffic volumes can be readily accommodated on the road network and Ballan Road is expected to continue to operate with a good level of service. Accordingly, it is concluded that the road network is able to accommodate the traffic generated by the solar farm during the construction period.

3.4 Cumulative Traffic Impacts

A review has been undertaken for any other renewable projects in the surrounding area. The VicPlan Map Tool indicates that there are no other renewable projects proposed in the surrounding area.

4. Route Assessment

GeelongPort has been identified as the location where the solar farm plant will be imported. The construction traffic access route from the port to the site is expected to be via Corio Quay Road, Princes Highway, Cox Road, Anakie Road, and Ballan Road. The arterial roads are designated for B-Double vehicles as outlined within the DoT Gazetted Roads for B-Doubles Map provided within Figure 3. Accordingly, the access route is able to accommodate the loads and type of vehicle movement to be generated during construction of the solar farm.

It is also noted that some oversize and overmass vehicles will be required to deliver larger plant to the site such as the sub-station transformer and earthmoving equipment. The vehicles are subject to specific road permits that will be applied for by the contractor once the dimensions of the load and the specific delivery vehicle are known.

5. Access Assessment

5.1 Access Design

Following discussions with Department of Transport Officers it has been agreed that the site access is to be designed in accordance with Guideline Drawing *AGRD Part 4 – Typical Design to Rural Properties*. The drawing is provided within Appendix A and provides the design requirements for access by a B-Double vehicle. Accordingly, the site access is expected to be able to accommodate the traffic generated by the solar farm in a safe manner subject to the adoption of the guideline drawing.

5.2 Sight Distance

Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections specifies the Safe Intersection Sight Distance (SISD) as the minimum sight distance which should be provided along the major road at any intersection. Table 3.1 of the guide specifies the SISD required for various design speeds. Given Ballan Road has a speed limit of 100km/hr a design speed of 110km/hr has been adopted which requires an SISD of 285 metres.

The available sight distance at the site access greatly exceeds the Austroads requirements given the flat and straight alignment of Ballan Road and limit vegetation / buildings in the surrounding area.

6. Construction Management Plan

A Construction Traffic Management Plan (CTMP) will be prepared prior to construction commencing by the appointed contractor. The CTMP will provide additional information regarding the traffic volumes and distribution of construction vehicles that is not available at this time, including:

- Road transport volumes, distribution and vehicle types broken down into:
  - Hours and days of construction.
  - Schedule for phasing/staging of the project.
- The origin, destination and routes for:
  - Employee and contractor light traffic.
  - Heavy vehicle traffic.
  - Oversize and overmass traffic.

The following provides recommended measures that should be adopted within the CTMP to minimise the impact of construction traffic along the road network:

- Neighbours of the solar farm be consulted and notified regarding the timing of major deliveries which may require additional traffic control and disrupt access.
- Loading and unloading is proposed to occur within the work area. No street or roads will be used for material storage or parking of vehicles at any time.
- All vehicles will enter and exit the site in a forward direction.
- Management of vehicular access to and from the site is essential in order to maintain the safety of the general public as well as the labour force. The following code is to be implemented as a measure to maintain safety within the site:
  - Utilisation of only the designated transport routes.
  - Construction vehicle movements are to abide by finalised schedules as agreed by the relevant authorities.
- Implementation of a proactive erosion and sediment control plan for on-site roads, hardstands and laydown areas.
- All permits for working within the road reserve must be received from the relevant authority prior to works commencing.
- A map of the primary haulage routes highlighting critical locations.
- An induction process for vehicle operators and regular toolbox meetings.
- A complaint resolution and disciplinary procedure.
- Local climatic conditions that may impact road safety of employees throughout all project phases (e.g. fog, wet and significant dry, dusty weather).

The above recommendations will ensure the construction traffic will create a minimal impact to the capacity and safety of the surrounding road network.

7. Conclusion

Amber has assessed the traffic impacts of the 4.95MW solar farm located approximately 6km south of Anakie. Access to the site will be provided via a new access to Ballan Road at the northern end of the site. Staff will primarily be located in Anakie and Geelong with all plant expected to be delivered from GeelongPort. The above assessment determined the following:

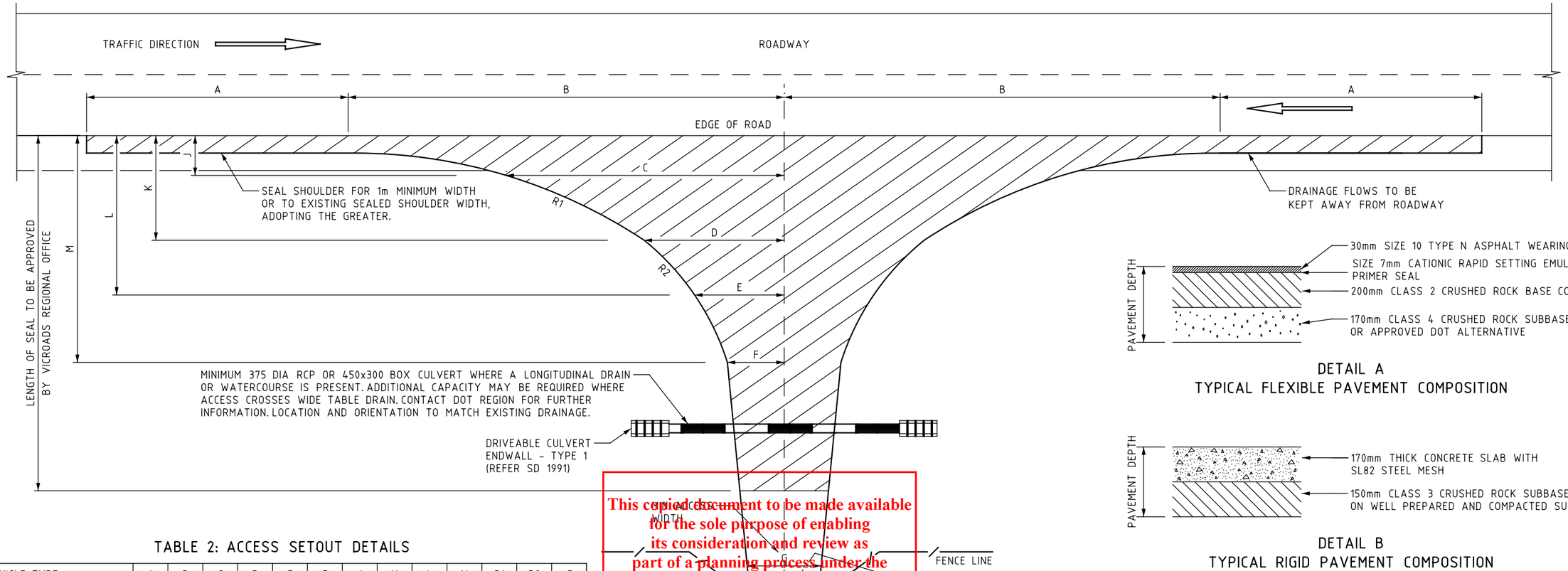
- The site will generate up to 108 vehicle movements per day during peak construction times, including 38 truck movements;
- The road network is able to accommodate the traffic generated by the development during the construction, operation and decommissioning stages;
- The site access is proposed to be constructed to accommodate B-Double vehicles in accordance with the Department of Transport standard drawing for access to rural properties;
- The construction traffic access route from GeelongPort to the site is proposed to be via Corio Quay Road, Princes Highway, Cox Road, Anakie Road, and Ballan Road. The roads are designated for B-Double vehicles and as such, the access route is able to accommodate the loads and type of vehicle movement to be generated during construction of the solar farm;
- It is noted that some oversize and overmass vehicles will be required to deliver larger plant to the site such as the sub-station transformer and earthmoving equipment. The vehicles are subject to specific road permits that will be applied for by the contractor once the dimensions of the load and the specific delivery vehicle are known; and
- In order to mitigate the impacts of the development during construction a CTMP will be prepared which should include the recommendations provided within this document.

Accordingly, based on the assessment above, it is concluded that the proposed access arrangements for the solar farm are suitable to accommodate the expected construction vehicle types and traffic volumes during the construction and operation phase of the project.

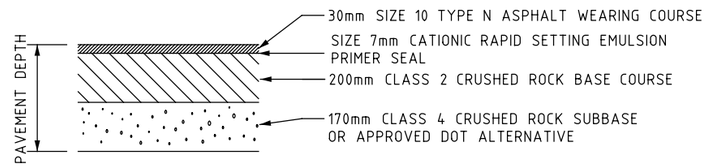
Appendix A

Intersection Design

ISSUE	APPROVED BY	DATE	AMENDMENT
A	M-RD&SSE	12/21	REVISED PAVEMENT DETAILS AND GENERAL NOTES 1, 2, 3, 4, & 5



PLAN - DRIVEWAY ACCESS LAYOUT



DETAIL A
TYPICAL FLEXIBLE PAVEMENT COMPOSITION

DETAIL B
TYPICAL RIGID PAVEMENT COMPOSITION

TABLE 2: ACCESS SETOUT DETAILS

VEHICLE TYPE	A	B	C	D	E	F	J	K	L	M	R1	R2	G
26m B-DOUBLE	15.0	30.3	20.4	11.0	6.1	3.7	2.1	5.3	9.4	15.3	45	13	4.3
19m SEMI TRAILER	15.0	24.6	17.2	10.3	5.2	3.0	1.9	4.6	9.3	15.7	30	14	4.2
ARTICULATED 19m BUS	15.0	21.9	14.4	7.5	4.4	2.9	2.1	5.4	9.6	14.7	26	15	4.0
12.5m SINGLE UNIT	15.0	20.1	12.9	6.4	4.1	3.0	2.2	5.6	9.7	16.3	23	18	4.0
TRUCK + 3 AXLE TRAILER	15.0	18.3	11.8	6.2	4.0	3.0	2.2	5.7	9.8	14.2	18	18	4.0
TRUCK + 4 AXLE TRAILER	15.0	19.2	12.2	6.0	4.0	3.0	2.3	5.9	9.8	14.0	20	17	4.0
8.8m SERVICE VEHICLE	15.0	12.6	8.7	5.4	4.1	3.5	1.8	4.1	6.7	9.6	10	13	4.0
PASSENGER VEHICLE	5.0	9.3	3.8	1.8	-	-	2.2	7.5	-	-	7.5	-	3.6

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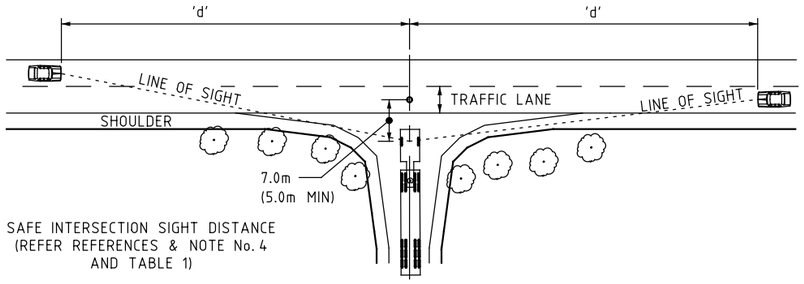

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80	181	-4	-7	-10	-13	4	9	14	20
90	226	-5	-9	-13	-16	5	11	18	25
100	262	-6	-11	-16	-20	6	14	22	31
110	300	-7	-13	-19	-24	8	17	26	38

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TYPICAL ACCESS TO RURAL PROPERTIES

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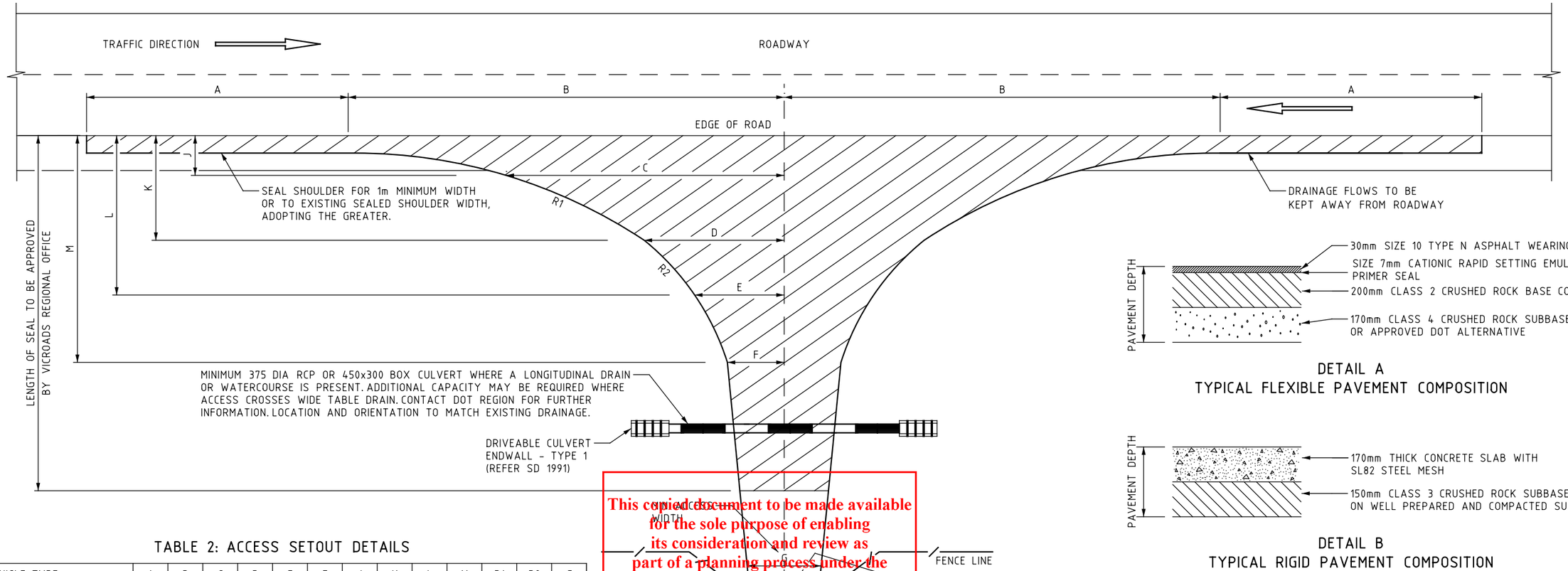
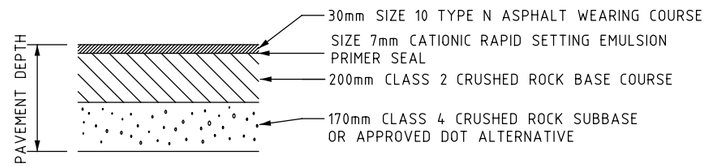
VicRoads Drawing No. 720453

Appendix E Visual impact assessment

ISSUE	APPROVED BY	DATE	AMENDMENT
A	M-RD&SSE	12/21	REVISED PAVEMENT DETAILS AND GENERAL NOTES 1, 2, 3, 4, & 5



PLAN - DRIVEWAY ACCESS LAYOUT



DETAIL A
TYPICAL FLEXIBLE PAVEMENT COMPOSITION

DETAIL B
TYPICAL RIGID PAVEMENT COMPOSITION

TABLE 2: ACCESS SETOUT DETAILS

VEHICLE TYPE	A	B	C	D	E	F	J	K	L	M	R1	R2	G
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19m SEMI TRAILER	15.0	24.6	17.2	10.3	5.2	3.0	1.9	4.6	9.3	15.7	30	14	4.2
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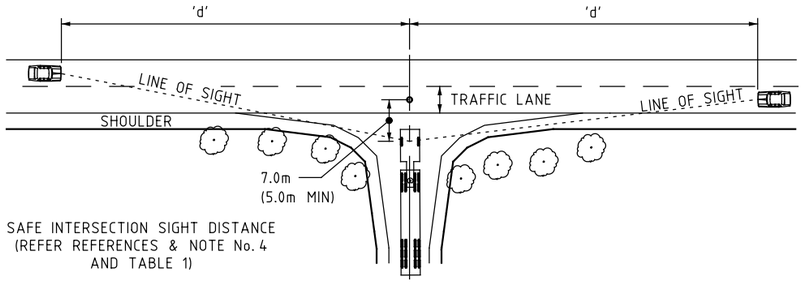

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VicRoads Drawing No. 720453

Appendix E Visual impact assessment

Visual Impact Assessment

Anakie Solar Farm –1435-1475 Ballan Road Anakie

October 2022

Project Number: 21-425

ADVERTISED PLAN

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Document verification

Project Title:	Anakie Solar Farm –1435-1475 Ballan Road Anakie
Project Number:	21-425
Project File Name:	"\\10.0.19.1\Active\Projects\2021\21-425 Anakie Solar Farm Planning Study"

Revision	Date	Prepared by	Reviewed by	Approved by
Draft V1.0	2/06/2022	Johanna Duck	Fi Cotter/Lizzie Olesen-Jensen	Johanna Duck
Final V1.0	2/08/2022	Johanna Duck	Lizzie Olesen - Jensen	Johanna Duck
Final V1.1	11/10/2022	Johanna Duck – minor map update only (Fig 1-3)		Johanna Duck

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Figures

Tables

1. Introduction

1.1 Overview

This Visual Impact Assessment (VIA) has been prepared by NGH on behalf of BNRG Leeson, to assess the potential impacts of the Anakie Solar Farm and Battery Energy Storage System (BESS) at 1435-1475 Ballan Road Anakie (the proposal). The Anakie Solar Farm (the proposal) is located on the Ballan Road 22 km north of the Geelong CBD and 6km south of the rural town of Anakie, Victoria, see Figure 1-1 and Figure 1-2.

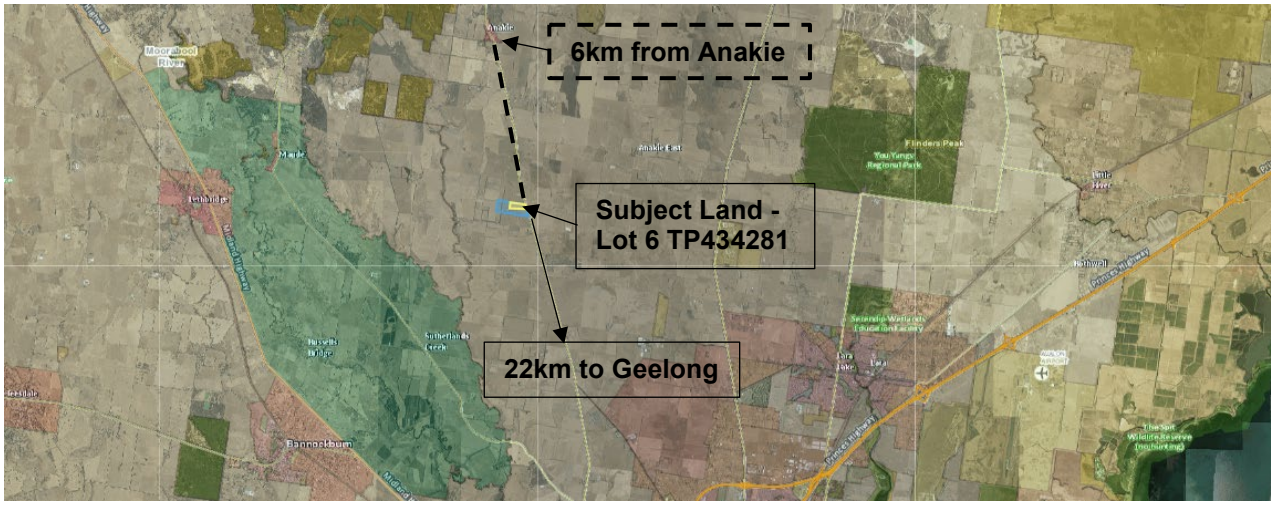


Figure 1-1 Location map – Proximity of the subject land to Anakie (Source: Vic Plan, 2022)

The proposal, see Figure 1-3, includes the installation solar infrastructure and associated works and has the following key features:

- 11.7 hectares (ha) of single axis (tracking) solar array.
- Inverter/switch station.
- BESS.
- Overhead transmission line connection.
- Site entry (new crossover) (construction/operation access).
- Perimeter roads, and security measures such as fencing, lighting and CCTV.

Figure 1-2 View towards the proposal site when travelling south towards Geelong (NGH, 2022)

Figure 1-3 Proposal layout (Source: BNRG, 2022)

This VIA identifies and assesses the potential visual impacts associated with the construction, operation, and decommissioning of the proposal. The construction and decommissioning would result in temporary impacts, whereas the operation of the proposal having a minimum 30-year life span has potential to result in longer term impacts, specifically for near neighbours. This assessment considers the design of the proposal in relation to the near neighbours, local road users and distant views.

The land is subject to the planning provisions of the Greater Geelong Planning Scheme and is located on land zoned Farming Zone (FZ). This VIA considers the proposal against the purpose of the FZ and associated decision guideline Clause 35.07-6.

1.1.1 Approach

The Solar Energy Facilities Design and Development Guideline (DELWP, 2019) requires assessment of the visual impact of a solar energy facility, including:

- The sensitivity of the landscape and its ability to absorb change.
- The size, height, scale, spacing, colour and surface reflectivity of the facility's components.
- The number of solar energy facilities located close to each other another within the same landscape.
- The excessive removal, or planting of inappropriate species of vegetation.
- The location and scale of other ancillary uses, buildings and works including transmission lines, battery storage units and associated access roads.

- The proximity to environmentally sensitive areas such as public land, water courses and low-lying areas.

To address the requirements of the guideline, a visual impact assessment (VIA) was completed by NGH in the following stages:

1. Background investigations and mapping, defining where the proposal may be visible in the landscape, and identifying key viewpoints such as local and main roads and dwellings within proximity of the proposal.
2. Photography of the landscape in the area near the proposal site.
3. Consideration of outcomes of the community engagement undertaken by the proponent.
4. Impact assessment, describing the potential impact on visual amenity during construction and operation of the Proposal, including potential for light spill and dust impacts.
5. Consideration of the any required visual impact mitigation measures.

