Appendix K

Bushfire Risk Analysis

Tamworth Solar Farm Bushfire Risk Analysis

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Template 2.8.1

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Abbreviations

Abbreviation	Description
APZ	Asset protection zone
ERP	Emergency response plan
FDI	Fire danger index
FDR	Fire danger rating
FRNSW	Fire and Rescue New South Wales
GFDI	Grassland Fire danger index
LGA	Local Government Area
NSWRFS	NSW Rural Fire Service
PV	Photovoltaic

Glossary

Term	Description
Assets	Anything valued by people which includes houses, crops, forests and, in many cases, the environment.
Asset protection zone (APZ)	A fuel-reduced area surrounding a built asset or structure which provides a buffer zone between a bush fire hazard and an asset. The APZ includes a defendable space within which fire fighting operations can be carried out. The size of the required asset protection zone varies with slope, vegetation and Fire Danger Index (NSWRFS 2018).
Bushfire	Unplanned vegetation fire. A generic term which includes grass fires, forest fires and scrub fires both with and without a suppression objective.
Fire danger index (FDI)	A relative number denoting the potential rates of spread, or suppression difficulty for specific combinations of temperature, relative humidity, drought effects and wind speed.
Fire danger rating (FDR)	A relative class denoting the potential rates of spread, or suppression difficulty for specific combinations of temperature, relative humidity, drought effects and wind speed. Expressed as LOW, MODERATE, HIGH, VERY HIGH, SEVERE, EXTREME or CATASTROPHIC
Fuel hazard	Fine fuels in bushland that burn in the continuous flaming zone at the fire's edge. These fuels contribute the most to the fire's rate of spread, flame height and intensity. Typically, they are dead plant material, such as leaves, grass, bark and twigs thinner than 6 mm thick, and live plant material thinner than 3 mm thick.
Grassland Curing	The proportion of dead material in grasslands – usually increases over summer as tillers die off and dry out, increasing the risk of grassland fire. Note: Grassland curing is measure of grass greenness and expressed as a percentage of the dead grass material based a visual estimate using a guide such as CFA 2014
Intensity	The rate of energy release per unit length of fire front usually expressed in kilowatts per metre (kW/m).
Residence time	The time required for the flaming zone of a fire to pass a stationary point; the width of the flaming zone divided by the rate of spread of the fire.
Spotting	Behaviour of a fire producing sparks or embers that are carried by the wind and start new fires beyond the zone of direct ignition by the main fire.

Note: Definitions sourced from the AFAC Bushfire Glossary (AFAC 2012) unless referenced otherwise.

1. Introduction

1.1 Background

Oriens Energy (Oriens) propose to construct and operate an 80 MW solar photovoltaic (PV) farm, incorporating battery storage.

The Proposal would be located at "Bonnie Brae", 2209 Soldiers Settlement Road, Bective, NSW, 2340 and contained within a single land title, Lot 186 DP 755340 (the "site").

The site is approximately 230 hectares and is currently used for agriculture, specifically cattle grazing. It is approximately 25 km west of Tamworth in the Tamworth Regional Council Local Government Area. The site is currently accessible via Soldiers Settlement Road to the east and Warminster Road to the north west (see **Figure 1**).

The Proposal includes installation PV solar panels in four main blocks on single axis trackers inclusive of cabling on approximately 170 ha of the subject site. Solar PV modules will be installed at varying angles to accommodate the variations in site topography and will not exceed 4.5 m in height. The PV mounting structure will comprise steel pile posts installed using a pile driver. Additional support structures would be attached to the steel mounting structures and the PV modules would then be attached to the support structures. The site layout is shown in **Figure 2**.

Power generated by the facility will be transmitted to an existing 132 kV high voltage powerline that runs through the south of the property. A substation with associated infrastructure will be built on the site which will connect directly into the 132 kV line to transmit power into the high voltage grid. There is also a 11kV distribution power line under easement that crosses the property, entering on the western boundary and exiting on the southern boundary.