The impact assessment methodology used in this VIA for operational impacts is based around the Bureau of Land Management (BLM) Visual Resource Management System, developed by the BLM, US Department of the Interior (n.d.) and is consistent with similar VIA methods used by Australian State departments/agencies and is therefore considered a best practice visual impact analysis method and acceptable for the purpose of this VIA. The BLM developed a systematic process to analyse the visual impact of proposed developments. The basic philosophy states that the degree to which a development affects the visual landscape depends on the visual contrast imposed by the project. Key steps undertaken to assess the visual impact are as follows:

- Define the landscape:
  - The scenic quality.
  - The expected sensitivity at viewpoints.
  - The proximity of viewpoints.
- Evaluate the degree of visual effect.
- Determine the acceptability of the visual effect and sensitivity (landscape management zones); this is the resultant visual impact, rated as high, medium, or low.

For the purpose of this VIA, visual elements of the proposal include the site access and internal roads, fencing, lighting, substation, inverter, solar panel array areas, operations and maintenance building, battery system, and landscaping.

1.1.2 Terrain

The site of the proposal, as shown in Figure 1-4 below (and Figure 1-2 above), is located in a gently undulating/sloping landscape with hills in the distance roughly 5km from the proposal site up to a level of approximately 160m AHD to the west and 230m AHD to the northwest. The proposal site has an elevation of approximately 106 to 100m AHD falling to the rear (west) of the site. Dwellings to the south are approximately the same level as the proposal site. Dwellings to the west are located on an elevation of approximately 93-90m AHD.

Figure 1-4 Views of the panel area and background landscape from the northeast corner of the site showing potential views and existing boundary plantings (Source: NGH 2022)

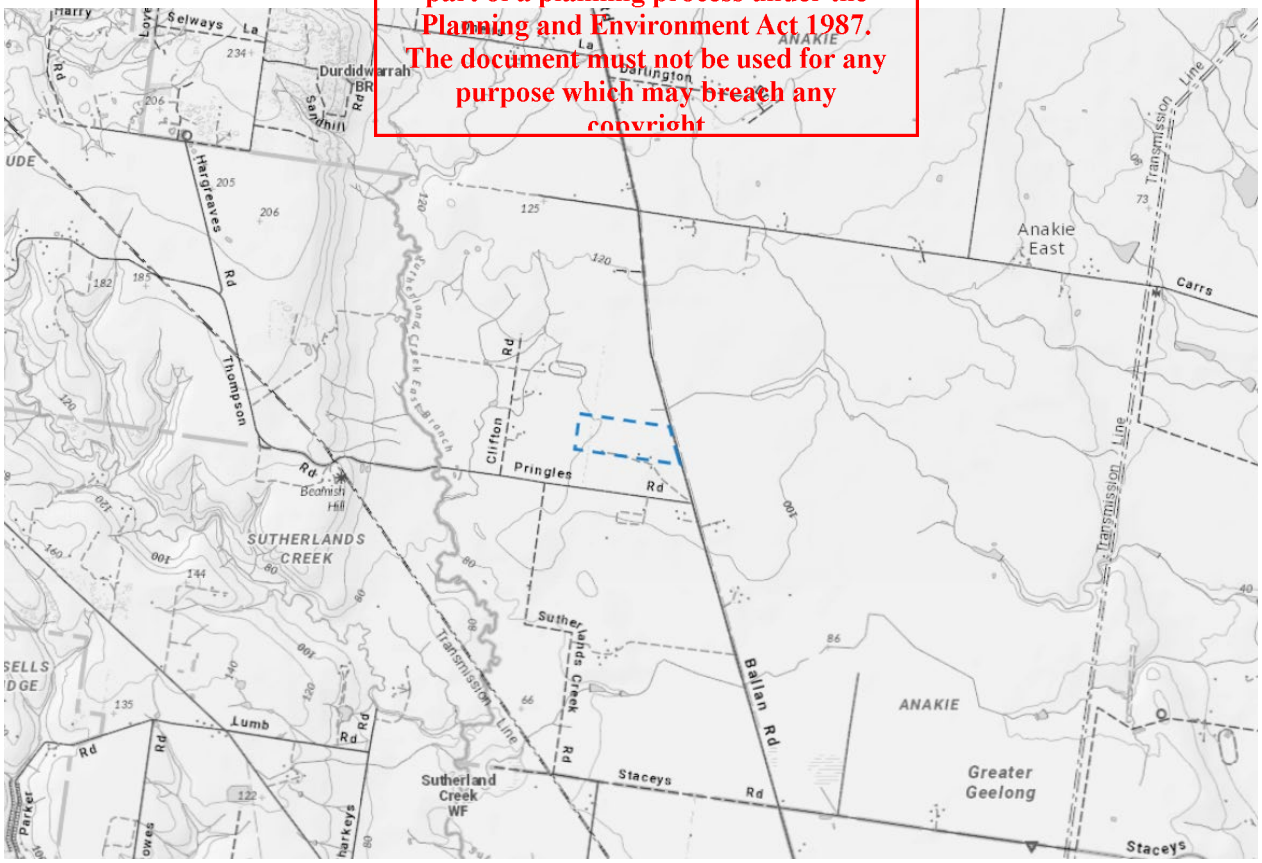


Figure 1-5 Topography of the locality (Source: Vic Plan, State of Victoria, 2022)

Figure 1-6 Views from the ridgeline located approximately 4-5km to the west of the proposal site, showing potential for distant (background) views of the proposal site (NGH, 2022)

1.1.3 Engagement

Consultation for the proposal was conducted for near neighbours by the proponent.

Landowners within 2km were directly engaged and the wider community and the near landowners were invited to a drop-in session at a local hall. Landowners within 2km of the proposal site (development site) are shown in Figure 1-7. Aspects of the proposal were discussed with the residents of each dwelling including opportunity to raise concerns about visual impacts.

Questions about potential visual impacts were raised at the community drop-in session. After viewing the aerial photos and plans, the community members present indicated they were satisfied there would be no unacceptable impact.

1.1.4 Landscape character and representative viewpoints

Considering topography, vegetation, land use, and other distinct landscape features, the surrounding land is described as an undulating rural landscape with low scale woodland areas and a modified landscape surrounding the rural township of Anakie and towards Geelong.

The scenic quality was identified as follows:

- A high scenic quality for natural landscapes (national parks, woodland, along creek lines).
- A moderate scenic quality for historic areas, modified landscapes, general agricultural areas, grazing and cropped land etc, and areas of quality roadside vegetation.
- Lower scenic quality in areas of rural industry, general urban areas.

The BLM methodology requires identification of representative viewpoints in the study area. These may be along travel routes, near waterways and recreational areas, residential areas, tourist facilities, houses, and farmland.

Figure 1-7 Rural dwellings within 2km of the development site and viewpoints (Source: NGH Adapted from Vic Plan, State of Victoria, 2022)

1.1.5 Visual sensitivity

The predicted sensitivity of each viewpoint can be determined considering its proximity to the development site and factors such as use, scenic quality and regional significance.

Criteria for proximity are as follows:

- Foreground, 0 – 1km.
- Middle ground, 1 – 2km.
- Background, more than 2km.

Criteria for scenic quality are as follows:

- High sensitivity:
  - High use routes or areas.
  - Routes or areas of national or state significance.
  - Areas with high scenic quality (i.e., land subject to significant landscape overlay under the planning scheme).
- Moderate sensitivity:
  - Moderate use routes or areas.
  - Routes or areas of regional or local significance.
  - Areas with moderate scenic quality.
- Low sensitivity:
  - Low use routes or areas.
  - Routes or areas of low local significance.
  - Areas with low scenic quality.

1.1.6 Definition of landscape management zones (visual effect)

Visual landscape management zones (LMZs) were assigned to each representative viewpoint. The zones were derived by combining scenic quality, viewer sensitivity and the distance to the proposal. Combined they produce a three-tiered management hierarchy: A – C, as shown in Table 1-1.

Table 1-1 Visual Landscape Management Zone decision matrix.

Proximity / sensitivity								
Scenic quality		**Fore-ground High**	**Middle ground High**	**Back-ground High**	**Fore-ground Moderate**	**Middle ground Moderate**	**Back-ground Moderate**	**Fore-ground Low**
	High	A	A	A	A	B	B	B
	Moderate	A	B	B	B	B	C	C
	Low	B	B	B	B	C	C	C

Each zone has associated objectives to guide management of visual change and to help evaluate proposed project impacts. These are shown in Table 1-2 below. Table 1-2.

Table 1-2 Visual Landscape Management Zone management objectives.

Management priority	Management objectives
A	Maximise retention of existing visual amenity. Landscapes are least able to absorb change. Developments may lead to a major change.
B	Maintain existing visual amenity, where possible. Protect dominant visual features. Developments may be allowed to be visually apparent.
C	Less importance for retaining existing visual amenity. Landscapes can absorb change. Developments may be allowed to dominate but should reflect existing forms and colours where possible.

The management priority for each viewpoint is listed in Table 2-1.

2. Potential impacts

A VIA for the operation stage of the proposal has been conducted considering:

- The specific elements of the proposal including the site access and internal roads, fencing, lighting, substation, inverter, solar panel array areas, operations and maintenance building, battery system, and landscaping. Associated effects of light spill and dust impacts (that can also result in air quality impacts).
- The potential for the proposal to be viewed from representative viewpoints.
- The degree of contrast the proposal would have within the identified LMZ. LMZs were assigned to viewpoints based on the results of the field work, and the contrast at that viewpoint was evaluated, as described below.
- The findings of the Glint and Glare Assessment (MOIR, 2022). There are no potential glare impacts to dwellings from the proposal.

2.1 Evaluation criteria

The ratings for the degree of contrast created by the mine at each viewpoint have the following definitions:

- High contrast: the proposal would be dominant within the landscape and generally not overlooked by the observer, the visual change would not be absorbed.
- Medium contrast: the proposed activity would be moderately dominant and noticed; the visual change would be partially absorbed.
- Low contrast: the proposed activity would be seen but would not attract attention; the visual change would be well absorbed.
- Indistinct: contrast would not be seen or would not attract attention; the visual change would be imperceptible.

To determine if the objectives for the visual LMZ's are met, the contrast rating for the viewpoint is compared with the relevant management objectives to give a visual impact level. The visual impact level is consequently defined as:

- High impact: contrast is greater than what is acceptable.
- Medium impact: contrast is acceptable.
- Low impact: visual contrast is little or not perceived and is acceptable.

For high impact viewpoints, mitigation must be considered. Mitigation for moderately impacted receivers is considered on a case-by-case basis. No mitigation is warranted for low impacts.

2.1.1 Evaluation results (resultant visual impact)

Table 2-1 evaluates the expected level of visual impact from the 3 representative viewpoints (V1-V3), representing the rural dwellings and public viewpoints (roads) within 2km of the proposal site.

This evaluation considers the views of the proposal without any mitigation measures and then with proposed mitigation measures.

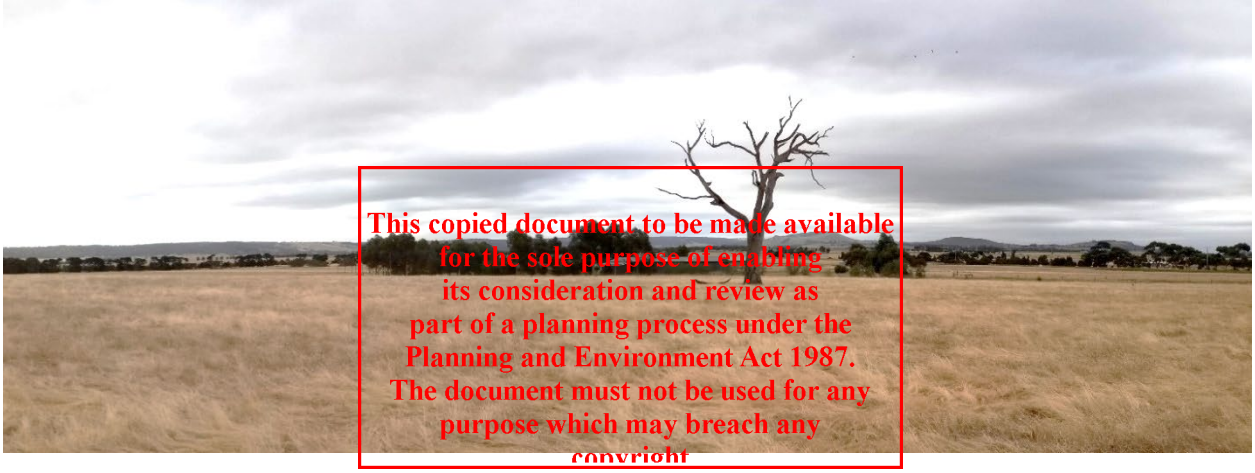
Following changes to the proposal design to reduce visual impacts with mitigation measures, no high impact viewpoints were identified. Moderate and low impacts were found to be possible. Relevant

mitigation measures have been identified and included in the summary of mitigation measures in section 3.1.2. Mitigated outcomes are considered to result in low impacts for adjoining landowners and road users.

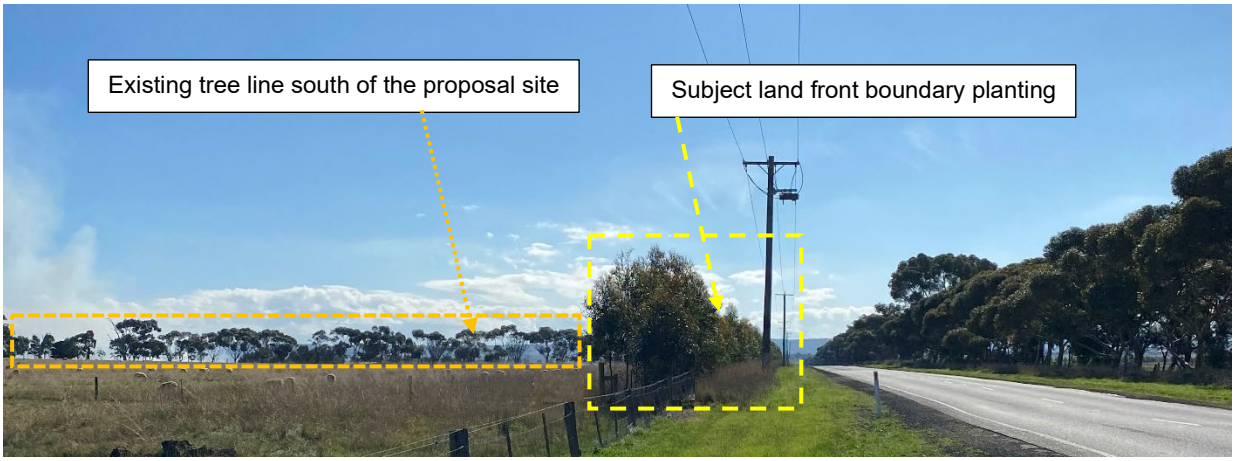
Table 2-1 Visual impacts at representative viewpoints and their associated receivers.

VIEWPOINT 1 (V1) (representing R3 and R9/ Ballan Road traffic)		
Summary of viewpoint		Viewpoint description / impact
Landscape	Rural and associated dwellings	V1 is located on Ballan Road (refer to representative photos provided below for V1.1 and V1.3 and as identified on Figure 1-7), just north and south of the proposal site. The representative photos are taken on the east (V1.1) and west (V1.3) side of the road and show areas for improvements to vegetation where views from traffic are possible (typically glance views from vehicles travelling south) and where recent plantings provide quality screening from the road (when directly opposite the site and for north travelling vehicles approaching the site). In addition to road traffic this viewpoint represents the shed at R13 to the north and dwellings R2, R3 and R9 to the south. The main visual change would be a new site access, increased heavy vehicle movements and potential dust impacts, predominantly limited to the construction phase. Trees in the area (including vegetation screening around R13, as seen in photo V1.2 below) and flat landscape generally provide effective screening or minimal to no view from the representative dwellings. Anakie is a rural town with minor tourism attractions and is within driving distance from the major centre of Geelong. Regional and local significance of the site is low, with scenic quality of the locality being moderate. Ballan Road viewpoints range from distant to foreground views. Views were assessed as generally having a moderate sensitivity given the travel speed and surrounding agricultural activities. View durations are generally short as vehicle speeds are up to 100km/hr, and the expected number of local vehicles on these local roads is considered to be low to moderate. The established front boundary tree line provides reasonable screening for the level of potential impact from V1. **No mitigations are considered to be required for this viewpoint in addition measures recommended for dust management, materials used, control of light spill, and traffic management.** Traffic management measures included in this PR and supporting TIA (Amber, 2022) would minimise construction traffic impacts and would be temporary (short term). Traffic impacts during operation are minimal due to very low numbers of vehicles visiting the site during operation as shown in the TIA (Amber 2022).
Scenic quality	Moderate	
Proximity	Foreground (road traffic) and Middle ground (dwellings)	
Sensitivity	Moderate	
LMZ objective	B	
Contrast	Low due to vegetation screening	
Inherent visual impact	Moderate	
Mitigated visual impact	Low	

V1.1 view from the northeast of the proposal site on Ballan Road, looking southwest across the proposal site representing views from road users.

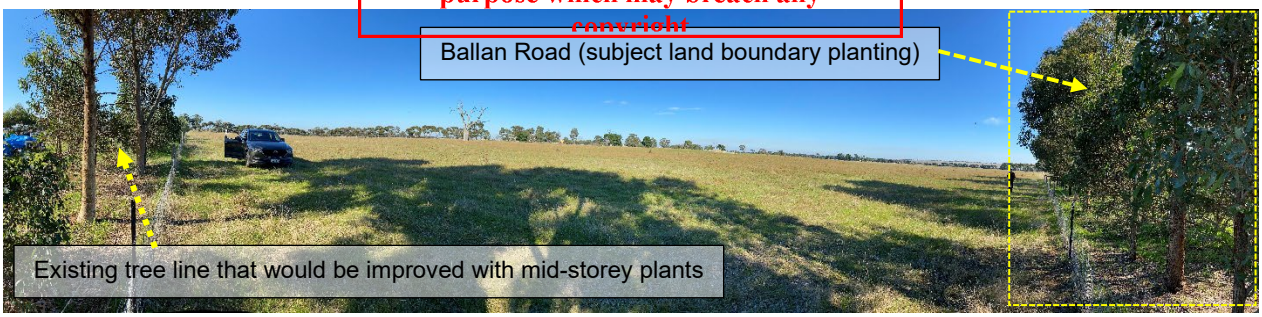


V1.2 from south side of the proposal site looking north showing R13 (shed) showing there is some vegetation screening around the shed.



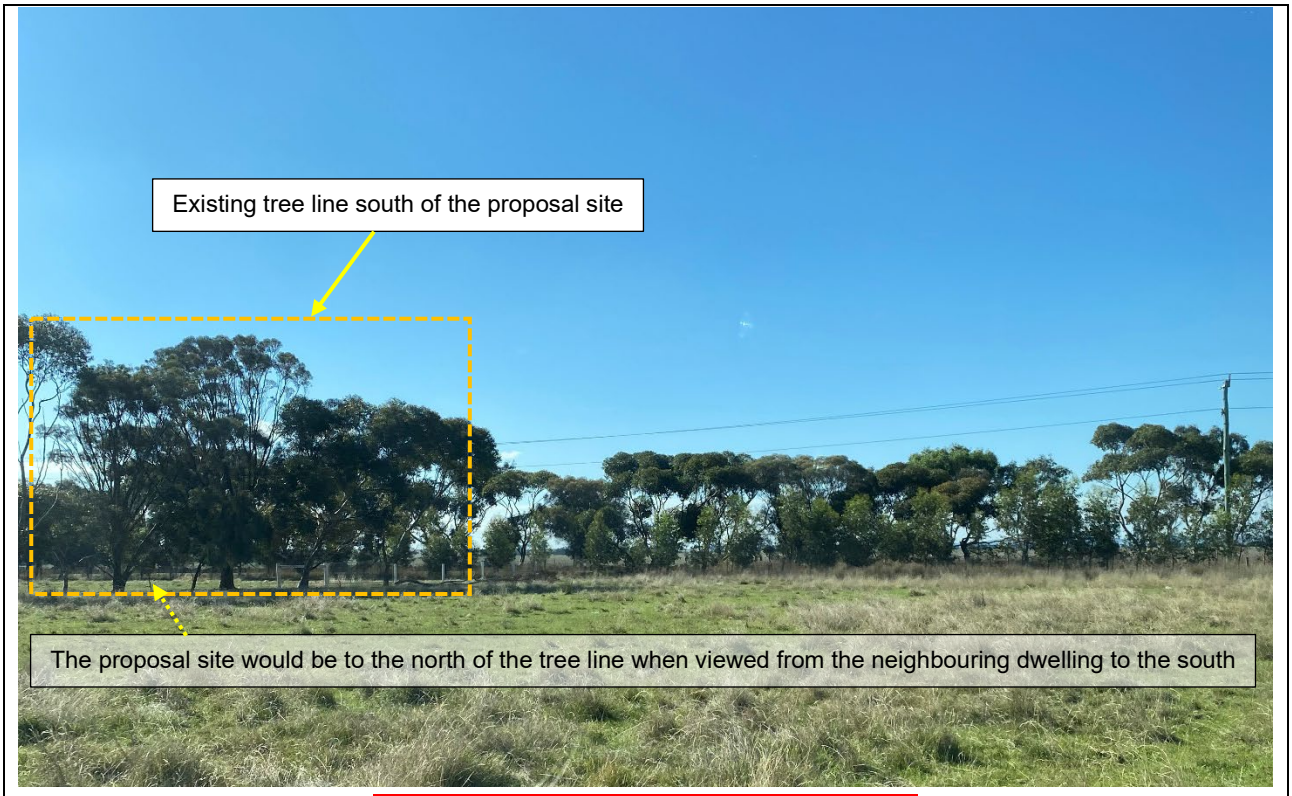
V1.3 Existing planted tree line on front boundary providing quality screening (representing views from R3 and R9.

VIEWPOINT 2 (V2) (representing dwelling R2)		
Summary of viewpoint		Viewpoint description / impact
Landscape	Rural	V2 (photos below V2.1 and V2.2) representing views from dwelling R2 (and any building in close proximity to R2) located to the south of the subject land. This viewpoint is located 118m to the south of the proposal site. There are trees and structures on the subject land that would screen some views to the proposed solar farm. The proposal would contrast with the colour of the grasses on the land from this viewpoint, particularly when dried out in hotter weather, the shade created by existing trees and colour of bark would be a similar colour to the solar infrastructure providing for some integration and ability of the landscape to absorb impacts. This agricultural and rural dwelling viewpoint was assessed as generally having a moderate sensitivity due to being the highest potential for views from this site. If there is a view of the proposal, the view duration could be expected to be longer due to the closer proximity to the site, but existing vegetation and 100m separation would provide effective screening for agricultural activities. **Additional screen planting within the tree line to the south of the proposal would minimise any potential visual impacts for the dwelling at R2. In addition, the measures proposed for dust control, colours of materials used, control of light spill and traffic management would minimise construction and operational impacts.**
Scenic quality	Moderate	
Proximity	Foreground	
Sensitivity	Moderate	
LMZ objective	B	
Contrast	Moderate	
Inherent visual impact	Moderate	
Mitigated visual impact	Low	



V2.1 taken from inside proposal site looking northwest towards the location of the shed (R13) and Ballan Road screening vegetation.

V2.2 taken from inside the subject land looking north, adjacent to the dwelling located on the property to the south.



V2.3 taken from near the dwelling on the subject land looking northeast showing the established screening vegetation and opportunities for improved screening of the tree line vegetation (mid-storey plantings – providing hedge style screening).

VIEWPOINT 3 (V3) (representing R4 to R7, Pringles Road and Clifton Road)		
Summary of viewpoint		Viewpoint description / impact
Landscape	Rural	Viewpoint 3 (V3 – photos below V3.1 and V3.2), representing views from agricultural land and dwellings identified as R4-R8 located to the west of the subject land and local road use. This viewpoint is located 600m plus from the proposal site. R4 to R8 are on an elevation approximately 10m below the proposal site. The proposal has low contrast from this viewpoint due to the dark greens of the pine trees (and other boundary vegetation) present on the subject land and surrounding properties providing high ability to absorb the proposal into the background. Local roads, agricultural (including rural dwellings) viewpoints were assessed as generally having a low to moderate sensitivity due to low use of roads and topography and vegetation screening the majority of views maintaining the rural character. If there is a view of the proposal, the view duration could be expected to be longer due to the closer proximity to the site, activities undertaken on adjoining land (agricultural and rural residential uses), lower travel speeds and potential for increased interaction for local residents with heavy vehicles during construction when entering Ballan Road.
Scenic quality	Moderate	
Proximity	Foreground	
Sensitivity	Moderate	
LMZ objective	B	
Contrast	Low	
Inherent visual impact	Low	
Mitigated visual impact	N/A	

		There are limited to no views of the proposal site from this viewpoint. **No mitigations are considered to be required for this viewpoint in addition to the measures proposed for dust control, colour of materials used, control of light spill and traffic management.**

V3.1 View from Clifton Road looking northeast towards the proposal site confirming topography (land rising to the east) and layering of existing vegetation providing screening of the proposal site.

V3.2 View from the southwest corner of the subject land to the northeast – topography and established tree lines limiting views of array area from properties to the west and southwest

3. Results summary

3.1 Moderate and Low residual (mitigated) impact

Many sites have established mid-sized trees planted along site boundaries. The subject site has trees located along its frontage and some other tree lines around the proposal site. Undulating topography to the west prevents some views into the site, until you get higher on the ridge where you can see down. When driving down from the ridge east you may get some views into the project.

The impacts, post mitigation, are assessed as Low. The proposal would be generally completely screened by existing vegetation and topography except for:

- The shed (R13) immediately to the north. There are some established trees at the location of the shed along part of the property boundary.
- Some local traffic moving out of driveways entering directly onto Ballan Road and high speed glance views from vehicles, primarily when travelling north to south along Ballan Road with a speed of 100km/hr.

Potential views from the dwelling (R2) and associated buildings to the south would be further screened by improved existing tree lines. The mitigation measures committed to by the proponent in this PR relating to management of traffic, control of light spill and dust minimisation would avoid and minimise associated impacts. The materials and colour of onsite infrastructure would, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that would blend with the landscape. Mitigation measures for the proposal are listed in Table 3-1.

3.1.1 Potential cumulative impacts

Adverse cumulative impacts occur when the infrastructure or activities at the proposal site exacerbate the negative impacts of other activities occurring nearby. Due to the undulating and flatter nature of the land in direct proximity to the site, it is unlikely that the proposal would contribute to cumulative visual impacts for residents within 2km of the development site as combined views of the solar infrastructure and industrial scale rural (poultry) sheds would not be common.

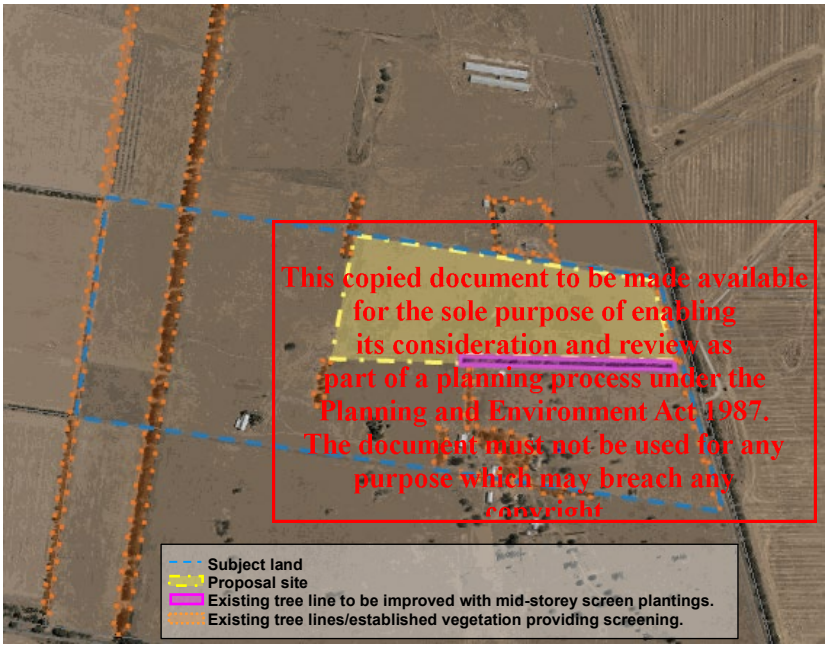
Distant views of a number of agricultural structures and the proposal site (from 4-5km away) may be possible due to the rising ridgelines to the west and north, however would only form a minor component of the entire field of view.

Views from most if not all viewpoints would remain dominated by agricultural land use and existing vegetation.

3.1.2 Safeguards and mitigation measures

Table 3-1 Safeguards and mitigation measures for visual impacts

No.	Safeguards and mitigation measures	C	O	D
V1	A construction and operational Landscape Management Plan	**C**	**O**	

No.	Safeguards and mitigation measures	C	O	D
	would be prepared and would include, but not limited to: • A Landscape Plan. The plan would be consistent with the provisions of any Landscape Management Plan. The plan would include planting lists for the site. Any planted vegetation (screen planting) would be fire resistant and retardant plants as the priority. • Management and regular maintenance plans for screen plantings, specifically to the south and east.			
V2	The Landscape Plan would include improved screening vegetation would be planted within the existing fenced tree line immediately to the south of the proposal site (as shown and described below):  • Plantings would be at least two rows deep to break up views of infrastructure including the fencing and minimising any lighting impacts. The fenced tree-line area would be increased in width where necessary to accommodate the screen plantings. • The plant species to be used in the screen would be native and derived from the naturally occurring vegetation community in the area. They should be fast growing and comprise a mixture of mid-storey plants capable of reaching a height of 2m within 2 years and up to 3m within 8 years. • Planting would be completed as part of early works, or during winter/spring to increase the chance of plant survival, or as agreed with DELWP. All screen plantings (including tree lines within the subject land, particularly to the south and east) would be maintained during construction and for the operational life of the proposal. Dead plants would be replaced. Pruning and weeding would be undertaken as required to maintain the screen's visual amenity			

No.	Safeguards and mitigation measures	C	O	D
	and effectiveness in screening views.			
V3	The materials and colour of onsite infrastructure would, where practical, be non-reflective and in keeping with the materials and colouring of existing infrastructure or of a colour that would blend with the landscape.	**C**	**O**	
V4	During construction, dust would be controlled in response to visual cues. Areas of soil disturbed by the project would be rehabilitated progressively or immediately post-construction. Dust management measures for all stages would be incorporated into the EMP.	**C**	**O**	**D**
V5	If considered necessary for safety during winter or low light, lighting would be minimal and limited to the substation/BESS area. Wherever possible, safety lighting would be directed downwards to minimise light spill. Lighting would comply with the relevant Australian standards for the control of obtrusive effects of outdoor lighting.	**C**	**O**	**D**

C: Construction (prior to and/or during); O: Operation; D: Decommissioning

4. Conclusion

The proposed Anakie Solar Farm would meet the relevant provisions of the Greater Geelong Planning Scheme, specifically the provisions of clause 53.13 as it relates to protection of amenity and visual impacts associated with the design of the proposal. The proposal would be consistent with the FZ purpose, as they relate to visual impacts, specifically:

- *To ensure that non-agricultural uses, including dwellings, do not adversely affect the use of land for agriculture.*
  - The proposal would not have adverse visual impacts that affect the use of the land for agriculture (including changes to the landscape, views, light spill, and dust), dwellings associated with agricultural use would also have reasonable amenity protected, provided the mitigation measures recommended in this VIA are implemented.
- *To provide for the use and development of land for the specific purposes identified in a schedule to this zone.*
  - Solar energy facilities are a land use identified in the schedule.

The proposal would also be consistent with the farming zone decision guideline Clause 35.07-6

- *General issues - Whether the site is suitable for the use or development and whether the proposal is compatible with adjoining and nearby land uses.*
  - The proposal would be compatible with adjoining agricultural land use and associated rural dwellings with agricultural use. Dwellings would also have reasonable amenity protected, provided the mitigation measures recommended in this VIA are implemented.
- *Design and siting issues - The need to locate buildings in one area to avoid any adverse impacts on surrounding agricultural uses and to minimise the loss of productive agricultural land. The impact of the siting, design, height, bulk, colours and materials to be used, on the natural environment, major roads, vistas and water features and the measures to be undertaken to minimise any adverse impacts. The impact on the character and appearance of the area or features of architectural, historic or scientific significance or of natural scenic beauty or importance.*
  - The proposal is sited to be as far as practicable from adjoining dwellings and avoids impacts to high quality vegetation on the site and makes best use of existing screening vegetation and topography. The proposal is compatible with surrounding developments when considering height and scale, specifically height of dwellings, and height and scale of poultry farms buildings. The additional mitigation measures provide for further integration with the landscape when viewed from the dwelling to the south. The view of the proposal would be most prominent from Ballan Road, but as the speed is 100km/hr, views would generally be quick glance views and predominately when travelling from the north to south. Views would also be possible from the property to the north, however existing trees surround the shed on the land and the remaining land is currently cropped and is a lower use area. Views would generally be end views of the array rows as the panels would track east to west.

The proposal has been designed to minimise visual impacts consistent with the DELWP guidelines for solar facilities. Appropriate management plans would need to be prepared prior to construction to manage visual impacts of the proposal. To avoid and mimimise impacts the recommended screening vegetation would need to be planted as part of early works and maintained for the life of the proposal.

Appendix F Glint and glare assessment

ADVERTISED PLAN

Anakie Solar Farm

Glint and Glare Assessment

Prepared for: **NGH Consulting**

Project No: **2152** Issue: **Rev C** Date: **02.08.2022**

ADVERTISED PLAN

DOCUMENT HISTORY AND STATUS

Project No: **2152**

Project Name: **Anakie Solar Farm**

Issue	Status	Date of Issue	Author	Approved by
A	Draft issued for review	02.05.2022	SW	AR
B	Final Issue for Submission	01.08.2022	SW	AR
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1.0 Introduction

Moir Landscape Architects has been engaged by NGH Consulting to assess the potential glint and glare impacts of the proposed Anakie Solar Farm (the Project) in Anakie, south western Victoria. The Project will include construction, operation and maintenance of a Photovoltaic (PV) system with a capacity of less than 5 Megawatts (MW) and other associated ancillary infrastructure.

The Project is located Approximately 6 km to the south of Anakie town centre and about 18 km to the north west of Geelong. The development boundary forms part of a larger Site (Refer Figure 1). The PV system will be orientated north-south, mounted on a single axis horizontal tracking system. The overall height will be a maximum of 5.10 metres.

The facility will have a dedicated power station within the development boundary which will be connected to the existing overhead transmission line running along Geelong - Ballan Road.

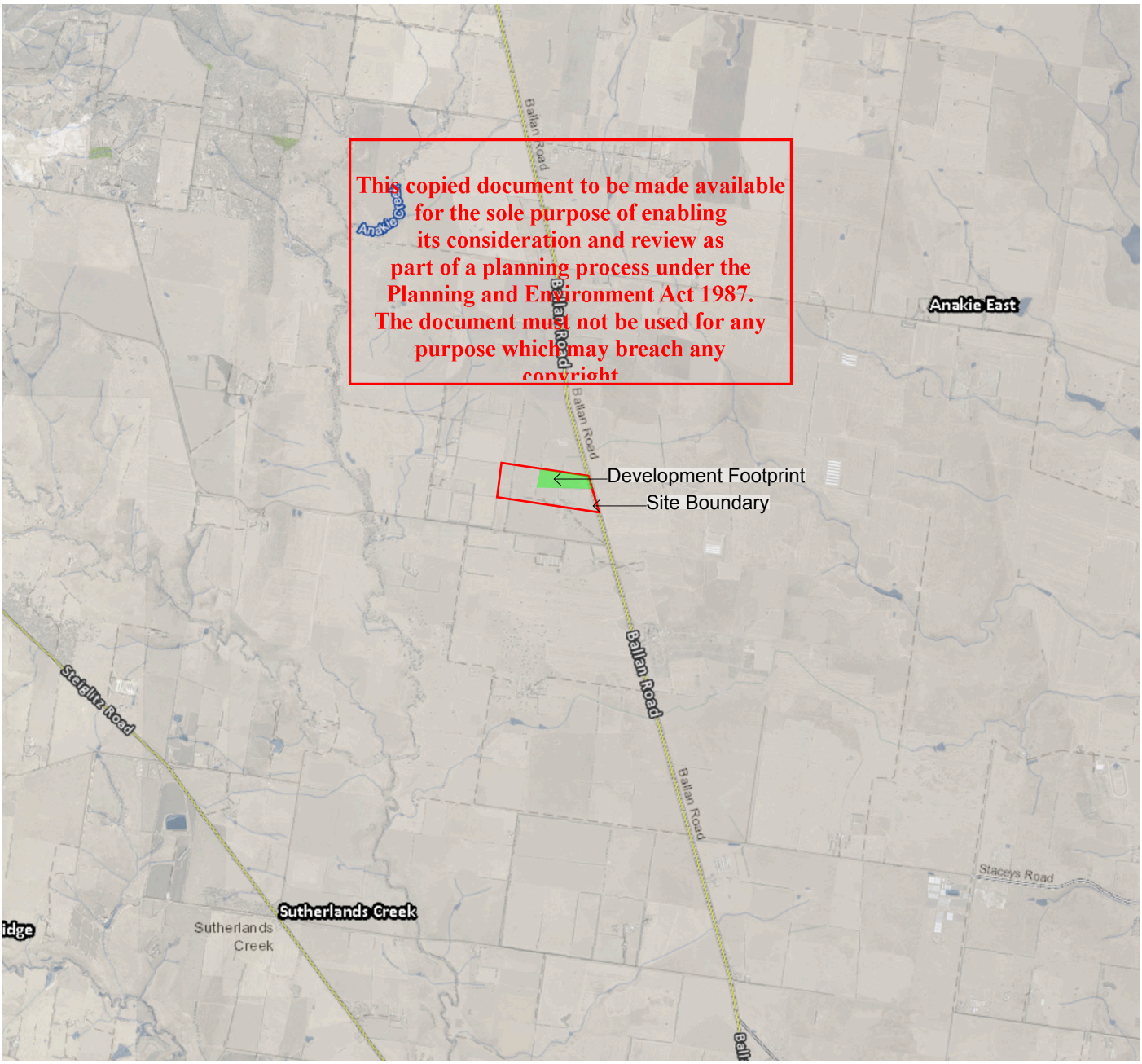

Figure 1: Project Location *(Source: Vicplan)*

2.0 Study Method

2.1 Overview of Glint and Glare

Glint is generally defined as a momentary flash of bright light while Glare can be defined as continuous source of excessive brightness proportionate to ambient lighting (FAA 2018) . The Glare analysis tool used to assess the glint and glare hazard was run at a simulation interval of one minute, based on the reflectivity of solar rays off PV modules which typically lasts for at least one minute.

Although Solar photovoltaic (PV) modules are designed to absorb as much light as possible, the glass modules and supporting frames have a tendency to generate glare. Assessment needs to be undertaken to ensure that sensitive visual receptors such as road users, surrounding rail network, nearby buildings, air traffic controllers and pilots are not impacted by the proposed development. (ForgeSolar, 2022)

2.2 Study Method

The Solar Glare Hazard Analysis Tool (SGHAT) developed by Sandia National Laboratories is used to evaluate glare resulting from solar farms at different receptors, based on proximity, orientation and specifications of the PV modules. This tool is recognised by the Australian Government Civil Aviation Safety Authority (CASA).

SGHAT is used to indicate the nature of glare that can be expected at each potential receptor. Glare can be broadly classified into three categories: low potential for after image, potential for after image, and potential for permanent eye damage. This is indicated by three colours:

- **Green Glare**: Low potential for temporary after-image
- **Yellow Glare**: Potential for temporary after-image
- **Red Glare**: Retinal burn, not expected for PV.

2.3 Glare Assessment Parameters

Glint and Glare assessment modelling for the solar farms in the SGHAT tool is based on the following factors:

- Position of the sun over time with respect to the location of the proposed solar farm.
- Tracking axis tilt, tracking axis orientation and properties of the PV modules.
- Location of sensitive receptors (receivers) from the Project including residential dwellings, Road and Rail receptors and Flight path receptors.
- Potential to screen the impact by surrounding topography.

2.4 Assumptions

The glare and glint impact is calculated utilising the geographic location, elevation, position of the sun and other vector calculations including module orientation, reflective environment and visual factors. Sun position is determined at every one (1) minute interval through out the year. Although the SGHAT is an extensive tool to understand the impacts of potential glare, it does not consider backtracking procedures in relation to the PV array tracking system, weather conditions, separation between PV modules and existing surrounding vegetation (if present) between the Project and a sensitive receiver.

Single axis tracking PV panels capable of rotating to a maximum of 60° have been considered for this analysis. The trackers are oriented north south with a maximum pitch distance of 6.5 metres. Due to the scope of the Project, potential visual receptors within 2000 metres of the site were considered which include nearby dwellings, sheds or outhouse buildings, rail network and road route users,

The visual impact of solar farm development depends on the scale and type of infrastructure, the prominence and topography of the site relative to the surrounding environment, and any proposed screening measures to reduce visibility of the site.

2.5 Backtracking Operations

A single axis horizontal tracking system can be configured to do a 'backtracking' technique, which implies that when the sun is low in the sky in the morning or evening, the tracking system can adjust the panels to maximise solar capture while minimising overshadowing.

ForgeSolar uses a simplified model of backtracking. Single-axis trackers follow the movement of the sun as it moves east to west throughout the day. Yields are maximized, and light reflection is minimised when panels are directly facing the sun. In times when the sun is not in the tracking range, we assume that the panels instantaneously revert to their resting angle of 0° (flat). Due to this, glare from the backtracking mechanism will be more conservatively simulated and at times of sunset and sunrise, when the sun is at a lower angle relative to the array, glare impacts will be more noticeable.

Variable angles of incidence of the sun relative to the panels may occur when the tracking system is performing a backtracking operation, and this variation is not yet represented by SGHAT software. However, SGHAT has a 'resting angle' option that simulates the impression of the panels returning to a predefined angle after the maximum tilt angle has been attained. It is important to note that 'resting angle modelling' is not a realistic representation of how a backtracking technique would work in actuality but on the other hand, gives some idea of the potential glare consequences of shifting the PV panels away from the sun after the maximum tilt is reached.

The following parameters have been considered to simulate a typical backtracking process for the proposed development:

- A maximum tracking angle of 60° is considered to indicate a full rotational range of 120°.
- To simulate 'backtracking', 'resting angle' determined as 45°, assuming the PV modules move directly to 45° once

maximum tilt of 60° is reached and represents a worst case scenario.

- To simulate glare experienced mid tracking, an angle of 22° is considered assuming the PV modules move from the resting angle prior to arriving at the stowing angle.
- Night time angle (stowing angle after dark) of 5° is considered assuming the PV modules move directly to 5° once maximum tilt of 60° is reached and represents a worst case scenario.

3.0 Project Overview

3.1 Study Area

Surrounding landscape within the vicinity of the project can be characterised as a rural landscape naturally cleared to support agricultural activities. The topography has slight undulations with an average slope of 1.3% across the Project. Anakie Creek Channel runs along the eastern edge of the Project and is located approximately 2.32 km from the Project. The Site and the surrounding land has been zoned as Farming Zone (FZ). Assessment of the aerial imagery indicates a dense boundary vegetation along the southern Project boundary. Eastern and northern edges of the Project appear to have scattered rows of vegetation. The western edge borders the Geelong - Ballan Road which will serve as an access to the Project. There is also an existing overhead transmission line running along Ballan Road. The proposed development will use the existing transmission line to transfer the energy produced through a point of insertion. For the purposes of this assessment sensitive receptors within the 2.0 kilometre ('Study Area') have been identified. 23 receptors have been identified within the Study Area of the Project. Few dispersed dwellings outside the 2.0 km radius do not form part of this assessment.

No other significant features were identified within the landscape that would contribute to the potential glare.