1.2 Aims and Objectives

This bushfire risk assessment has been prepared to meet the:

- Secretary's Environmental Assessment Requirements (SEARs) (Application Number SSD 9264) issued for Tamworth Solar Farm on 20 June 2019:

  Hazards and Electromagnetic Interference *– an assessment of potential hazards and risks associated with bushfires.*

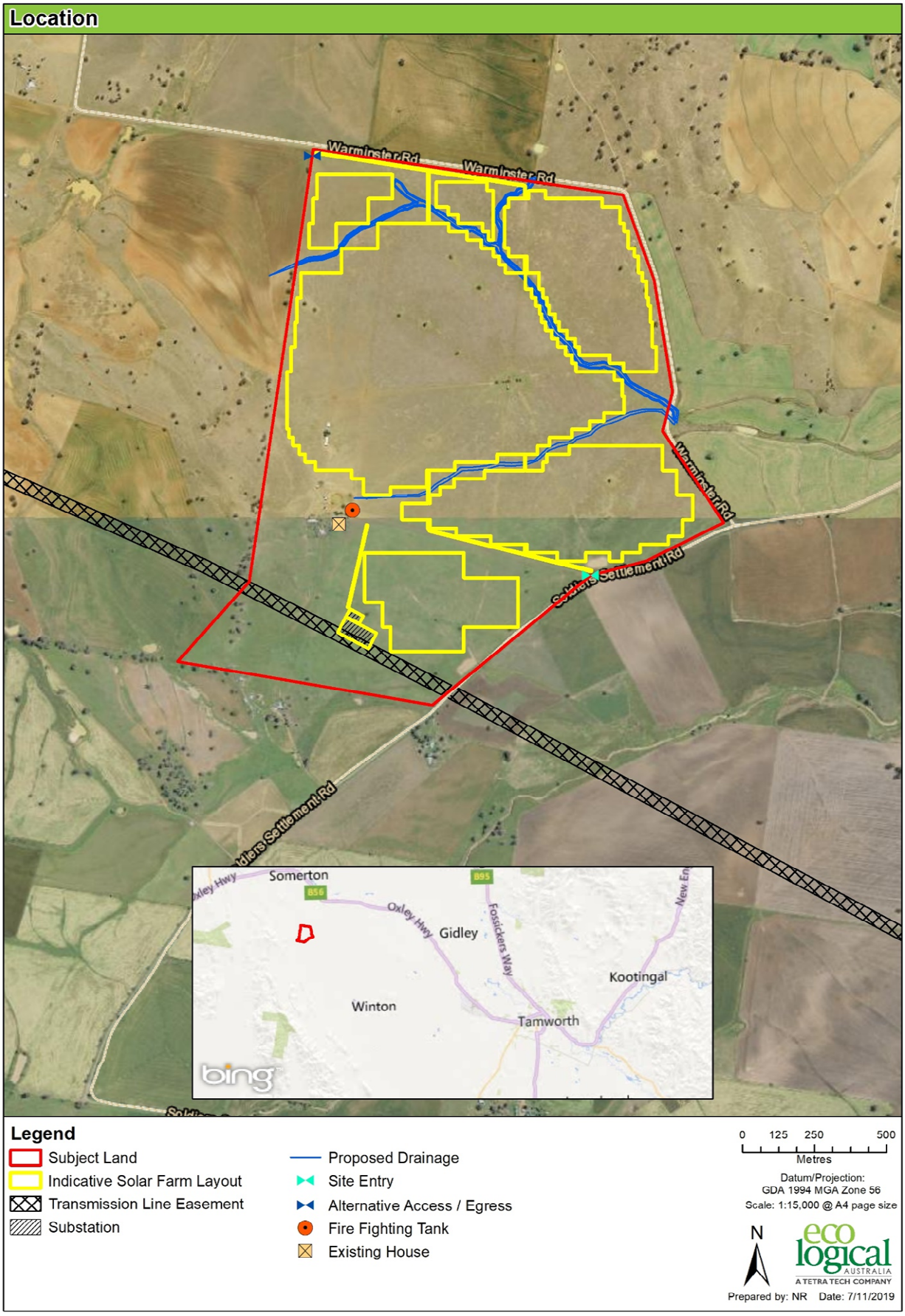

Figure 1: Location Map

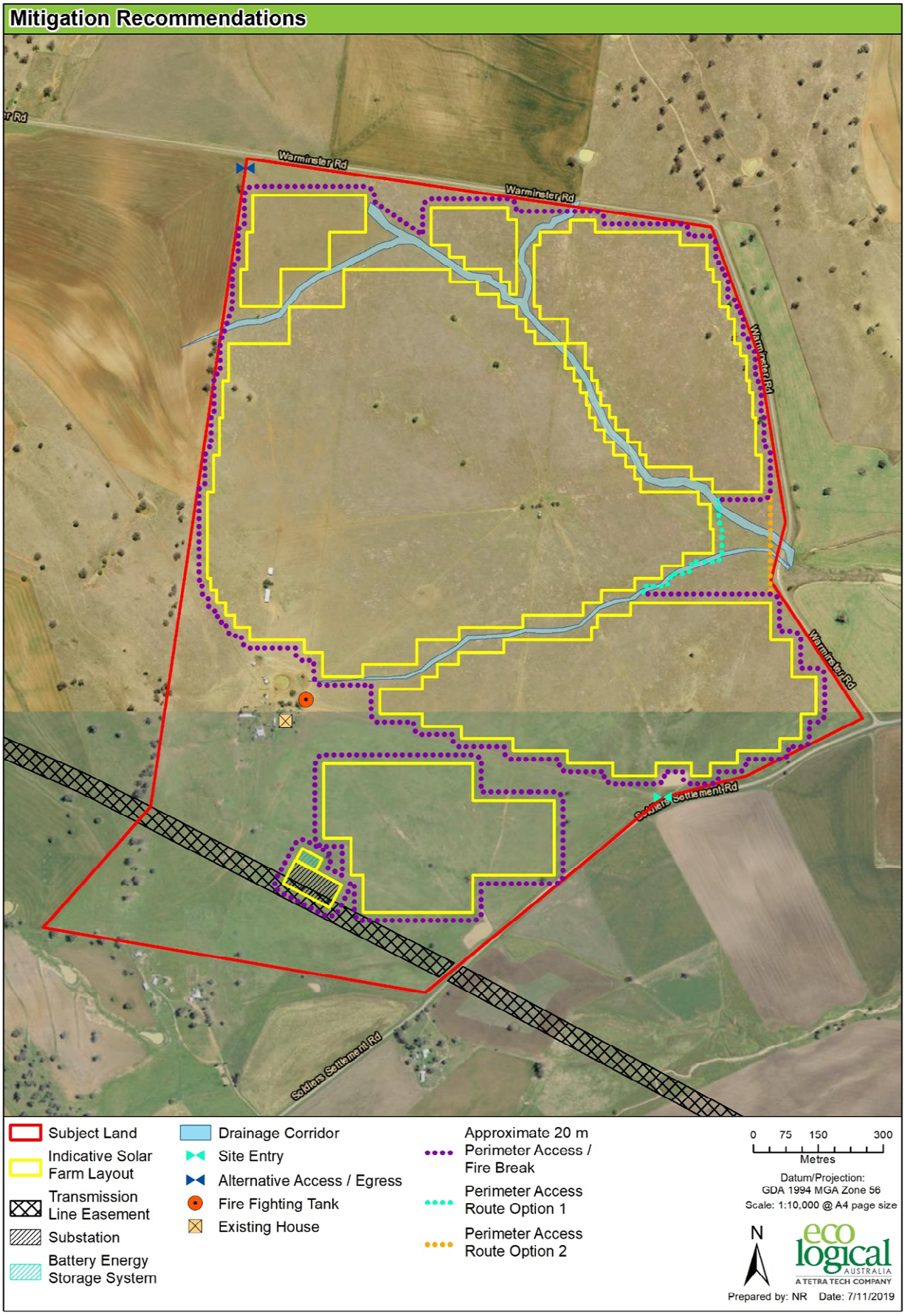

Figure 2: Site layout and Mitigation Strategies

2. Bushfire risk profile

2.1 Climate

The greatest potential for bushfire events at the site occurs November - January when drier westerly winds are predominant (Tamworth Bush Fire Management Committee (BFMC) 2011) and contribute to significant grass curing, making the landscape more susceptible to ignitions starting and spreading.

Whilst the declared bushfire season occurs from 1 October to 31 March annually, it can be extended when the usually wetter summers remain dry. The bushfire season can also be brought forward when a drier than average winter results in the landscape being more susceptible to fires starting and spreading in late spring and early summer.

The historical data indicates that over the life of the development, the site will experience a small number of days annually in which adverse fire weather may occur. Where such days coincide with periods when the fuel hazard is also conducive to fire spread (see **Section 2.2**) bush and/or grassfires may result.