3.2 Modules and Array Layout

Each module consists of P type Mono-crystalline cell type with a 2.0 mm, anti-reflection coated semi-tempered glass set in an anodised aluminium alloy frame (Suzhou Talesun Solar Technologies Co., Ltd. 2021). There will be an estimated 10625 modules mounted on a north/south axis to slowly track movement of the sun. Refer **Figure 2** for PV array stages.

A single axis tracking system follows the sun's trajectory and rotates the panels across east to west. To attain optimum solar energy collection, the project modelling has utilised a maximum rotational range of 120°. The tracking tilt angle upon which the panels rotate is considered as 0.74 degrees to match the average ground slope of the Site. The panels are fixed on a tubular frame with a single axis tracking procedure. The panels will have a maximum height not exceeding 5.10 m when facing at the highest angle and a maximum of 4.99 meters when horizontal. The rows of modules will be spaced approximately 6.5 m apart to ensure no shading occurs and allows for ease of access for maintenance purposes.

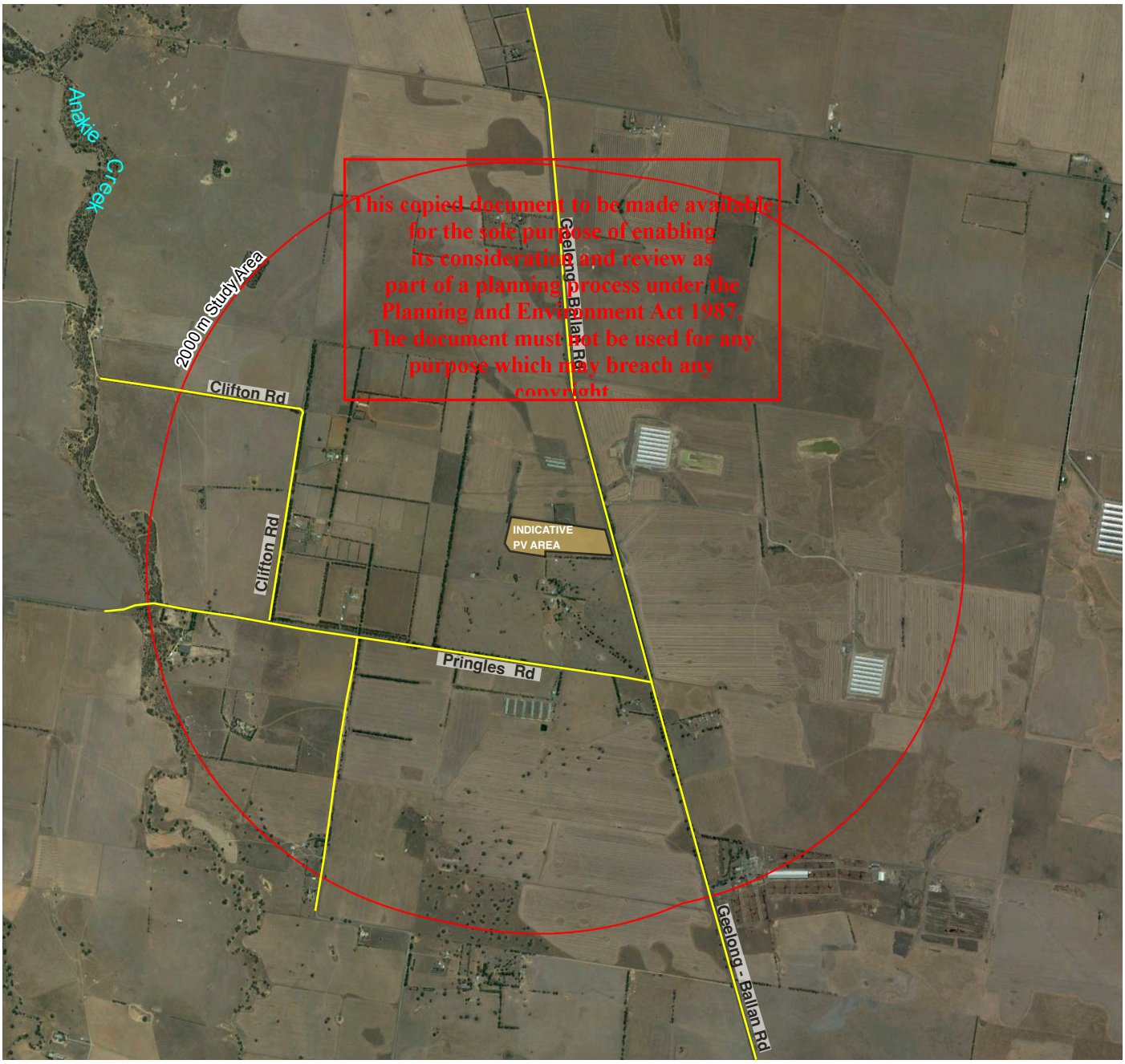

Figure 2: PV Array Stages *(Source: Google Earth)*

4.0 Modelling parameters

4.1 Panel Specifications

The Solar Panels have been assessed based on a maximum height of 5.10 metres above ground level.

General Solar PV system inputs:			
Input Data	**Units**	**Value**	**Comments**
Time Zone	UTC	+11	VIC time Zone
Orientation of Array	Degrees	0	Rows aligned in north-south directions
PV Surface materials	-	Smooth Glass with Anti-reflective Coating	Provided by the Client
Mounting Type	-	Single Axis Tracking	As per tracker data sheet
Single Axis Tracking Parameters			
Axis Orientation	Degrees	0	Panels orientated north south
Axis Tilt	Degrees	0.74	Elevation of tracking axis. Average ground slope is approximately 0.74 degrees (Google Earth)
Module Offset angle	Degrees	0	Facing upwards Panels rotate during operation
Max tracking angle	Degrees	±60° (Range of 120°)	Panels following the Sun
Resting angle	Degrees	0°, 22°, 45°, 5°	Panels following the Sun, to represent backtracking and after dark stowing angles
Height	Metres	5.10	

Table 1. Summary of modelling parameters

4.2 Eye Height

The following assumptions have been applied to assess receptors:

An average eye height of 2.4 metres has been considered to represent a truck driver's eye height (worst case scenario) (Austroads Ltd. 2021). For all dwelling receptors, an average eye height of 1.5 metres has been considered for the purposes of this assessment. Moir LA have assessed the routes with the above mentioned parameters to ensure a worst case scenario:

Eye Height for Receptors:	
- Road Receptors (Min): *Representative of eye level for commercial vehicle*	**1.8 m Above Ground Level**
- Road Receptors Max: *Representative of eye level for truck drivers*	**2.4 m Above Ground Level**
Dwelling Receptors	**1.5 m Above Ground Level**

Table 2. Parameters for receptors

5.0 Receptors

5.1 Potential Receptors

Four (4) route receptors, and 23 dwelling/sheds receptors (OP1 - OP23) have been identified within 2000 metres of the Project. The four receptor routes include Geelong - Ballan Road fronting the Project, Clifton Road to the west, Pringles Road and Southerlands Creek Road to the south. Refer to **Figure 3.**

No airstrips or flight paths were identified within 2000 metres of the Project. Lethbridge Aerodrome is located approximately 15 km north east of the Project. Avalon International Airport is also located in approximately 19 km southeast of the Project. Upon further investigation through a desktop review, there appear to be two private airstrips - Lovely Banks Airstrip and Wooloomanata Airstrip located approximately 10 km from the Site to the east and the southeast. These flight receptors are too far to assess potential glare of the Project and therefore do not form part of this assessment.

Figure 3: Locations of Receptors *(Source: Google Earth)*

6.0 Glint and Glare Assessment

6.1 Overview of Dwelling Receptors

Based on the desktop assessment no receptors (OP1 - OP23) have been identified to experience glare from the Project. Mitigation measures in the form of proposed and existing vegetation will further help in reducing potential to views of the Project at these locations. The time of day glare likely to be experienced is provided for each receptor in **Appendix A**.

6.2 Overview of Route Receptors

Four (4) route receptors were identified within the Study Area and formed part of this assessment. These include Geelong-Ballan Road, Clifton Road, Sutherlands Creek Road and Pringles Road. Based on desktop assessment one (1) route receptor has been identified to experience minimal 'Green' glare from the Project. Clifton Road will experience a total of 8 minutes annual Green Glare from the Projects limited to late January and early to mid November between 05:00 am to 06:00 am. Glare impacts outputs for each route receptor is provided in **Appendix A**.

Table 3: Glare mins / year for dwelling receptors

7.0 Summary and Recommendations

7.1 Summary of Results

No potential 'Yellow' glare will be experienced at dwellings neighbouring the Project Most of the locations have either existing vegetation surrounding the receptors or are at some distance from the receptors. Glare Impact studies also indicates one (1) route receptors - Clifton Road will experience potential glare from the Project. .

Various resting angles have been tested for backtracking and the resting angle does not change the outcomes of this assessment.

8.0 Mitigation Measures

Desktop assessment indicates only low potential for an after image predicted along Clifton Road. Intervening vegetation associated with roadside vegetation and surrounding residential properties will reduce the potential to experience glare impacts along Clifton Road. An overview of potential glare experienced by dwellings and other receptors including receptor routes, public viewing locations and sheds within the 2 kilometre 'Study Area' have been discussed in **Section 6** of this report.

9.0 Conclusion

The purpose of this report was to identify potential glint and glare impacts from the proposed Anakie Solar Farm on the surrounding dwellings and receptors routes within 2000 metres of the Project. Modelling was conducted along receptor routes and nearby dwellings receptors including out buildings or sheds identified within the Study Area. A desktop review indicated no flight paths or airstrips present within 2000 metres of the Project. Based on the assumptions and aforementioned parameters in this report a low potential for an after image was detected only along Clifton Road. Potential glare along Clifton Road has been indicated to occur between 05:00 am to 6:00 am from late January and mid to late November for 8 minutes annually.

No potential glint or glare was identified at a resting angle of 5°, 22° and 45° to simulate backtracking operations when the PV modules reverted to a night time stowing angle after dark.

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ForgeSolar n.d., www.forgesolar.com, viewed 27 April 2022, <https://www.forgesolar.com/help/#glare>.

Map of airports in Victoria, Australia @ OurAirports n.d., ourairports.com, viewed 29 April 2022, <https://ourairports.com/countries/AU/VIC/>.

Suzhou Talesun Solar Technologies Co., Ltd. 2021, Bipro TD7G78M 156 half-cell 570-590W Bifacial Dual Glass 10BB half-cut Mono Perc, TD7G78M, Suzhou Talesun Solar Technologies Co., Ltd.

Vicplan 2019, Geocortex Viewer for HTML5, Vic.gov.au.

ADVERTISED PLAN

APPENDIX A: ForgeSolar SGHAT Outputs

Updated: 01st August 2022

FORGESOLAR GLARE ANALYSIS

Project: **2152 ANAKIE SOLAR FARM**
2152 ANAKIE SOLAR FARM

Site configuration: **2152 ANAKIE SOLAR FARM 20220801**
Analysis conducted by David Moir (itsupport@moirla.com.au) at 23:47 on 31 Jul, 2022.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	N/A	No flight paths analyzed
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

ADVERTISED PLAN

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 73363.11981
Methodology: V2

PV Array(s)

Name: PV Array Area 01
Axis tracking: Single-axis rotation
Backtracking: Instant
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.74°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Rated power: -
Panel material: Smooth glass without AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.968306	144.269431	109.64	5.10	114.74
2	-37.968697	144.269417	109.78	5.10	114.88
3	-37.968700	144.269553	110.22	5.10	115.32
4	-37.969244	144.269533	109.89	5.10	114.99
5	-37.969242	144.269381	110.04	5.10	115.14
6	-37.969411	144.269372	110.00	5.10	115.10
7	-37.969150	144.267178	114.68	5.10	119.78
8	-37.969394	144.267167	114.95	5.10	120.05
9	-37.969183	144.265394	111.05	5.10	116.15
10	-37.969439	144.265386	112.10	5.10	117.20
11	-37.969203	144.263356	110.27	5.10	115.37
12	-37.968644	144.263375	109.56	5.10	114.66
13	-37.968644	144.263444	109.89	5.10	114.99
14	-37.968100	144.263464	109.02	5.10	114.12
15	-37.968100	144.263544	109.23	5.10	114.33
16	-37.967850	144.263553	109.00	5.10	114.10
17	-37.967853	144.263636	109.00	5.10	114.10
18	-37.967583	144.263647	109.00	5.10	114.10

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-37.967643	144.267038	109.77	1.50
OP 2	2	-37.962399	144.253757	99.24	1.50
OP 3	3	-37.964461	144.251943	94.34	1.50
OP 4	4	-37.968523	144.251101	92.33	1.50
OP 5	5	-37.971616	144.253401	98.17	1.50
OP 6	6	-37.971350	144.266242	116.09	1.50
OP 7	7	-37.971269	144.267181	117.79	1.50
OP 8	8	-37.972208	144.267058	116.71	1.50
OP 9	9	-37.977064	144.265575	102.00	1.50
OP 10	10	-37.976899	144.271412	107.88	1.50
OP 11	11	-37.977861	144.274978	109.00	1.50
OP 12	12	-37.984062	144.251315	91.11	1.50
OP 13	13	-37.978203	144.246536	95.53	1.50
OP 14	14	-37.973644	144.242626	84.81	1.50
OP 15	15	-37.984449	144.277955	100.00	1.50
OP 16	16	-37.972560	144.285913	99.05	1.50
OP 17	17	-37.964759	144.272337	106.35	1.50
OP 18	18	-37.952480	144.264137	125.66	1.50
OP 19	19	-37.970478	144.261092	106.59	1.50
OP 20	20	-37.970811	144.265609	115.05	1.50
OP 21	21	-37.968214	144.251715	94.34	1.50
OP 22	22	-37.967942	144.248730	94.09	1.50
OP 23	23	-37.974195	144.285156	100.00	1.50

Route Receptor(s)

Name: Clifton Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.972714	144.247898	87.51	2.40	89.91
2	-37.969094	144.248649	92.65	2.40	95.05
3	-37.965254	144.249486	91.60	2.40	94.00
4	-37.962141	144.250076	95.25	2.40	97.65
5	-37.961938	144.249422	95.28	2.40	97.68
6	-37.961050	144.242030	95.39	2.40	97.79
7	-37.960754	144.239444	97.59	2.40	99.99

Name: Geelong-Ballan Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.946315	144.265812	137.99	2.40	140.39
2	-37.948531	144.266027	132.08	2.40	134.48
3	-37.951543	144.266349	128.06	2.40	130.46
4	-37.954521	144.266627	123.45	2.40	125.85
5	-37.958159	144.267035	113.28	2.40	115.68
6	-37.960498	144.267226	111.24	2.40	113.64
7	-37.963940	144.268385	110.00	2.40	112.40
8	-37.966847	144.269378	110.28	2.40	112.68
9	-37.970180	144.270558	109.98	2.40	112.38
10	-37.973825	144.271749	107.98	2.40	110.38
11	-37.978377	144.273371	108.27	2.40	110.67
12	-37.982048	144.274626	99.63	2.40	102.03
13	-37.986484	144.276159	93.64	2.40	96.04
14	-37.991270	144.277940	87.40	2.40	89.80

Name: Pringles Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.975739	144.272345	108.97	2.40	111.37
2	-37.975396	144.269255	105.37	2.40	107.77
3	-37.974935	144.265366	107.97	2.40	110.37
4	-37.974297	144.259921	106.06	2.40	108.46
5	-37.973768	144.255710	100.29	2.40	102.69
6	-37.973132	144.250505	92.41	2.40	94.81
7	-37.972671	144.246536	86.29	2.40	88.69
8	-37.972122	144.242083	85.75	2.40	88.15
9	-37.971885	144.239895	85.63	2.40	88.03
10	-37.972223	144.238435	87.04	2.40	89.44

Name: Southerlands Creek Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.987490	144.250935	81.12	2.40	83.52
2	-37.984792	144.251525	87.73	2.40	90.13
3	-37.982069	144.252019	101.33	2.40	103.73
4	-37.979397	144.252555	114.45	2.40	116.85
5	-37.976708	144.253038	103.63	2.40	106.03
6	-37.975270	144.253324	101.50	2.40	103.90
7	-37.973565	144.253635	98.57	2.40	100.97

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV Array Area 01	SA tracking	SA tracking	8	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
Clifton Road	8	0
Geelong-Ballan Road	0	0
Pringles Road	0	0
Southerlands Creek Road	0	0

Results for: PV Array Area 01

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
Clifton Road	8	0
Geelong-Ballan Road	0	0
Pringles Road	0	0
Southerlands Creek Road	0	0

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 13

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 14

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 15

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 16

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 17

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 18

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 19

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 20

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 21

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 22

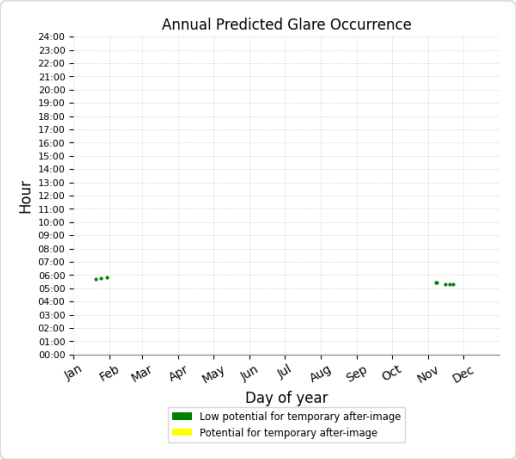
0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 23

0 minutes of yellow glare
0 minutes of green glare

Route: Clifton Road

0 minutes of yellow glare
8 minutes of green glare



Route: Geelong-Ballan Road

0 minutes of yellow glare
0 minutes of green glare

Route: Pringles Road

0 minutes of yellow glare
0 minutes of green glare

Route: Southerlands Creek Road

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to V1 algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

FORGESOLAR GLARE ANALYSIS

Project: **2152 ANAKIE SOLAR FARM**
2152 ANAKIE SOLAR FARM

Site configuration: **2152 ANAKIE SOLAR FARM 20220801**

Client: NGH

Created 31 Jul, 2022
Updated 31 Jul, 2022
Time-step 1 minute
Timezone offset UTC10
Site ID 73363.11981
Category 1 MW to 5 MW
DNI peaks at 1,000.0 W/m^2
Ocular transmission coefficient 0.5
Pupil diameter 0.002 m
Eye focal length 0.017 m
Sun subtended angle 9.3 mrad
Methodology V2

Summary of Results

Glare with low potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV Array Area 01	SA tracking	SA tracking	8	0.1	0	0.0	-

Total annual glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Clifton Road	8	0.1	0	0.0
Geelong-Ballan Road	0	0.0	0	0.0
Pringles Road	0	0.0	0	0.0
Southerlands Creek Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0

Component Data

PV Arrays

Name: PV Array Area 01
Axis tracking: Single-axis rotation
Backtracking: Instant
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.74°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Rated power: -
Panel material: Smooth glass without AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.968306	144.269431	109.64	5.10	114.74
2	-37.968697	144.269417	109.78	5.10	114.88
3	-37.968700	144.269553	110.22	5.10	115.32
4	-37.969244	144.269533	109.89	5.10	114.99
5	-37.969242	144.269381	110.04	5.10	115.14
6	-37.969411	144.269372	110.00	5.10	115.10
7	-37.969150	144.267178	114.68	5.10	119.78
8	-37.969394	144.267167	114.95	5.10	120.05
9	-37.969183	144.265394	111.05	5.10	116.15
10	-37.969439	144.265386	112.10	5.10	117.20
11	-37.969203	144.263356	110.27	5.10	115.37
12	-37.968644	144.263375	109.56	5.10	114.66
13	-37.968644	144.263444	109.89	5.10	114.99
14	-37.968100	144.263464	109.02	5.10	114.12
15	-37.968100	144.263544	109.23	5.10	114.33
16	-37.967850	144.263553	109.00	5.10	114.10
17	-37.967853	144.263636	109.00	5.10	114.10
18	-37.967583	144.263647	109.00	5.10	114.10

Route Receptors

Name: Clifton Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.972714	144.247898	87.51	2.40	89.91
2	-37.969094	144.248649	92.65	2.40	95.05
3	-37.965254	144.249486	91.60	2.40	94.00
4	-37.962141	144.250076	95.25	2.40	97.65
5	-37.961938	144.249422	95.28	2.40	97.68
6	-37.961050	144.242030	95.39	2.40	97.79
7	-37.960754	144.239444	97.59	2.40	99.99

Name: Geelong-Ballan Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.946315	144.265812	137.99	2.40	140.39
2	-37.948531	144.266027	132.08	2.40	134.48
3	-37.951543	144.266349	128.06	2.40	130.46
4	-37.954521	144.266627	123.45	2.40	125.85
5	-37.958159	144.267035	113.28	2.40	115.68
6	-37.960498	144.267226	111.24	2.40	113.64
7	-37.963940	144.268385	110.00	2.40	112.40
8	-37.966847	144.269378	110.28	2.40	112.68
9	-37.970180	144.270558	109.98	2.40	112.38
10	-37.973825	144.271749	107.98	2.40	110.38
11	-37.978377	144.273371	108.27	2.40	110.67
12	-37.982048	144.274626	99.63	2.40	102.03
13	-37.986484	144.276159	93.64	2.40	96.04
14	-37.991270	144.277940	87.40	2.40	89.80

Name: Pringles Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.975739	144.272345	108.97	2.40	111.37
2	-37.975396	144.269255	105.37	2.40	107.77
3	-37.974935	144.265366	107.97	2.40	110.37
4	-37.974297	144.259921	106.06	2.40	108.46
5	-37.973768	144.255710	100.29	2.40	102.69
6	-37.973132	144.250505	92.41	2.40	94.81
7	-37.972671	144.246536	86.29	2.40	88.69
8	-37.972122	144.242083	85.75	2.40	88.15
9	-37.971885	144.239895	85.63	2.40	88.03
10	-37.972223	144.238435	87.04	2.40	89.44

Name: Southerlands Creek Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.987490	144.250935	81.12	2.40	83.52
2	-37.984792	144.251525	87.73	2.40	90.13
3	-37.982069	144.252019	101.33	2.40	103.73
4	-37.979397	144.252555	114.45	2.40	116.85
5	-37.976708	144.253038	103.63	2.40	106.03
6	-37.975270	144.253324	101.50	2.40	103.90
7	-37.973565	144.253635	98.57	2.40	100.97

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-37.967643	144.267038	109.77	1.50
OP 2	2	-37.962399	144.253757	99.24	1.50
OP 3	3	-37.964461	144.251943	94.34	1.50
OP 4	4	-37.968523	144.251101	92.33	1.50
OP 5	5	-37.971616	144.253401	98.17	1.50
OP 6	6	-37.971350	144.266242	116.09	1.50
OP 7	7	-37.971269	144.267181	117.79	1.50
OP 8	8	-37.972208	144.267058	116.71	1.50
OP 9	9	-37.977064	144.265575	102.00	1.50
OP 10	10	-37.976899	144.271412	107.88	1.50
OP 11	11	-37.977861	144.274978	109.00	1.50
OP 12	12	-37.984062	144.251315	91.11	1.50
OP 13	13	-37.978203	144.246536	95.53	1.50
OP 14	14	-37.973644	144.242626	84.81	1.50
OP 15	15	-37.984449	144.277955	100.00	1.50
OP 16	16	-37.972560	144.285913	99.05	1.50
OP 17	17	-37.964759	144.272337	106.35	1.50
OP 18	18	-37.952480	144.264137	125.66	1.50
OP 19	19	-37.970478	144.261092	106.59	1.50
OP 20	20	-37.970811	144.265609	115.05	1.50
OP 21	21	-37.968214	144.251715	94.34	1.50
OP 22	22	-37.967942	144.249730	94.09	1.50
OP 23	23	-37.974195	144.285156	100.00	1.50

Glare Analysis Results

Summary of Results

Glare with low potential for temporary after-image predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV Array Area 01	SA tracking	SA tracking	8	0.1	0	0.0	-

Total annual glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Clifton Road	8	0.1	0	0.0
Geelong-Ballan Road	0	0.0	0	0.0
Pringles Road	0	0.0	0	0.0
Southerlands Creek Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0

PV: PV Array Area 01 low potential for temporary after-image

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Clifton Road	8	0.1	0	0.0
Geelong-Ballan Road	0	0.0	0	0.0
Pringles Road	0	0.0	0	0.0
Southerlands Creek Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0

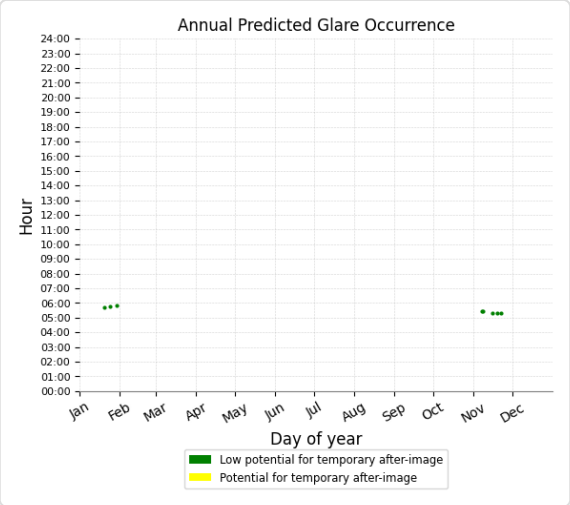
PV Array Area 01 and Clifton Road

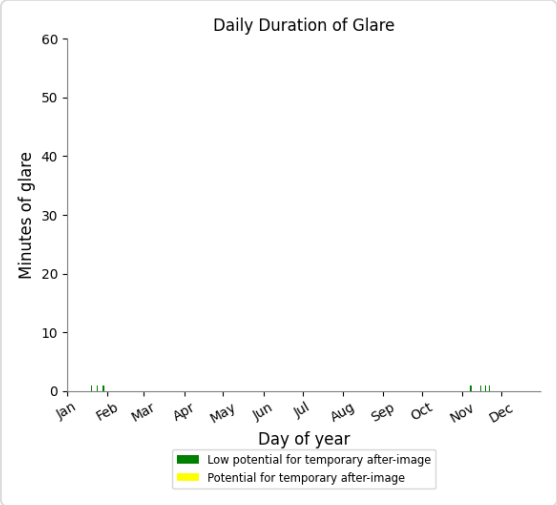
ADVERTISED PLAN

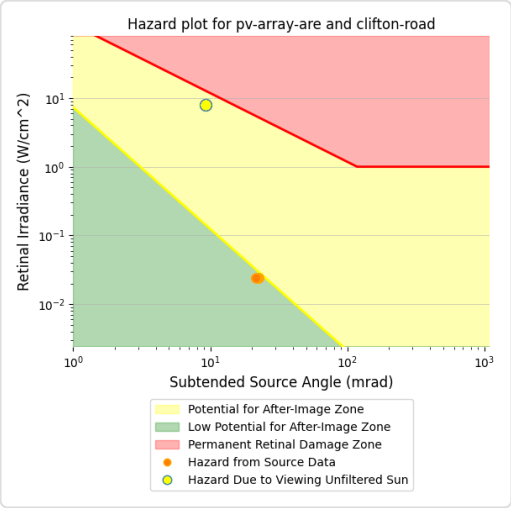
Receptor type: Route

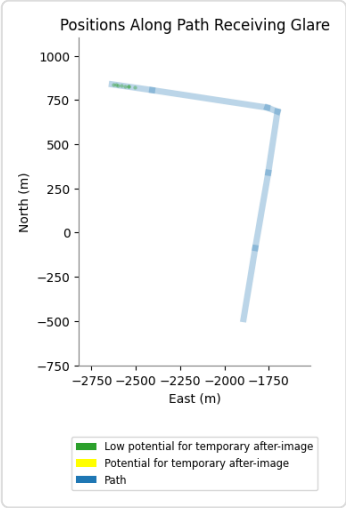
0 minutes of yellow glare

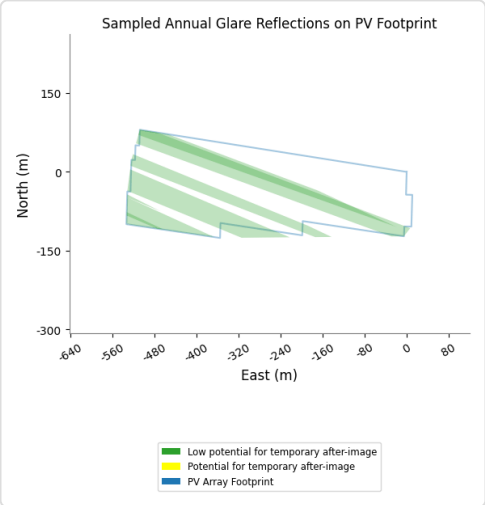
8 minutes of green glare











PV Array Area 01 and Geelong-Ballan Road

Receptor type: Route

No glare found

PV Array Area 01 and Pringles Road

Receptor type: Route

No glare found

PV Array Area 01 and Southerlands Creek Road

Receptor type: Route

No glare found

PV Array Area 01 and OP 1

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 2

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 3

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 4

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 5

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 6

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 7

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 8

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 9

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 10

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 11

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 12

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 13

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 14

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 15

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 16

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 17

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 18

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 19

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 20

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 21

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 22

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 23

Receptor type: Observation Point

No glare found

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.
Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.
Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.
The analysis does not consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.
The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FORGESOLAR GLARE ANALYSIS

Project: **2152 ANAKIE SOLAR FARM**
2152 ANAKIE SOLAR FARM

Site configuration: **2152 ANAKIE SOLAR FARM BCTR ANGLE 5 20220801**
Analysis conducted by David Moir (itsupport@moirla.com.au) at 00:39 on 01 Aug, 2022.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	N/A	No flight paths analyzed
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

ADVERTISED PLAN

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 73364.11981
Methodology: V2

ADVERTISED PLAN

PV Array(s)

Name: PV Array Area 01
Axis tracking: Single-axis rotation
Backtracking: Instant
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.74°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Rated power: -
Panel material: Smooth glass without AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.968306	144.269431	109.64	5.10	114.74
2	-37.968697	144.269417	109.78	5.10	114.88
3	-37.968700	144.269553	110.22	5.10	115.32
4	-37.969244	144.269533	109.89	5.10	114.99
5	-37.969242	144.269381	110.04	5.10	115.14
6	-37.969411	144.269372	110.00	5.10	115.10
7	-37.969150	144.267178	114.68	5.10	119.78
8	-37.969394	144.267167	114.95	5.10	120.05
9	-37.969183	144.265394	111.05	5.10	116.15
10	-37.969439	144.265386	112.10	5.10	117.20
11	-37.969203	144.263356	110.27	5.10	115.37
12	-37.968644	144.263375	109.56	5.10	114.66
13	-37.968644	144.263444	109.89	5.10	114.99
14	-37.968100	144.263464	109.02	5.10	114.12
15	-37.968100	144.263544	109.23	5.10	114.33
16	-37.967850	144.263553	109.00	5.10	114.10
17	-37.967853	144.263636	109.00	5.10	114.10
18	-37.967583	144.263647	109.00	5.10	114.10

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-37.967643	144.267038	109.77	1.50
OP 2	2	-37.962399	144.253757	99.24	1.50
OP 3	3	-37.964461	144.251943	94.34	1.50
OP 4	4	-37.968523	144.251101	92.33	1.50
OP 5	5	-37.971616	144.253401	98.17	1.50
OP 6	6	-37.971350	144.266242	116.09	1.50
OP 7	7	-37.971269	144.267181	117.79	1.50
OP 8	8	-37.972208	144.267058	116.71	1.50
OP 9	9	-37.977064	144.265575	102.00	1.50
OP 10	10	-37.976899	144.271412	107.88	1.50
OP 11	11	-37.977861	144.274978	109.00	1.50
OP 12	12	-37.984062	144.251315	91.11	1.50
OP 13	13	-37.978203	144.246536	95.53	1.50
OP 14	14	-37.973644	144.242626	84.81	1.50
OP 15	15	-37.984449	144.277955	100.00	1.50
OP 16	16	-37.972560	144.285913	99.05	1.50
OP 17	17	-37.964759	144.272337	106.35	1.50
OP 18	18	-37.952480	144.264137	125.66	1.50
OP 19	19	-37.970478	144.261092	106.59	1.50
OP 20	20	-37.970811	144.265609	115.05	1.50
OP 21	21	-37.968214	144.251715	94.34	1.50
OP 22	22	-37.967942	144.248730	94.09	1.50
OP 23	23	-37.974195	144.285156	100.00	1.50

Route Receptor(s)

Name: Clifton Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.972714	144.247898	87.51	2.40	89.91
2	-37.969094	144.248649	92.65	2.40	95.05
3	-37.965254	144.249486	91.60	2.40	94.00
4	-37.962141	144.250076	95.25	2.40	97.65
5	-37.961938	144.249422	95.28	2.40	97.68
6	-37.961050	144.242030	95.39	2.40	97.79
7	-37.960754	144.239444	97.59	2.40	99.99

Name: Geelong-Ballan Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.946315	144.265812	137.99	2.40	140.39
2	-37.948531	144.266027	132.08	2.40	134.48
3	-37.951543	144.266349	128.06	2.40	130.46
4	-37.954521	144.266627	123.45	2.40	125.85
5	-37.958159	144.267035	113.28	2.40	115.68
6	-37.960498	144.267226	111.24	2.40	113.64
7	-37.963940	144.268385	110.00	2.40	112.40
8	-37.966847	144.269378	110.28	2.40	112.68
9	-37.970180	144.270558	109.98	2.40	112.38
10	-37.973825	144.271749	107.98	2.40	110.38
11	-37.978377	144.273371	108.27	2.40	110.67
12	-37.982048	144.274626	99.63	2.40	102.03
13	-37.986484	144.276159	93.64	2.40	96.04
14	-37.991270	144.277940	87.40	2.40	89.80

Name: Pringles Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.975739	144.272345	108.97	2.40	111.37
2	-37.975396	144.269255	105.37	2.40	107.77
3	-37.974935	144.265366	107.97	2.40	110.37
4	-37.974297	144.259921	106.06	2.40	108.46
5	-37.973768	144.255710	100.29	2.40	102.69
6	-37.973132	144.250505	92.41	2.40	94.81
7	-37.972671	144.246536	86.29	2.40	88.69
8	-37.972122	144.242083	85.75	2.40	88.15
9	-37.971885	144.239895	85.63	2.40	88.03
10	-37.972223	144.238435	87.04	2.40	89.44

Name: Southerlands Creek Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.987490	144.250935	81.12	2.40	83.52
2	-37.984792	144.251525	87.73	2.40	90.13
3	-37.982069	144.252019	101.33	2.40	103.73
4	-37.979397	144.252555	114.45	2.40	116.85
5	-37.976708	144.253038	103.63	2.40	106.03
6	-37.975270	144.253324	101.50	2.40	103.90
7	-37.973565	144.253635	98.57	2.40	100.97

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV Array Area 01	SA tracking	SA tracking	0	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
Clifton Road	0	0
Geelong-Ballan Road	0	0
Pringles Road	0	0
Southerlands Creek Road	0	0

Results for: PV Array Area 01

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
Clifton Road	0	0
Geelong-Ballan Road	0	0
Pringles Road	0	0
Southerlands Creek Road	0	0

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 13

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 14

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 15

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 16

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 17

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 18

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 19

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 20

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 21

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 22

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 23

0 minutes of yellow glare
0 minutes of green glare

Route: Clifton Road

0 minutes of yellow glare
0 minutes of green glare

Route: Geelong-Ballan Road

0 minutes of yellow glare
0 minutes of green glare

Route: Pringles Road

0 minutes of yellow glare
0 minutes of green glare

Route: Southerlands Creek Road

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to V1 algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

FORGESOLAR GLARE ANALYSIS

Project: **2152 ANAKIE SOLAR FARM**
2152 ANAKIE SOLAR FARM

Site configuration: **2152 ANAKIE SOLAR FARM BCTR ANGLE 5 20220801**

Client: NGH

Created 01 Aug, 2022
Updated 01 Aug, 2022
Time-step 1 minute
Timezone offset UTC10
Site ID 73364.11981
Category 1 MW to 5 MW
DNI peaks at 1,000.0 W/m^2
Ocular transmission coefficient 0.5
Pupil diameter 0.002 m
Eye focal length 0.017 m
Sun subtended angle 9.3 mrad
Methodology V2

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV Array Area 01	SA tracking	SA tracking	0	0.0	0	0.0	-

Total annual glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Clifton Road	0	0.0	0	0.0
Geelong-Ballan Road	0	0.0	0	0.0
Pringles Road	0	0.0	0	0.0
Southerlands Creek Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0

Component Data

PV Arrays

Name: PV Array Area 01
Axis tracking: Single-axis rotation
Backtracking: Instant
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.74°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 5.0°
Rated power: -
Panel material: Smooth glass without AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.968306	144.269431	109.64	5.10	114.74
2	-37.968697	144.269417	109.78	5.10	114.88
3	-37.968700	144.269553	110.22	5.10	115.32
4	-37.969244	144.269533	109.89	5.10	114.99
5	-37.969242	144.269381	110.04	5.10	115.14
6	-37.969411	144.269372	110.00	5.10	115.10
7	-37.969150	144.267178	114.68	5.10	119.78
8	-37.969394	144.267167	114.95	5.10	120.05
9	-37.969183	144.265394	111.05	5.10	116.15
10	-37.969439	144.265386	112.10	5.10	117.20
11	-37.969203	144.263356	110.27	5.10	115.37
12	-37.968644	144.263375	109.56	5.10	114.66
13	-37.968644	144.263444	109.89	5.10	114.99
14	-37.968100	144.263464	109.02	5.10	114.12
15	-37.968100	144.263544	109.23	5.10	114.33
16	-37.967850	144.263553	109.00	5.10	114.10
17	-37.967853	144.263636	109.00	5.10	114.10
18	-37.967583	144.263647	109.00	5.10	114.10

Route Receptors

Name: Clifton Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.972714	144.247898	87.51	2.40	89.91
2	-37.969094	144.248649	92.65	2.40	95.05
3	-37.965254	144.249486	91.60	2.40	94.00
4	-37.962141	144.250076	95.25	2.40	97.65
5	-37.961938	144.249422	95.28	2.40	97.68
6	-37.961050	144.242030	95.39	2.40	97.79
7	-37.960754	144.239444	97.59	2.40	99.99

Name: Geelong-Ballan Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.946315	144.265812	137.99	2.40	140.39
2	-37.948531	144.266027	132.08	2.40	134.48
3	-37.951543	144.266349	128.06	2.40	130.46
4	-37.954521	144.266627	123.45	2.40	125.85
5	-37.958159	144.267035	113.28	2.40	115.68
6	-37.960498	144.267226	111.24	2.40	113.64
7	-37.963940	144.268385	110.00	2.40	112.40
8	-37.966847	144.269378	110.28	2.40	112.68
9	-37.970180	144.270558	109.98	2.40	112.38
10	-37.973825	144.271749	107.98	2.40	110.38
11	-37.978377	144.273371	108.27	2.40	110.67
12	-37.982048	144.274626	99.63	2.40	102.03
13	-37.986484	144.276159	93.64	2.40	96.04
14	-37.991270	144.277940	87.40	2.40	89.80

Name: Pringles Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.975739	144.272345	108.97	2.40	111.37
2	-37.975396	144.269255	105.37	2.40	107.77
3	-37.974935	144.265366	107.97	2.40	110.37
4	-37.974297	144.259921	106.06	2.40	108.46
5	-37.973768	144.255710	100.29	2.40	102.69
6	-37.973132	144.250505	92.41	2.40	94.81
7	-37.972671	144.246536	86.29	2.40	88.69
8	-37.972122	144.242083	85.75	2.40	88.15
9	-37.971885	144.239895	85.63	2.40	88.03
10	-37.972223	144.238435	87.04	2.40	89.44

Name: Southerlands Creek Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.987490	144.250935	81.12	2.40	83.52
2	-37.984792	144.251525	87.73	2.40	90.13
3	-37.982069	144.252019	101.33	2.40	103.73
4	-37.979397	144.252555	114.45	2.40	116.85
5	-37.976708	144.253038	103.63	2.40	106.03
6	-37.975270	144.253324	101.50	2.40	103.90
7	-37.973565	144.253635	98.57	2.40	100.97

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-37.967643	144.267038	109.77	1.50
OP 2	2	-37.962399	144.253757	99.24	1.50
OP 3	3	-37.964461	144.251943	94.34	1.50
OP 4	4	-37.968523	144.251101	92.33	1.50
OP 5	5	-37.971616	144.253401	98.17	1.50
OP 6	6	-37.971350	144.266242	116.09	1.50
OP 7	7	-37.971269	144.267181	117.79	1.50
OP 8	8	-37.972208	144.267058	116.71	1.50
OP 9	9	-37.977064	144.265575	102.00	1.50
OP 10	10	-37.976899	144.271412	107.88	1.50
OP 11	11	-37.977861	144.274978	109.00	1.50
OP 12	12	-37.984062	144.251315	91.11	1.50
OP 13	13	-37.978203	144.246536	95.53	1.50
OP 14	14	-37.973644	144.242626	84.81	1.50
OP 15	15	-37.984449	144.277955	100.00	1.50
OP 16	16	-37.972560	144.285913	99.05	1.50
OP 17	17	-37.964759	144.272337	106.35	1.50
OP 18	18	-37.952480	144.264137	125.66	1.50
OP 19	19	-37.970478	144.261092	106.59	1.50
OP 20	20	-37.970811	144.265609	115.05	1.50
OP 21	21	-37.968214	144.251715	94.34	1.50
OP 22	22	-37.967942	144.249730	94.09	1.50
OP 23	23	-37.974195	144.285156	100.00	1.50

Glare Analysis Results

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV Array Area 01	SA tracking	SA tracking	0	0.0	0	0.0	-

Total annual glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Clifton Road	0	0.0	0	0.0
Geelong-Ballan Road	0	0.0	0	0.0
Pringles Road	0	0.0	0	0.0
Southerlands Creek Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0

PV: PV Array Area 01 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Clifton Road	0	0.0	0	0.0
Geelong-Ballan Road	0	0.0	0	0.0
Pringles Road	0	0.0	0	0.0
Southerlands Creek Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0

PV Array Area 01 and Clifton Road

Receptor type: Route

No glare found

PV Array Area 01 and Geelong-Ballan Road

Receptor type: Route

No glare found

PV Array Area 01 and Pringles Road

Receptor type: Route
No glare found

PV Array Area 01 and Southerlands Creek Road

Receptor type: Route
No glare found

PV Array Area 01 and OP 1

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 2

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 3

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 4

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 5

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 6

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 7

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 8

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 9

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 10

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 11

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 12

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 13

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 14

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 15

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 16

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 17

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 18

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 19

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 20

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 21

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 22

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 23

Receptor type: Observation Point

No glare found

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.
Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.
Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.
The analysis does not consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.
The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

ADVERTISED PLAN

FORGESOLAR GLARE ANALYSIS

Project: **2152 ANAKIE SOLAR FARM**
2152 ANAKIE SOLAR FARM

Site configuration: **2152 ANAKIE SOLAR FARM BCTR ANGLE 22 20220801**
Analysis conducted by David Moir (itsupport@moirla.com.au) at 00:42 on 01 Aug, 2022.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	N/A	No flight paths analyzed
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

ADVERTISED PLAN

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 73365.11981
Methodology: V2

ADVERTISED PLAN

PV Array(s)

Name: PV Array Area 01
Axis tracking: Single-axis rotation
Backtracking: Instant
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.74°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 22.0°
Rated power: -
Panel material: Smooth glass without AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.968306	144.269431	109.64	5.10	114.74
2	-37.968697	144.269417	109.78	5.10	114.88
3	-37.968700	144.269553	110.22	5.10	115.32
4	-37.969244	144.269533	109.89	5.10	114.99
5	-37.969242	144.269381	110.04	5.10	115.14
6	-37.969411	144.269372	110.00	5.10	115.10
7	-37.969150	144.267178	114.68	5.10	119.78
8	-37.969394	144.267167	114.95	5.10	120.05
9	-37.969183	144.265394	111.05	5.10	116.15
10	-37.969439	144.265386	112.10	5.10	117.20
11	-37.969203	144.263356	110.27	5.10	115.37
12	-37.968644	144.263375	109.56	5.10	114.66
13	-37.968644	144.263444	109.89	5.10	114.99
14	-37.968100	144.263464	109.02	5.10	114.12
15	-37.968100	144.263544	109.23	5.10	114.33
16	-37.967850	144.263553	109.00	5.10	114.10
17	-37.967853	144.263636	109.00	5.10	114.10
18	-37.967583	144.263647	109.00	5.10	114.10

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-37.967643	144.267038	109.77	1.50
OP 2	2	-37.962399	144.253757	99.24	1.50
OP 3	3	-37.964461	144.251943	94.34	1.50
OP 4	4	-37.968523	144.251101	92.33	1.50
OP 5	5	-37.971616	144.253401	98.17	1.50
OP 6	6	-37.971350	144.266242	116.09	1.50
OP 7	7	-37.971269	144.267181	117.79	1.50
OP 8	8	-37.972208	144.267058	116.71	1.50
OP 9	9	-37.977064	144.265575	102.00	1.50
OP 10	10	-37.976899	144.271412	107.88	1.50
OP 11	11	-37.977861	144.274978	109.00	1.50
OP 12	12	-37.984062	144.251315	91.11	1.50
OP 13	13	-37.978203	144.246536	95.53	1.50
OP 14	14	-37.973644	144.242626	84.81	1.50
OP 15	15	-37.984449	144.277955	100.00	1.50
OP 16	16	-37.972560	144.285913	99.05	1.50
OP 17	17	-37.964759	144.272337	106.35	1.50
OP 18	18	-37.952480	144.264137	125.66	1.50
OP 19	19	-37.970478	144.261092	106.59	1.50
OP 20	20	-37.970811	144.265609	115.05	1.50
OP 21	21	-37.968214	144.251715	94.34	1.50
OP 22	22	-37.967942	144.248730	94.09	1.50
OP 23	23	-37.974195	144.285156	100.00	1.50

Route Receptor(s)

Name: Clifton Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.972714	144.247898	87.51	2.40	89.91
2	-37.969094	144.248649	92.65	2.40	95.05
3	-37.965254	144.249486	91.60	2.40	94.00
4	-37.962141	144.250076	95.25	2.40	97.65
5	-37.961938	144.249422	95.28	2.40	97.68
6	-37.961050	144.242030	95.39	2.40	97.79
7	-37.960754	144.239444	97.59	2.40	99.99

Name: Geelong-Ballan Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.946315	144.265812	137.99	2.40	140.39
2	-37.948531	144.266027	132.08	2.40	134.48
3	-37.951543	144.266349	128.06	2.40	130.46
4	-37.954521	144.266627	123.45	2.40	125.85
5	-37.958159	144.267035	113.28	2.40	115.68
6	-37.960498	144.267226	111.24	2.40	113.64
7	-37.963940	144.268385	110.00	2.40	112.40
8	-37.966847	144.269378	110.28	2.40	112.68
9	-37.970180	144.270558	109.98	2.40	112.38
10	-37.973825	144.271749	107.98	2.40	110.38
11	-37.978377	144.273371	108.27	2.40	110.67
12	-37.982048	144.274626	99.63	2.40	102.03
13	-37.986484	144.276159	93.64	2.40	96.04
14	-37.991270	144.277940	87.40	2.40	89.80

Name: Pringles Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.975739	144.272345	108.97	2.40	111.37
2	-37.975396	144.269255	105.37	2.40	107.77
3	-37.974935	144.265366	107.97	2.40	110.37
4	-37.974297	144.259921	106.06	2.40	108.46
5	-37.973768	144.255710	100.29	2.40	102.69
6	-37.973132	144.250505	92.41	2.40	94.81
7	-37.972671	144.246536	86.29	2.40	88.69
8	-37.972122	144.242083	85.75	2.40	88.15
9	-37.971885	144.239895	85.63	2.40	88.03
10	-37.972223	144.238435	87.04	2.40	89.44

Name: Southerlands Creek Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.987490	144.250935	81.12	2.40	83.52
2	-37.984792	144.251525	87.73	2.40	90.13
3	-37.982069	144.252019	101.33	2.40	103.73
4	-37.979397	144.252555	114.45	2.40	116.85
5	-37.976708	144.253038	103.63	2.40	106.03
6	-37.975270	144.253324	101.50	2.40	103.90
7	-37.973565	144.253635	98.57	2.40	100.97

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV Array Area 01	SA tracking	SA tracking	0	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
Clifton Road	0	0
Geelong-Ballan Road	0	0
Pringles Road	0	0
Southerlands Creek Road	0	0

Results for: PV Array Area 01

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
Clifton Road	0	0
Geelong-Ballan Road	0	0
Pringles Road	0	0
Southerlands Creek Road	0	0

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 13

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 14

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 15

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 16

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 17

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 18

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 19

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 20

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 21

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 22

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 23

0 minutes of yellow glare
0 minutes of green glare

Route: Clifton Road

0 minutes of yellow glare
0 minutes of green glare

Route: Geelong-Ballan Road

0 minutes of yellow glare
0 minutes of green glare

Route: Pringles Road

0 minutes of yellow glare
0 minutes of green glare

Route: Southerlands Creek Road

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to V1 algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

FORGESOLAR GLARE ANALYSIS

Project: **2152 ANAKIE SOLAR FARM**
2152 ANAKIE SOLAR FARM

Site configuration: **2152 ANAKIE SOLAR FARM BCTR ANGLE 22 20220801**

Client: NGH

Created 01 Aug, 2022
Updated 01 Aug, 2022
Time-step 1 minute
Timezone offset UTC10
Site ID 73365.11981
Category 1 MW to 5 MW
DNI peaks at 1,000.0 W/m^2
Ocular transmission coefficient 0.5
Pupil diameter 0.002 m
Eye focal length 0.017 m
Sun subtended angle 9.3 mrad
Methodology V2

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV Array Area 01	SA tracking	SA tracking	0	0.0	0	0.0	-

Total annual glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Clifton Road	0	0.0	0	0.0
Geelong-Ballan Road	0	0.0	0	0.0
Pringles Road	0	0.0	0	0.0
Southerlands Creek Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0

Component Data

PV Arrays

Name: PV Array Area 01
Axis tracking: Single-axis rotation
Backtracking: Instant
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.74°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 22.0°
Rated power: -
Panel material: Smooth glass without AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.968306	144.269431	109.64	5.10	114.74
2	-37.968697	144.269417	109.78	5.10	114.88
3	-37.968700	144.269553	110.22	5.10	115.32
4	-37.969244	144.269533	109.89	5.10	114.99
5	-37.969242	144.269381	110.04	5.10	115.14
6	-37.969411	144.269372	110.00	5.10	115.10
7	-37.969150	144.267178	114.68	5.10	119.78
8	-37.969394	144.267167	114.95	5.10	120.05
9	-37.969183	144.265394	111.05	5.10	116.15
10	-37.969439	144.265386	112.10	5.10	117.20
11	-37.969203	144.263356	110.27	5.10	115.37
12	-37.968644	144.263375	109.56	5.10	114.66
13	-37.968644	144.263444	109.89	5.10	114.99
14	-37.968100	144.263464	109.02	5.10	114.12
15	-37.968100	144.263544	109.23	5.10	114.33
16	-37.967850	144.263553	109.00	5.10	114.10
17	-37.967853	144.263636	109.00	5.10	114.10
18	-37.967583	144.263647	109.00	5.10	114.10

Route Receptors

Name: Clifton Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.972714	144.247898	87.51	2.40	89.91
2	-37.969094	144.248649	92.65	2.40	95.05
3	-37.965254	144.249486	91.60	2.40	94.00
4	-37.962141	144.250076	95.25	2.40	97.65
5	-37.961938	144.249422	95.28	2.40	97.68
6	-37.961050	144.242030	95.39	2.40	97.79
7	-37.960754	144.239444	97.59	2.40	99.99

Name: Geelong-Ballan Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.946315	144.265812	137.99	2.40	140.39
2	-37.948531	144.266027	132.08	2.40	134.48
3	-37.951543	144.266349	128.06	2.40	130.46
4	-37.954521	144.266627	123.45	2.40	125.85
5	-37.958159	144.267035	113.28	2.40	115.68
6	-37.960498	144.267226	111.24	2.40	113.64
7	-37.963940	144.268385	110.00	2.40	112.40
8	-37.966847	144.269378	110.28	2.40	112.68
9	-37.970180	144.270558	109.98	2.40	112.38
10	-37.973825	144.271749	107.98	2.40	110.38
11	-37.978377	144.273371	108.27	2.40	110.67
12	-37.982048	144.274626	99.63	2.40	102.03
13	-37.986484	144.276159	93.64	2.40	96.04
14	-37.991270	144.277940	87.40	2.40	89.80

Name: Pringles Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.975739	144.272345	108.97	2.40	111.37
2	-37.975396	144.269255	105.37	2.40	107.77
3	-37.974935	144.265366	107.97	2.40	110.37
4	-37.974297	144.259921	106.06	2.40	108.46
5	-37.973768	144.255710	100.29	2.40	102.69
6	-37.973132	144.250505	92.41	2.40	94.81
7	-37.972671	144.246536	86.29	2.40	88.69
8	-37.972122	144.242083	85.75	2.40	88.15
9	-37.971885	144.239895	85.63	2.40	88.03
10	-37.972223	144.238435	87.04	2.40	89.44

Name: Southerlands Creek Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.987490	144.250935	81.12	2.40	83.52
2	-37.984792	144.251525	87.73	2.40	90.13
3	-37.982069	144.252019	101.33	2.40	103.73
4	-37.979397	144.252555	114.45	2.40	116.85
5	-37.976708	144.253038	103.63	2.40	106.03
6	-37.975270	144.253324	101.50	2.40	103.90
7	-37.973565	144.253635	98.57	2.40	100.97

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-37.967643	144.267038	109.77	1.50
OP 2	2	-37.962399	144.253757	99.24	1.50
OP 3	3	-37.964461	144.251943	94.34	1.50
OP 4	4	-37.968523	144.251101	92.33	1.50
OP 5	5	-37.971616	144.253401	98.17	1.50
OP 6	6	-37.971350	144.266242	116.09	1.50
OP 7	7	-37.971269	144.267181	117.79	1.50
OP 8	8	-37.972208	144.267058	116.71	1.50
OP 9	9	-37.977064	144.265575	102.00	1.50
OP 10	10	-37.976899	144.271412	107.88	1.50
OP 11	11	-37.977861	144.274978	109.00	1.50
OP 12	12	-37.984062	144.251315	91.11	1.50
OP 13	13	-37.978203	144.246536	95.53	1.50
OP 14	14	-37.973644	144.242626	84.81	1.50
OP 15	15	-37.984449	144.277955	100.00	1.50
OP 16	16	-37.972560	144.285913	99.05	1.50
OP 17	17	-37.964759	144.272337	106.35	1.50
OP 18	18	-37.952480	144.264137	125.66	1.50
OP 19	19	-37.970478	144.261092	106.59	1.50
OP 20	20	-37.970811	144.265609	115.05	1.50
OP 21	21	-37.968214	144.251715	94.34	1.50
OP 22	22	-37.967942	144.249730	94.09	1.50
OP 23	23	-37.974195	144.285156	100.00	1.50

Glare Analysis Results

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV Array Area 01	SA tracking	SA tracking	0	0.0	0	0.0	-

Total annual glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Clifton Road	0	0.0	0	0.0
Geelong-Ballan Road	0	0.0	0	0.0
Pringles Road	0	0.0	0	0.0
Southerlands Creek Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0

PV: PV Array Area 01 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Clifton Road	0	0.0	0	0.0
Geelong-Ballan Road	0	0.0	0	0.0
Pringles Road	0	0.0	0	0.0
Southerlands Creek Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0

PV Array Area 01 and Clifton Road

Receptor type: Route

No glare found

PV Array Area 01 and Geelong-Ballan Road

Receptor type: Route

No glare found

PV Array Area 01 and Pringles Road

Receptor type: Route
No glare found

PV Array Area 01 and Southerlands Creek Road

Receptor type: Route
No glare found

PV Array Area 01 and OP 1

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 2

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 3

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 4

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 5

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 6

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 7

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 8

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 9

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 10

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 11

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 12

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 13

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 14

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 15

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 16

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 17

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 18

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 19

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 20

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 21

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 22

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 23

Receptor type: Observation Point

No glare found

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.
Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.
Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.
The analysis does not consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.
The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

ADVERTISED PLAN

FORGESOLAR GLARE ANALYSIS

Project: **2152 ANAKIE SOLAR FARM**
2152 ANAKIE SOLAR FARM

Site configuration: **2152 ANAKIE SOLAR FARM BCTR ANGLE 45 20220801**
Analysis conducted by David Moir (itsupport@moirla.com.au) at 00:46 on 01 Aug, 2022.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	N/A	No flight paths analyzed
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

ADVERTISED PLAN

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 73367.11981
Methodology: V2

ADVERTISED PLAN

PV Array(s)

Name: PV Array Area 01
Axis tracking: Single-axis rotation
Backtracking: Instant
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.74°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 45.0°
Rated power: -
Panel material: Smooth glass without AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.968306	144.269431	109.64	5.10	114.74
2	-37.968697	144.269417	109.78	5.10	114.88
3	-37.968700	144.269553	110.22	5.10	115.32
4	-37.969244	144.269533	109.89	5.10	114.99
5	-37.969242	144.269381	110.04	5.10	115.14
6	-37.969411	144.269372	110.00	5.10	115.10
7	-37.969150	144.267178	114.68	5.10	119.78
8	-37.969394	144.267167	114.95	5.10	120.05
9	-37.969183	144.265394	111.05	5.10	116.15
10	-37.969439	144.265386	112.10	5.10	117.20
11	-37.969203	144.263356	110.27	5.10	115.37
12	-37.968644	144.263375	109.56	5.10	114.66
13	-37.968644	144.263444	109.89	5.10	114.99
14	-37.968100	144.263464	109.02	5.10	114.12
15	-37.968100	144.263544	109.23	5.10	114.33
16	-37.967850	144.263553	109.00	5.10	114.10
17	-37.967853	144.263636	109.00	5.10	114.10
18	-37.967583	144.263647	109.00	5.10	114.10

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-37.967643	144.267038	109.77	1.50
OP 2	2	-37.962399	144.253757	99.24	1.50
OP 3	3	-37.964461	144.251943	94.34	1.50
OP 4	4	-37.968523	144.251101	92.33	1.50
OP 5	5	-37.971616	144.253401	98.17	1.50
OP 6	6	-37.971350	144.266242	116.09	1.50
OP 7	7	-37.971269	144.267181	117.79	1.50
OP 8	8	-37.972208	144.267058	116.71	1.50
OP 9	9	-37.977064	144.265575	102.00	1.50
OP 10	10	-37.976899	144.271412	107.88	1.50
OP 11	11	-37.977861	144.274978	109.00	1.50
OP 12	12	-37.984062	144.251315	91.11	1.50
OP 13	13	-37.978203	144.246536	95.53	1.50
OP 14	14	-37.973644	144.242626	84.81	1.50
OP 15	15	-37.984449	144.277955	100.00	1.50
OP 16	16	-37.972560	144.285913	99.05	1.50
OP 17	17	-37.964759	144.272337	106.35	1.50
OP 18	18	-37.952480	144.264137	125.66	1.50
OP 19	19	-37.970478	144.261092	106.59	1.50
OP 20	20	-37.970811	144.265609	115.05	1.50
OP 21	21	-37.968214	144.251715	94.34	1.50
OP 22	22	-37.967942	144.248730	94.09	1.50
OP 23	23	-37.974195	144.285156	100.00	1.50

Route Receptor(s)

Name: Clifton Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.972714	144.247898	87.51	2.40	89.91
2	-37.969094	144.248649	92.65	2.40	95.05
3	-37.965254	144.249486	91.60	2.40	94.00
4	-37.962141	144.250076	95.25	2.40	97.65
5	-37.961938	144.249422	95.28	2.40	97.68
6	-37.961050	144.242030	95.39	2.40	97.79
7	-37.960754	144.239444	97.59	2.40	99.99

Name: Geelong-Ballan Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.946315	144.265812	137.99	2.40	140.39
2	-37.948531	144.266027	132.08	2.40	134.48
3	-37.951543	144.266349	128.06	2.40	130.46
4	-37.954521	144.266627	123.45	2.40	125.85
5	-37.958159	144.267035	113.28	2.40	115.68
6	-37.960498	144.267226	111.24	2.40	113.64
7	-37.963940	144.268385	110.00	2.40	112.40
8	-37.966847	144.269378	110.28	2.40	112.68
9	-37.970180	144.270558	109.98	2.40	112.38
10	-37.973825	144.271749	107.98	2.40	110.38
11	-37.978377	144.273371	108.27	2.40	110.67
12	-37.982048	144.274626	99.63	2.40	102.03
13	-37.986484	144.276159	93.64	2.40	96.04
14	-37.991270	144.277940	87.40	2.40	89.80

Name: Pringles Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.975739	144.272345	108.97	2.40	111.37
2	-37.975396	144.269255	105.37	2.40	107.77
3	-37.974935	144.265366	107.97	2.40	110.37
4	-37.974297	144.259921	106.06	2.40	108.46
5	-37.973768	144.255710	100.29	2.40	102.69
6	-37.973132	144.250505	92.41	2.40	94.81
7	-37.972671	144.246536	86.29	2.40	88.69
8	-37.972122	144.242083	85.75	2.40	88.15
9	-37.971885	144.239895	85.63	2.40	88.03
10	-37.972223	144.238435	87.04	2.40	89.44

Name: Southerlands Creek Road
Path type: Two-way
Observer view angle: 50.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.987490	144.250935	81.12	2.40	83.52
2	-37.984792	144.251525	87.73	2.40	90.13
3	-37.982069	144.252019	101.33	2.40	103.73
4	-37.979397	144.252555	114.45	2.40	116.85
5	-37.976708	144.253038	103.63	2.40	106.03
6	-37.975270	144.253324	101.50	2.40	103.90
7	-37.973565	144.253635	98.57	2.40	100.97

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV Array Area 01	SA tracking	SA tracking	0	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
Clifton Road	0	0
Geelong-Ballan Road	0	0
Pringles Road	0	0
Southerlands Creek Road	0	0

Results for: PV Array Area 01

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	0	0
OP 6	0	0
OP 7	0	0
OP 8	0	0
OP 9	0	0
OP 10	0	0
OP 11	0	0
OP 12	0	0
OP 13	0	0
OP 14	0	0
OP 15	0	0
OP 16	0	0
OP 17	0	0
OP 18	0	0
OP 19	0	0
OP 20	0	0
OP 21	0	0
OP 22	0	0
OP 23	0	0
Clifton Road	0	0
Geelong-Ballan Road	0	0
Pringles Road	0	0
Southerlands Creek Road	0	0

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 6

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 7

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 8

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 9

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 10

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 11

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 12

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 13

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 14

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 15

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 16

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 17

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 18

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 19

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 20

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 21

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 22

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 23

0 minutes of yellow glare
0 minutes of green glare

Route: Clifton Road

0 minutes of yellow glare
0 minutes of green glare

Route: Geelong-Ballan Road

0 minutes of yellow glare
0 minutes of green glare

Route: Pringles Road

0 minutes of yellow glare
0 minutes of green glare

Route: Southerlands Creek Road

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to V1 algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

FORGESOLAR GLARE ANALYSIS

Project: **2152 ANAKIE SOLAR FARM**
2152 ANAKIE SOLAR FARM

Site configuration: **2152 ANAKIE SOLAR FARM BCTR ANGLE 45 20220801**

Client: NGH

Created 01 Aug, 2022
Updated 01 Aug, 2022
Time-step 1 minute
Timezone offset UTC10
Site ID 73367.11981
Category 1 MW to 5 MW
DNI peaks at 1,000.0 W/m^2
Ocular transmission coefficient 0.5
Pupil diameter 0.002 m
Eye focal length 0.017 m
Sun subtended angle 9.3 mrad
Methodology V2

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV Array Area 01	SA tracking	SA tracking	0	0.0	0	0.0	-

Total annual glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Clifton Road	0	0.0	0	0.0
Geelong-Ballan Road	0	0.0	0	0.0
Pringles Road	0	0.0	0	0.0
Southerlands Creek Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0

Component Data

PV Arrays

Name: PV Array Area 01
Axis tracking: Single-axis rotation
Backtracking: Instant
Tracking axis orientation: 0.0°
Tracking axis tilt: 0.74°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 45.0°
Rated power: -
Panel material: Smooth glass without AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.968306	144.269431	109.64	5.10	114.74
2	-37.968697	144.269417	109.78	5.10	114.88
3	-37.968700	144.269553	110.22	5.10	115.32
4	-37.969244	144.269533	109.89	5.10	114.99
5	-37.969242	144.269381	110.04	5.10	115.14
6	-37.969411	144.269372	110.00	5.10	115.10
7	-37.969150	144.267178	114.68	5.10	119.78
8	-37.969394	144.267167	114.95	5.10	120.05
9	-37.969183	144.265394	111.05	5.10	116.15
10	-37.969439	144.265386	112.10	5.10	117.20
11	-37.969203	144.263356	110.27	5.10	115.37
12	-37.968644	144.263375	109.56	5.10	114.66
13	-37.968644	144.263444	109.89	5.10	114.99
14	-37.968100	144.263464	109.02	5.10	114.12
15	-37.968100	144.263544	109.23	5.10	114.33
16	-37.967850	144.263553	109.00	5.10	114.10
17	-37.967853	144.263636	109.00	5.10	114.10
18	-37.967583	144.263647	109.00	5.10	114.10

Route Receptors

Name: Clifton Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.972714	144.247898	87.51	2.40	89.91
2	-37.969094	144.248649	92.65	2.40	95.05
3	-37.965254	144.249486	91.60	2.40	94.00
4	-37.962141	144.250076	95.25	2.40	97.65
5	-37.961938	144.249422	95.28	2.40	97.68
6	-37.961050	144.242030	95.39	2.40	97.79
7	-37.960754	144.239444	97.59	2.40	99.99

Name: Geelong-Ballan Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.946315	144.265812	137.99	2.40	140.39
2	-37.948531	144.266027	132.08	2.40	134.48
3	-37.951543	144.266349	128.06	2.40	130.46
4	-37.954521	144.266627	123.45	2.40	125.85
5	-37.958159	144.267035	113.28	2.40	115.68
6	-37.960498	144.267226	111.24	2.40	113.64
7	-37.963940	144.268385	110.00	2.40	112.40
8	-37.966847	144.269378	110.28	2.40	112.68
9	-37.970180	144.270558	109.98	2.40	112.38
10	-37.973825	144.271749	107.98	2.40	110.38
11	-37.978377	144.273371	108.27	2.40	110.67
12	-37.982048	144.274626	99.63	2.40	102.03
13	-37.986484	144.276159	93.64	2.40	96.04
14	-37.991270	144.277940	87.40	2.40	89.80

Name: Pringles Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.975739	144.272345	108.97	2.40	111.37
2	-37.975396	144.269255	105.37	2.40	107.77
3	-37.974935	144.265366	107.97	2.40	110.37
4	-37.974297	144.259921	106.06	2.40	108.46
5	-37.973768	144.255710	100.29	2.40	102.69
6	-37.973132	144.250505	92.41	2.40	94.81
7	-37.972671	144.246536	86.29	2.40	88.69
8	-37.972122	144.242083	85.75	2.40	88.15
9	-37.971885	144.239895	85.63	2.40	88.03
10	-37.972223	144.238435	87.04	2.40	89.44

Name: Southerlands Creek Road
Path type: Two-way
Observer view angle: 50.0°

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	-37.987490	144.250935	81.12	2.40	83.52
2	-37.984792	144.251525	87.73	2.40	90.13
3	-37.982069	144.252019	101.33	2.40	103.73
4	-37.979397	144.252555	114.45	2.40	116.85
5	-37.976708	144.253038	103.63	2.40	106.03
6	-37.975270	144.253324	101.50	2.40	103.90
7	-37.973565	144.253635	98.57	2.40	100.97

Discrete Observation Point Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
OP 1	1	-37.967643	144.267038	109.77	1.50
OP 2	2	-37.962399	144.253757	99.24	1.50
OP 3	3	-37.964461	144.251943	94.34	1.50
OP 4	4	-37.968523	144.251101	92.33	1.50
OP 5	5	-37.971616	144.253401	98.17	1.50
OP 6	6	-37.971350	144.266242	116.09	1.50
OP 7	7	-37.971269	144.267181	117.79	1.50
OP 8	8	-37.972208	144.267058	116.71	1.50
OP 9	9	-37.977064	144.265575	102.00	1.50
OP 10	10	-37.976899	144.271412	107.88	1.50
OP 11	11	-37.977861	144.274978	109.00	1.50
OP 12	12	-37.984062	144.251315	91.11	1.50
OP 13	13	-37.978203	144.246536	95.53	1.50
OP 14	14	-37.973644	144.242626	84.81	1.50
OP 15	15	-37.984449	144.277955	100.00	1.50
OP 16	16	-37.972560	144.285913	99.05	1.50
OP 17	17	-37.964759	144.272337	106.35	1.50
OP 18	18	-37.952480	144.264137	125.66	1.50
OP 19	19	-37.970478	144.261092	106.59	1.50
OP 20	20	-37.970811	144.265609	115.05	1.50
OP 21	21	-37.968214	144.251715	94.34	1.50
OP 22	22	-37.967942	144.249730	94.09	1.50
OP 23	23	-37.974195	144.285156	100.00	1.50

Glare Analysis Results

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
PV Array Area 01	SA tracking	SA tracking	0	0.0	0	0.0	-

Total annual glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Clifton Road	0	0.0	0	0.0
Geelong-Ballan Road	0	0.0	0	0.0
Pringles Road	0	0.0	0	0.0
Southerlands Creek Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0

PV: PV Array Area 01 no glare found

Receptor results ordered by category of glare

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
Clifton Road	0	0.0	0	0.0
Geelong-Ballan Road	0	0.0	0	0.0
Pringles Road	0	0.0	0	0.0
Southerlands Creek Road	0	0.0	0	0.0
OP 1	0	0.0	0	0.0
OP 2	0	0.0	0	0.0
OP 3	0	0.0	0	0.0
OP 4	0	0.0	0	0.0
OP 5	0	0.0	0	0.0
OP 6	0	0.0	0	0.0
OP 7	0	0.0	0	0.0
OP 8	0	0.0	0	0.0
OP 9	0	0.0	0	0.0
OP 10	0	0.0	0	0.0
OP 11	0	0.0	0	0.0
OP 12	0	0.0	0	0.0
OP 13	0	0.0	0	0.0
OP 14	0	0.0	0	0.0
OP 15	0	0.0	0	0.0
OP 16	0	0.0	0	0.0
OP 17	0	0.0	0	0.0
OP 18	0	0.0	0	0.0
OP 19	0	0.0	0	0.0
OP 20	0	0.0	0	0.0
OP 21	0	0.0	0	0.0
OP 22	0	0.0	0	0.0
OP 23	0	0.0	0	0.0

PV Array Area 01 and Clifton Road

Receptor type: Route

No glare found

PV Array Area 01 and Geelong-Ballan Road

Receptor type: Route

No glare found

PV Array Area 01 and Pringles Road

Receptor type: Route
No glare found

PV Array Area 01 and Southerlands Creek Road

Receptor type: Route
No glare found

PV Array Area 01 and OP 1

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 2

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 3

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 4

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 5

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 6

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 7

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 8

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 9

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 10

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 11

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 12

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 13

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 14

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 15

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 16

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 17

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 18

Receptor type: Observation Point
No glare found

PV Array Area 01 and OP 19

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 20

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 21

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 22

Receptor type: Observation Point

No glare found

PV Array Area 01 and OP 23

Receptor type: Observation Point

No glare found

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.
Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.
Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.
The analysis does not consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.
The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

ADVERTISED PLAN

Appendix G Acoustic assessment

RENZO TONIN & ASSOCIATES
inspired to achieve

Acoustics
Vibration
Structural Dynamics

ANAKIE SOLAR FARM

Acoustic Report

ADVERTISED PLAN

1 September 2022

BNRG Renewables Ltd

MD724-01F01 Acoustic Report (r2)

35 1982-2017 ACOUSTIC ENGINEERING EXCELLENCE

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aaac Association of Australian Acoustical Consultants

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Important Disclaimers:

The work presented in this document was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian/New Zealand Standard AS/NZS ISO 9001.

This document is issued subject to review and authorisation by the suitably qualified and experienced person named in the last column above. If no name appears, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

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We have prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures, and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

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Executive summary

Renzo Tonin & Associates was engaged by BNRG Renewables Ltd to undertake an acoustic assessment of the proposed 6.16 MW DC Solar Farm in Anakie, Victoria (Greater Geelong Shire) (the 'Proposal'). Renzo Tonin & Associates understands the likely noise sources to include:

- Approximately 30,000 panels supported by approximately 450 x tracker motors
- Up to 20 inverters
- Up to 2 substations, including switch gears and ancillary equipment
- Up to 4 battery containers and 8 transformers (servicing the battery area)

On the basis of the assessed configuration, it considered that the 'Proposal' is low risk with respect to operational and construction noise and vibration, and can operate continuously and at full capacity without adverse acoustic impact on residential amenity.

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1 Introduction

Renzo Tonin & Associates was engaged by BNRG Renewables Ltd (the Proponent) to undertake an acoustic assessment of the proposed 6.16 MW DC Solar Farm (the 'Proposal') with an area of 9.4 hectares. The subject land is comprised of a single property being 1435-1475 Ballan Road, Anakie in the Anakie area of Victoria (the 'Site') (Greater Geelong LGA).

The assessment responds to the DELWP *'Solar Energy Facilities - Design and Development Guideline - August 2019'* (the Guideline).

The work documented in this report was carried out in accordance with the Renzo Tonin & Associates Quality Assurance System, which is based on Australian Standard / NZS ISO 9001. APPENDIX A contains a glossary of acoustic terms used in this report.

2 Overview of site and surrounds

2.1 The Proposal

BNRG Renewables Ltd is proposing to develop a 6.16MW (DC) solar energy facility (the 'Proposal'), located within the 'Farming Zone'.

The Subject Development is proposed to include the following items relevant to acoustics:

- Approximately 30,000 panels supported by approximately 450 x tracker motors
- Up to 20 inverters
- Up to 2 substations, including switch gears and ancillary equipment
- Up to 4 battery containers and 8 transformers (servicing the battery area)

The 'Proposal' will have the capacity to generate electricity during day light hours. This will predominantly be during day and evening periods (7am-6pm and 6pm-10pm, respectively) throughout the year and potentially part of the night-time period (prior to 7am) during the summer months. Batteries could potentially operate at all times.

2.2 Sensitive Receivers

Nearby dwellings relevant for the assessment were identified using aerial maps and are presented in Table 1. As noise reduces with distance, assessment of noise levels at these dwellings also addresses noise impacts at more distant dwellings.

Table 1: Dwellings near the Proposal

ID	Address	Approximate distance to site boundary	Zone
R1	1435-1475 Ballan Road, ANAKIE VIC 3213	230 m	Farm Zone 1 (FZ1)
R2	1385-1425 Ballan Road, ANAKIE VIC 3213	340 m	Farm Zone 1 (FZ1)
R3	170 Pringles Road, ANAKIE VIC 3213	700 m	Farm Zone 1 (FZ1)
R4	80 Clifton Road, ANAKIE VIC 3213	830 m	Farm Zone 1 (FZ1)
R5	120 Clifton Road, ANAKIE VIC 3213	830 m	Farm Zone 1 (FZ1)
R6	1485-1575 Ballan Road, ANAKIE VIC 3213	55 m	Farm Zone 1 (FZ1)

Notes: As noise reduces with distance, assessment of noise levels at these dwellings also addresses noise impacts at more distant dwellings.

Figure 1, overleaf, presents an overview of the Subject Site and surrounding land uses.

Figure 1: Overview of the Site and dwellings assessed

3 Noise criteria

3.1 DELWP Solar Energy Facilities – Design and Development Guideline

The Department of Environment Land Water and Planning (DELWP) *Solar Energy Facilities – Design and Development Guideline, 2019* (the 'Guideline') provides an overview of the policy, legislative and statutory planning arrangements for solar energy facilities in Victoria. The Solar Facilities Guideline states the following in relation to acoustics:

- *"Noise*

  A facility should keep its noise impacts at or below the levels in EPA Victoria's Noise from industry in regional Victoria guideline [see Section 3.2]. *Noise attenuation measures could include:*
  • ensuring any components operate to relevant standards
  • acoustic housing or baffles at the noise source
  • conducting maintenance and other operational activity during the daytime
  • using landscaping or locating noisier components centrally within a site"

- *"Construction noise and dust management*

  To address impacts on nearby sensitive land uses, a proponent should reduce the potential noise from vehicles servicing the site, from fixed machinery onsite and from construction activities, for example by limiting times when noisy operations are allowed. It should also engage with stakeholders to address any potential impacts...
  The EMP should outline measures to address noise and the disturbance of dust and sediment during construction and operation of the facility.
  EPA Victoria's Environmental Guidelines for Major Construction Sites has best-practice guidelines for general construction" [see Section 3.3.2.]

3.2 EPA Publication 1826 - industrial noise

From 1 July 2021, EPA Publication 1826 '*Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues*' (EPA Pub. 1826) superseded:

- *State Environmental Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1* (SEPP N-1), and
- EPA Publication 1411, *'Guidelines: Noise from Industry in Regional Victoria'* (NIRV)

For this assessment's application, EPA Publication 1826 (1826-P1) uses the same methods to assess noise impacts as the superseded noise policies, but with slight amendments to the durations of day, evening & night.

3.2.1 Industrial noise limits (Rural area method)

Since the Subject Site is not located in a Major Urban Area (i.e., <7,000 population), applicable noise limits for commercial activity are set out in Part 1, Section 2 of EPA Publication *1826 'Noise Limit and Assessment Protocol for the Control of Noise from Commercial, Industrial and Trade Premises and Entertainment Venues'* (1826-P1) following the 'rural area method'. Table 2 presents the applicable EPA 1826-P1 noise limits, which are applicable for mechanical services and on-site commercial activities.

Table 2: EPA 1826-P1 noise limits

Period	Generating zone	Receiving zone	EPA 1826-P1 limit, L_{eq} dB(A)[1]
Day	Farming Zone 1 (FZ1)	Farming Zone 1 (FZ1)	46
Evening			41
Night			36

EPA 1826-P1 period definitions:	Day:	Monday-to-Saturday 7am-to-6pm;	Sundays NA
	Evening:	Monday-to-Saturday 6pm-to-10pm;	Sundays or Holidays 7am-to-10pm
	Night:	All days 10pm-to-7am	

EPA 1826-P1 night-time noise limits are more stringent than that of the day or evening periods. As such, compliance during the night-time period implies compliance during the day and evening periods, provided that emitted noise levels do not vary. For this assessment the applicable location of assessment is outside surrounding dwellings, assessed over a 30-minute period.

3.3 Construction noise and vibration

3.3.1 Legislation

There are currently no objective legislative requirements to limit noise and vibration from construction in Victoria however there are Guidelines that set out best practice and are considered below.

3.3.2 EPA Civil construction, building and demolition guide, Publication 1834

From November 2020, EPA Publication 1834 *'Civil Construction, Building and Demolition Guide'* (EPA Pub. 1834) superseded:

- EPA Publication 480, *'Environmental Guidelines for Major Construction Sites* (EPA Pub 480)
- **Section 2** of EPA Publication 1254 *Noise Control Guidelines (October 2008)* (EPA Pub 1254), however there is a superseded version…EPA Publication 1254.2 *Noise Control Guidelines* (May 2021) (EPA Pub 1254).

Per Section 3.1, the DELWP *Solar Energy Facilities – Design and Development Guideline* states that "…*EPA Victoria's Environmental Guidelines for Major Construction Sites has best-practice guidelines for general construction*".

The Civil construction, building and demolition guide (EPA Pub 1834) states:

> *"New environment protection laws mean that anyone engaging in an activity that poses risk of harm to human health and the environment, from pollution or waste, must eliminate or reduce that risk. The* ***general environmental duty*** *applies to all Victorians.*
>
> *It is your responsibility to understand and assess your risks. This includes understanding how your activities can impact land, water and air quality, or cause harm from waste or excessive noise.*
>
> *You also need to eliminate or reduce risk as far as reasonably practicable. You can do this by putting appropriate controls in place that are proportionate to the risk.*
>
> *Your approach to managing risk will depend on the complexity and scale of your activities or project, as well as the nature of the risks you need to manage."*

Section 4.2 of EPA Pub. 1834 sets out the following key aspects to consider when planning a project:

- *Identifying people and sensitive environments (sensitive receivers) that could be affected by your activities*
- *carrying out appropriate engagement as early as possible*
- *avoiding the generation of noise and vibration*
- *facilitating construction during normal working hours, where possible*
- *reducing noise and vibration by using the most appropriate equipment and work practices for your activities*
- *choosing alternative equipment or methods that generate less noise or vibration*
- *maintaining equipment and vehicles according to manufacturer's instructions*
- *attenuating noise by obstructing the path between noise source and receiver*
- *mitigating offsite noise with measures such as respite offers and acoustic treatment*
- *considering alternatives if noise and vibration cannot be reduced through avoidance, reduction or attenuation*

Section 4.3 of EPA Pub. 1834 provides (within Table 4.1 & Table 4.2) the working hours schedule for construction, building and demolition noise, reproduced below:

Minimise noise and vibration as far as possible in any situation

Normal working hours for all civil construction, building and demolition activities.

AM → PM: **Monday to Friday, 7 am – 6 pm**	
AM → PM: **Saturday, 7 am – 1 pm**	AM → PM: **Saturday, 9 am – 1 pm**
Normal working hours for: • works for commissioning or construction of **major infrastructure projects** • commercial and industrial construction and demolition sites • demolition works on an existing commercial or industrial site that is intended for residential redevelopment • construction works for **large-scale residential developments** in non-residential zones • commercial and industrial land subdivision.	Normal working hours for: • residential construction and demolition sites • residential or mixed-use development in **residential zones**, including urban infill and redevelopments • land preparation on infill and smaller residential developments • land preparation for residential subdivision, not including works to construct or upgrade a road • residential construction in a **large-scale fringe residential subdivision**, once the road servicing the residential development is complete.

Minimise noise and vibration as far as possible in any situation

Outside normal working hours for all civil construction, building and demolition activities.

Monday to Friday, 6 pm – 10 pm	
Saturday, 1 pm – 10 pm	**Saturday, 1 pm – 8 pm**
Sundays and public holidays, 7 am – 10 pm	**Sundays and public holidays, 9 am – 8 pm**

Applies to:

- works for commissioning or construction of **major infrastructure projects**
- commercial and industrial construction and demolition sites
- demolition works on an existing commercial or industrial site that is intended for residential redevelopment
- construction works for **large-scale residential developments** in non-residential zones
- commercial and industrial land subdivision.

See section 4.4 for conditions to apply within these hours and for works outside these hours.

Working hours providing that the activities do not result in **unreasonable noise** for:

- residential construction and demolition sites
- residential or mixed-use development in **residential zones**, including urban infill and redevelopments
- land preparation on infill and smaller residential developments
- land preparation for residential subdivision
- residential construction in a **large-scale fringe residential subdivision**.

See section 4.4. No works to be conducted after 6 pm unless they are inaudible.

Section 4.3.3 of EPA Pub. 1834 sets out the following noise source controls to help achieve the objectives:

- *Undertake preparatory work offsite where there is low potential for impacting people (e.g., formwork, cutting or prefabrication of materials offsite prior to transporting to the construction site)*
- *Connect to the electricity grid as early as possible to avoid the use of diesel generators.*
- *Restrict areas where mobile plant can operate so that it is away from people who could be affected by noise.*
- *Locate site vehicle access and waiting areas away from people who could be affected by noise.*
- *Plan vehicle movements to avoid manoeuvres and idling at location nearest to nearby people.*
- *Use quieter equipment or methods. This may require considering*
  - *buying or leasing quieter equipment*
  - *avoiding metal-to-metal and metal-to-stone contact*
  - *installing mufflers*
  - *reducing throttle and turning off equipment when not in use*
  - *placing things down rather than throwing*
  - *educating drivers to use driving practices that minimise noise*
- *Use low noise saw blades*
- *Use electrical equipment rather than equipment driven by a diesel generator.*
- *Use low noise emitting generators*
- *Use effective alternatives to 'beeper' alarms (e.g., broadband alarms, proximity sensors).*
- *Avoid using reversing alarms by designing site layout to avoid reversing (e.g., drive-through for parking and deliveries).*

- *Maintain equipment by:*
  - *inspecting regularly and maintaining equipment to ensure good working order*
  - *checking machines with enclosures, including doors & door seals and that the door closes properly against seals*
  - *maintaining air lines on pneumatic equipment so they do not leak.*
- *Maintain vehicles by:*
  - *considering good working conditions of mufflers*
  - *securing loose parts that may rattle.*
- *Limit noise caused by people onsite. This may include procedures to:*
  - *avoid yelling and shouting onsite (note: if people onsite need to shout to hear each other over the site ambient noise, it is possible the noise level may be putting their hearing at risk)*
  - *minimising the use and volume of any electrical amplified sound-reproducing equipment, for example radios, stereos, televisions, or public address systems*
- *Plan transport and haulage routes to minimise the number of trucks/vehicles. Where there are large numbers of truck movements, consider truck route and truck waiting protocols (e.g., engines on/off and restart requirements).*
- *Implement substitute methods taking into consideration:*
  - *alternatives to rock-breaking work methods, such as hydraulic splitters for rock and concrete, hydraulic jaw crushers, chemical rock and concrete splitting, and controlled blasting such as penetrating cone fractures. The suitability of alternative methods should be considered on a case-by-case basis, including what potential risks they involve.*
  - *alternatives to diesel and petrol engines and pneumatic units, such as hydraulic or electrical generator located away from nearby people.*

Section 4.3.4 of EPA Pub. 1834 sets out the following vibration and regenerated noise source controls to help achieve the objectives:

- *Use alternative lower-impact equipment or methods (e.g., substitute impact piling with bored piling, grip jacking or the use of hammer cushion when driving piles where noise is the dominant issue).*
- *Use non-explosive demolition agents and/or chemical agents to facilitate concrete/rock breaking activities to reduce the noise generated.*
- *Substitute demolition methods not involving impact where feasible (e.g., use hydraulic rock splitters rather than rock breakers).*
- *Schedule the use of vibration-causing equipment such as jackhammers, demolition, earthmoving, and ground-impacting operations at the least sensitive time of day.*
- *Routing, operating, or locating high vibration sources as far away from people who could be affected by noise.*
- *Sequencing operations so that vibration-causing activities do not occur simultaneously.*
- *Isolate equipment causing vibration on resilient mounts.*
- *Isolate activities from adjoining structures.*
- *Maintain equipment in accordance with manufacturer's specifications.*

Section 4.3.5 of EPA Pub. 1834 sets out the following noise reduction between noise source and receiver controls to help achieve the objectives:

- *Plan to have as much distance as possible between plant, equipment or other noisy activities and people who could be affected by noise.*
- *Maximise shielding taking into consideration:*
  - *topography of the site (e.g., use of earth mounds as barriers)*
  - *existing structures, temporary buildings, and material stockpiles*

–	*early construction of permanent walls so they can be used as early as possible as noise barriers*
–	*avoiding placing noise-producing equipment in locations where reflected noise will increase noise exposure or reduce the effectiveness of mitigation measures.*
•	*Prioritise construction of structures such as buildings and walls that can contribute to shielding noise from the construction site.*
•	*Obstruct the transmission path of sound (e.g., using acoustical walls or barrier, flexible noise barriers such as noise curtain or blankets, acoustic sheds, or enclosures. See Figure 4.2 and Figure 4.3.*
•	*Protect noise sensitive receivers (e.g., increasing window sound insulation by retrofitting acoustic glazing or suitable double glazing).*

Table 3: EPA Pub. 1834 - operation schedule and noise guidelines

Normal working hours	Weekend/evening work hours	Night period
Monday to Friday, 7am – 6pm Saturday, 7am – 1pm	Noise level from non-residential construction at any residential premises is not to exceed background noise by: • 10dB(A) or more for up to 18 months after project commencement • 5dB(A) or more after 18 months during the hours of: • 6pm – 10pm Monday to Friday • 1pm – 10pm Saturdays • 7am – 10pm Sundays and public holidays	Noise inaudible (see definition below) within a habitable room of any residential premises during the hours of: • 10pm – 7am Monday to Friday • 10pm – 7am Saturdays, Sundays and public holidays

3.3.3 Construction vibration

Currently there is no existing Australian Standard for assessment of structural building damage caused by vibration energy, however, Australian Standard AS 2187.2 *'Explosives—Storage and use'*, refers to British Standard BS 7385.2 '*Evaluation and measurement of vibration in buildings'* for prevention of minor or cosmetic damage occurring in structures from ground vibration.

Regarding application to heritage buildings, British Standard 7385.2 notes that *"a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive."*

German Standard DIN 4150.3 '*Structural vibration in buildings - Effects on Structure*' also provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration and are generally recognised to be conservative. Per DIN450.3 "*Experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur. If damage nevertheless occurs, it is to be assumed that other causes are responsible. Exceeding the values in table 1* [provided in Table 6 below] *does not necessarily lead to damage; should they be significantly exceeded; however, further investigations are necessary."*

The tables overleaf present summaries of applicable BS 7385 and DIN 4150.3 criteria.

Table 4: BS 7385 structural damage criteria

Group	Type of structure	Damage level	Peak component particle velocity, mm/s		
			4Hz to 15Hz	15Hz to 40Hz	40Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	Cosmetic	25(1)	25(1)	25(1)
2	Un-reinforced or light framed structures Residential or light commercial type buildings	Cosmetic	7.5(1) to 10(1)	10(1) to 25(1)	25(1)

Note: 1. Presented noise levels are 50% lower than presented in BS 7385.2, as per BS 7385.2 Section 7.3.3 *"Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values … may need to be reduced by up to 50%"*

Table 5: DIN 4150-3 structural damage criteria (recognised to be conservative)

Group	Type of structure	Vibration velocity, mm/s			
		At foundation at frequency of			Plane of floor uppermost storey
		1Hz to 10Hz	10Hz to 50Hz	50Hz to 100Hz	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Group 1 or 2 and have intrinsic value (e.g., buildings under a preservation order)	3	3 to 8	8 to 10	8

Table 6: DIN 4150-3 Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on buried pipework

Line	Pipe Material	Guideline values for vibration velocity measured on the pipe, mm/s
1	Steel (including welded pipes)	100
2	Clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80
3	Masonry, plastic	50

Note: For gas and water supply pipes within 2 m of buildings, the levels given in Table 13 should be applied. Consideration must also be given to pipe junctions with the building structure as potential significant changes in mechanical loads on the pipe must be considered.

For long-term vibration the guideline levels presented should be halved.

Previously, EPA Pub. 480 stated:

- *"A British study has found that nuisance from ground vibration and building damage is unlikely to occur if the operation is conducted at distances greater than 50 metres.*
- *Complaints about air vibrations from blasting have been received from people 100 metres away from the activity."*

As it is understood that blasting is <u>not required</u> or proposed for the construction of the 'Proposal', vibration and noise distance thresholds for typical construction activities are considered to be much less onerous (i.e., closer) than the 50 metres and 100 metres thresholds respectively.

4 Noise impact assessment

4.1 Noise propagation model

A Cadna-A three-dimensional noise model, implementing ISO 9613 noise propagation algorithms was built, to calculate noise propagation from the 'Proposal' to surrounding residential premises during the operational period. The built form of the 'Proposal' and surrounding dwellings were integrated into the model. The following propagation effects were included in the predictive model:

- Mitigation of noise with distance, including geometrical spreading and air absorption (per ISO 9613)
- Reflections from buildings and environment (max. order 3 reflections)
- Barrier effects due to obstructions between noise sources and dwellings (predominantly due to topography)
- Ground absorption effects (G=0.5)
- Local topography (Topographic data for the Subject Site and surrounding area was in the form of 10-20m resolution contour lines from VicMaps.)

4.2 Operational noise

Table 7 provides details of typical equipment and corresponding sound power levels which have been incorporated into this assessment. Equipment has been assumed to be distributed uniformly across the site except where equipment locations have been indicated specifically in provided drawings. Note, all equipment is assumed to be operating continuously throughout and at full capacity.

Table 7: Typical equipment and associated sound power levels

Plant Item	Plant Description[1]	$L_{W,eq}$ Sound Power Levels, dB(A) re. 1pW
1	NEXTracker Gemini 2P tracker motors (450 in total)	52 (each)[3]
2	Inverter/power stations: SMA SC 2475-EV inverters (20 in total)	85 (each)[3]
3	Substation area: 7 MVA transformer (2 in total)	86 (each)[2,4]
4	Battery area: 50 MWH battery storage units (4 in total)	87 (each)[2]
6	Battery area: Transformers (8 in total)	83 (each)[2,4]

Notes:
1. The above equipment is understood to comprise typical equipment and corresponding sound power levels. Once the project has progressed to design development, the equipment shall be selected and installed such that EPA 1826-P1 noise criteria are conformed with at all times.
2. Based on sound power level data from past projects and/or RT&A's acoustic database.
3. Based on sound power level data provided by the client or manufacturer.
4. +5dB correction applied to plant during assessment to account for tonality.

Table 8 presents the predicted noise levels at the nearest dwellings. Since noise reduces with distance, assessment of noise levels at these dwellings also addresses noise impacts at more distant dwellings. As shown, noise levels conform with EPA 1826-P1 night time criteria and therefore also conform with day and evening EPA 1826-P1 criteria.

On the basis of the assessed configuration, without additional noise mitigation measures, it is considered that the Proposal can operate without adverse acoustic impact on residential amenity and is considered very low risk with respect to noise.

Table 8: Predicted noise levels at dwellings from operation

Dwelling ID	Predicted noise levels, L_{eq} dB(A)	EPA 1826-P1 recommended night time noise limit (most stringent), L_{eq} dB(A)	Complies?
R1	34	36	✓
R2	30	36	✓
R3	28	36	✓
R4	18	36	✓
R5	17	36	✓
R6	16	36	✓

4.3 Construction noise and vibration

It is understood that the construction of the 'Proposal' is likely to occur in one stage over less than 12 months, between the following hours:

- Mondays – Fridays: 7am – 6pm
- Saturdays: 7am – 1pm

During the standard building activity hours (Weekdays 7am-6pm; Saturdays 7am-1pm), there are no quantitative noise criteria and therefore noise monitoring is not mandatory during these hours.

Between 6pm and 8pm Mondays to Fridays, 1pm and 8pm on Saturdays and 7am to 8pm on Sundays and public holidays, EPA Pub. 1834 recommends construction noise levels at dwellings be limited to:

- $L_{eq} \leq L_{90}$ + 10dB(A) **for** the first 18 months = 46[1]
- $L_{eq} \leq L_{90}$ + 5dB(A) **after** the first 18 months = 41[1]

Notes 1. In lieu of background monitoring the noise criteria are based on the EPA 1826-P1 limit from Table 2.

It is therefore recommended that only low noise works occur during the 'Weekend/Evening working hours' periods. In consideration of local stakeholders, it is understood that Heavy Goods Vehicles (HGV) will be managed to standard construction hours (Weekdays 7am-6pm; Saturdays 7am-1pm).

With consideration of the significant distance to the surrounding dwellings, and with implementation of appropriate noise management strategies (see Section 3.3 for examples), construction of the 'Proposal' is considered low risk with respect to noise and adverse acoustic impact on residential amenity.

Referring to EPA Pub. 480 (previously stated in 3.3.3).

- *"A British study has found that nuisance from ground vibration and building damage is unlikely to occur if the operation is conducted at distances greater than 50 metres.*
- *Complaints about air vibrations from blasting have been received from people 100 metres away from the activity."*

As it is understood that blasting is not proposed for the 'Proposal', vibration and noise distance thresholds for typical construction activities are much less onerous than the 50 metres and 100 metres thresholds respectively.

The 'Proposal' is considered low risk with respect to construction noise and vibration impact on the basis of

- A 'Proposal' commitment to construction noise and vibration management strategies consistent with EPA Pub 1834
- The significant intervening distance between the 'Proposal' and the surrounding dwelling (> 230 metres), with the nearest dwellings (approximately 55 metres)
- A 'Proposal' commitment to limit HGV construction movements and roadworks to standard construction hours.

5 Conclusion

Renzo Tonin & Associates was engaged by BNRG Renewables Ltd to undertake an acoustic assessment of the proposed 6.16 MW DC Solar Farm in Anakie, Victoria (Greater Geelong LGA)(the 'Proposal'). The assessment responds to the DELWP *'Solar Energy Facilities - Design and Development Guideline - August 2019'* (the Guideline). The Guideline states:

The design response should also include one or more written reports and assessments including an assessment of:

- *potential noise impacts: EPA Victoria's Noise from industry in regional Victoria* (EPA Pub 1411 'NIRV')
- *construction management plan: EPA Victoria's Environmental Guidelines for Major Construction Sites has best-practice guidelines for general construction.* (EPA Pub 480)

Renzo Tonin & Associates advises that the above documents have been superseded as follows:

- *EPA Victoria's Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* (EPA Pub 1826.4) *has superseded EPA Victoria's Noise from industry in regional Victoria* (EPA Pub 1411)
- *EPA Victoria's Civil construction, building and demolition guide* (EPA Pub 1834) *has superseded EPA Victoria's Environmental Guidelines for Major Construction Sites.* (EPA Pub 480)

The assessment comprised:

- Review of the surroundings, the Subject Site and the 'Proposal'
- Determination of relevant noise criteria:
  - EPA 1826 noise limits
  - Construction noise and vibration criteria
- Assessment of the operational noise from the 'Proposal'
- Recommendations with respect to noise and vibration during the construction phase

On the basis of the assessed configuration, it considered that the 'Proposal' is low risk with respect to operational and construction noise and vibration, and can operate continuously and at full capacity without adverse acoustic impact on residential amenity.

APPENDIX A Glossary of terminology

The following is a brief description of the technical terms used to describe noise to assist in understanding the technical issues presented.

A-weighting	A filter applied to the sound recording made by a microphone to approximate the response of the human ear.		
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise, measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L_{A90} noise level if measured as an overall level or an L_{90} noise level when measured in octave or third-octave bands.		
Decibel [dB]	The units that sound is measured in. The following are examples of the decibel readings of common sounds in our environment:		
	threshold of hearing	0 dB	The faintest sound we can hear, defined as 20 micro Pascal
		10 dB	Human breathing
	almost silent	20 dB	
		30 dB	Quiet bedroom or in a quiet national park location
	generally quiet	40 dB	Library
		50 dB	Typical office space or ambience in the city at night
	moderately loud	60 dB	CBD mall at lunch time
		70 dB	The sound of a car passing on the street
	loud	80 dB	Loud music played in the home
		90 dB	The sound of a truck passing on the street
	very loud	100 dB	Indoor rock band concert
		110 dB	Operating a chainsaw or jackhammer
	extremely loud	120 dB	Jet plane take-off at 100m away
	threshold of pain	130 dB	
		140 dB	Military jet take-off at 25m away
dB(A)	A-weighted decibel. The A- weighting noise filter simulates the response of the human ear at relatively low levels, where the ear is not as effective in hearing low frequency sounds as it is in hearing high frequency sounds. That is, low frequency sounds of the same dB level are not heard as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter is denoted as dB(A). Practically all noise is measured using the A filter.		
Reflection	Sound wave reflected from a solid object obscuring its path.		
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.		
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power of 1 pico watt.		
Sound pressure level	The level of noise, usually expressed in decibels, as measured by a standard sound level meter with a microphone referenced to 20 micro Pascals.		
Tonal Noise	Sound containing a prominent frequency and characterised by a definite pitch.		

Appendix H Agriculture assessment

MERIDIAN
Agriculture

ADVERTISED PLAN

Agricultural Assessment Report
Anakie Solar Farm

Prepared: J Shovelton

26 April 2022

Document control and status

Revision	Date	Description	By	Review	Approved
Draft	2 March 2022	Preparation of draft	J Shovelton	E Goodall	
Final	26 April 2022	Final Report	J Shovelton		Yes

Agricultural Assessment Report
Anakie Solar Farm

Executive Summary

The site proposed for the solar farm is a parcel of approximately 13.5 ha on the Geelong-Ballan Road, Anakie.

The property has been used almost exclusively for grazing of cattle in the past although there is evidence of hay being cut in some years, on the roadside section of the site. The property has potential for cropping as evidenced by activities on adjoining properties. By virtue of its small size, the property contributes insignificantly to the agricultural output of the region and is not located on a unique, high value soil type.

There is potential for a sheep grazing enterprise to continue under the solar. Factors which need to be addressed if grazing was to take place are outlined in the document.

The installation of a solar farm on this site would have no long term detrimental effect on the productive capacity of the soil, nor would it have a significant impact on the overall productivity of the region or the state, or impact on the ability of neighbouring businesses to operate.

Background

An agricultural assessment of the site for a 6.16 KW solar farm at Anakie has been requested by NGH Consulting.

The solar farm is proposed for a parcel of land of approximately 13.5 ha located approximately 21 km north of Geelong, on the western side of the Geelong Ballan Road.

Figure 1. Location of the Anakie solar farm site.

The requirements of an agricultural assessment are outlined in the Victorian Solar Energy Facilities Design and Development Guidelines, July 2019.

These guidelines specify a number of issues which should be addressed in such a report

- Whether agricultural land is strategically important or high-value at local and regional levels due to features such as high quality soils, good rainfall, access to water, resilience to climate change, infrastructure investment and integration with industry – and including whether it is highly productive, highly versatile, or located in an irrigation district.

- Assessment of the agricultural productivity/carrying capacity of the land.
- Impacts of the proposal on the agricultural use of a site and whether any continued agricultural use (or 'agrophotovoltaics') can be achieved.
- Impacts on the agricultural values of adjacent and surrounding land (such as their ability to operate efficiently or their productivity) and impacts on the agricultural sector in a wider region (such as supply or market competition).

Site Characteristics

Geology and Topography[1]

The surface geology of the site is newer basalts (Qvn) with a section of You Yang's granite (Dug) at depth towards the south eastern corner of the site.

1 You Yangs sheet, 28120- ed 1, Geological Survey of Victoria. 1:50,000,

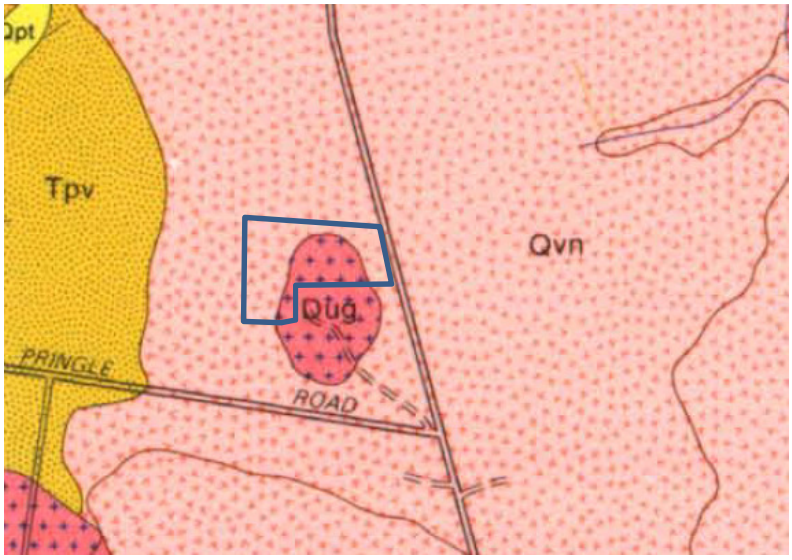

Figure 2. Approximate location of the Anakie solar farm site (outlined in blue) in relation to surrounding geology.

The property is very slightly undulating and slopes to the east.

Soils

There are no specific soil surveys for the area. However, soils developed from the newer volcanics are typically duplex soils (having distinct soil horizons) and may have impeded internal drainage.

In their natural state, the soils would have been deficient in phosphorus, nitrogen, sulphur and molybdenum. The current nutrient status of soils will be a reflection of recent fertilizer history which is not available. While no soil tests are available but it would be expected that at least the phosphorus and sulphur levels would have improved under agriculture and that soil acidity levels would have increased, if lime has not been applied.

These soils have high water-holding capacity but require significant amounts of rain before water is available to plants. Gypsum and/or lime may be required to improve their structure. These soils can be difficult to cultivate especially when they are wet and crops may suffer from waterlogging in years of high rainfall.

Vegetation

Vegetation assessment has been carried out by NGH. This indicates that the majority of land contains exotic species while there are smaller area of open grassland and ECV55 Plains Grassy Woodland derived grasslands.

Agricultural Use

Historical images indicate that the property has been used for grazing at least since 2010. The stock run appear mainly to be cattle although there is evidence that sheep have been run occasionally during the last ten years. There is a shearing shed and yards on the property south of the area proposed for

the solar farm. Stock water in the paddock proposed for the solar farm is supplied from a trough. (Figure 3).

Figure 3. Property showing trough location and the sheep handling facilities

While the property has not been cropped, the properties to the north and east have been cropped in recent years. There are two housed-poultry farms to the north (400m) and to the south (800m).

Agricultural Assessment

Strategic importance of land

The land has no direct strategic importance being similar to much of the surrounding farming land. It is a very small area (approx. 13.5ha) compared to the land used for grazing (306,414ha) and cropping (128,905ha) in the Barwon Statistical District.[2]

The site is not located in an irrigation district.

Agricultural Productivity

While the area is small, it would be possible to crop the land although the area may not be practical for contractors to service.

Potential crop yields can be inferred from the growing season rainfall (GSR). In simple terms growing season rainfall (mm) is a combination of a 50% discount of the rain falling from February to April, plus the rainfall from May to October. This figure is multiplied by a factor of 20 to give the potential yield of wheat and by 10 to give the potential yield for canola.

Rainfall data for this location (Anakie data set[3]) indicates that the average growing season rainfall for the last 20 years has been around 340 mm. This equates to a potential yield of 7.2 t/ha for wheat and 3.6t/ha for canola. These figures assume excellent agronomy and absence of subsoil impediments. Data from a recent survey of the economics of grain production in Victoria[4] indicated a conversion

[2] Agricultural commodities–Australia, States and Territories and ASGS regions–2019-20, ABS, May 2021
[3] https://www.longpaddock.qld.gov.au/silo/point-data/,
[4] Cropping Zone Management Guideline Victorian High Rainfall. GRDC (2017)

factor of 80% of potential yield is a realistic outcome. Therefore lower yields of 5.7t/ha wheat and 2.9t/ha for canola should be achievable, long-term yields for an intensively farmed cropping property.

Based on 50% price deciles for wheat[5], the gross income would be expected to be around $1100/ha or $17,600 for the block.

The latest available data for cropping[6] indicates average variable costs of $273/ha to give a gross margin of $827/ha or $13,250. Overhead costs such as rates, insurance, power, etc. need to be deducted from these gross margin figures to arrive at net farm income, out of which, financing costs, capital purchases, etc., would need to be paid.

Stock Productivity

The length of growing season is used to provide an estimate of potential stock carrying capacity[7]. The growing season is a function of amount of rain its distribution and the water-holding capacity of the soil . Realisation of this potential similarly depends on the consistent good agronomy and husbandry and the absence of inherent soil constraints.

Based on the rainfall data for the area, the likely average growing season is around 6.5 months for the property. This equates to a potential stocking rate of around 13 Dry Sheep Equivalents[8] (DSE) /ha. The potential stocking rate should be achievable given the type of soil, provided there are appropriate pasture species and nutritional deficiencies are addressed.

Because the property has not been cropped there will be continued growth of pasture after the installation of the solar farm.

Agrovoltaic considerations

The likely strong regeneration of pasture will require management to reduce fire risk. If grazing was to be considered, the most suitable agricultural use of the land once under solar panels will be sheep grazing. The relative importance of the need to generate agricultural income and the management of vegetation under the solar panels, will determine the appropriate grazing/pasture strategy. Trading stock or non-breeding animals are likely to be the most appropriate enterprises due to the difficulties of managing animal welfare issues during lambing.

The location of the subdivisional fences if any, and water sources will be influenced by the orientation of the solar panels and could be installed after the solar farm when the locations of the trenched cabling trenches are known.

[5] https://mecardo.com.au/wp-content/uploads/2021/08/Grain-Percentiles-August-2021-2.pdf

[6] The integration of technical data and profit drivers for more informed decisions, GRDC

[7] Saul G.R and Kearney, G.A (2003) Potential carrying capacity of grazed pastures in southern Australia, Department of Natural Resources and Environment, Victoria.

[8] Dry Sheep Equivalent is a standard animal (non lactating/non pregnant 50 kg sheep) that is used to compare carrying capacity, profitability, etc., between different stock types. For example, one breeding ewe is equivalent to two DSE over a year and a cow and calf is equivalent to 17 DSE over a year.

Impact on agricultural use of land

When the solar farm is decommissioned, there will be no residual detrimental impact on the productivity of the site. Soil fertility will decline over time, but this can be corrected rapidly through the addition of appropriate amendments.

Impact on surrounding land

The installation of the solar farm will have no effect on the ability of surrounding property owners to operate, nor will it impact on the agricultural sector in the wider region.

Other issues

The previously section sown to exotic species on the northern boundary of the sites indicates that it is highly unlikely that there will be any remnant native vegetation in this section. The remaining areas with open grassland and Grassy Woodlands derived grassland have developed under grazing and should not be affected should grazing be continued under the solar panels.

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26 April 2022