2.2 Fuel Hazard

2.2.1 Fire spread potential within the surrounding landscape

The site and surrounding lands are not classified as bush fire prone, as they are managed agricultural lands predominantly used for grazing and cropping. The closest bushfire hazard mapped as bushfire prone land is located approximately 2.5 km west of the subject site. These areas not classified as bush fire prone, may still carry a grassfire if:

- Grasses are cured (generally more than 50% for continuous fire spread (Cheney and Sullivan 2008), although discontinuous spread can be propagated in instances as low as 25-30% curing (Cruz et al 2017);
- Grass loads are heavier which provides a greater chance of ignition and fire spread (although grassfires may still start and burn through grazed, eaten out areas and stubble); and
- Pasture grass fuels are continuously linked across the landscape.

At the site it is unlikely, as neighbouring properties are commercial agricultural enterprises, that adjoining pastures will be carrying heavy pastures loads which are also fully cured. A more likely scenario is that by mid to late summer (when pastures are either partially to fully cured), the pasture condition is likely to be either cut/grazed or eaten-out. Grassfires burning in lighter pasture fuels will burn at a *quicker* rate of spread, *lower* flame height and *shorter residence time* than heavier pastures (Cruz *et al* (2017)[1]).

[1] Cruz MG, Sullivan AL, Hurley RJ, Plucinski MP, Gould JS (2017) *The effect of fuel load and structure on grassland fire behaviour and fire danger*. CSIRO Land and Water, Client Report No EP178976, Canberra, Australia

Grass fire spread can be held up or stopped where continuous cured grass cover is broken up by local roads, green creek lines, arterial public roads, firebreaks, fully eaten-out areas and farm breaks/tracks. Such features occur in the landscape surrounding the site, and include:

- Drainage lines which bisect the site;
- Screening, ornamental or wind break plantings of non-native tree species;
- Residential houses, shed and other infrastructure required for agricultural activity;
- 132kV powerline easement which bisects the southern aspect of the subject site;
- Warminster Road which runs along the Northern and Eastern boundary and Soldiers Settlement Road along the South; and
- Farm access tracks in all adjoining properties.

These features significantly make it unlikely that large areas of the surrounding landscape can easily support a continuous (fully linked) cured grass cover, which will then allow development of a large-scale grassfire.

2.2.2 Fire spread potential within the site

Under and between the PV panel infrastructure it is intended that pasture fuels are maintained in a low fuel state by sheep grazing and other land management activities such as mowing and application of herbicides. While a fire could still spread in these fuels under adverse fire weather conditions, there is less potential for damage to infrastructure than if heavier pasture fuels are present. Heavier pasture fuels are more difficult to extinguish, have a longer flame length, travel slower with a longer residence time than lighter pasture fuels (Cruz *et al* 2017), and therefore a higher potential to damage elevated infrastructure.

The likelihood of a fire spreading within the solar farm installation (if the panels were able to be initially ignited) by propagating from panel to panel is difficult to fully assess at this stage because of a lack of previous fire records from fire agencies and solar farm sites, or available research results for similar environments, climate and solar farm components, relevant to Australia. Although no relevant information is available from within Australia, the risk of a fire spreading widely from panel to panel is considered likely to be very low because of the panel construction materials and its fire resistance rating, and the time of flame exposure which is required to initially ignite these materials.

2.3 Fire History and Ignition Sources

There is no fire history documented for the site but the broader Tamworth Regional Council (LGA) experiences on average 200 bushfires per annum, with up to 15 which are considered major fires (Tamworth BFMC 2011). Across these LGAs the main sources of fire ignition are identified as:

- Lightning Strikes;
- Agricultural Burns;
- Arson;
- Escaped Pile Burns;
- Farm machinery or equipment;
- Burning without a permit; or
- Welding/Grinding and associated construction activities.

Any of these potential ignition sources are possible in the vicinity of the site.

During site construction and operations, the following are potential ignition sources:

- Earth moving equipment;
- Vehicles;
- Power tools (such as welders, grinders);
- Mowers and slashers;
- and
- Accidental ignitions (such as discarded cigarettes).

The solar panels are non-reflective and present no risk of ignitions from concentrated solar energy. Ignitions from other PV equipment is theoretically possible from electrical faults such as arc faults, short circuits, ground faults and reverse currents (Allianz Risk Consulting 2012). The proponent advised that arcing issues are normally created from the following:

- Incorrect connecting of the inter module connectors;
- Corroded inter module connectors caused from incorrect storage of modules on site;
- Electrical connections on isolators / DC combiners; or
- Mismatch of inter module connectors causing insufficient electrical connections.

It is conceivable that arcs or melted components resulting from a fault could if conditions were suitable ignite grass fuels under or surrounding installations and start a bushfire. However, the level of risk from faults cannot be assessed at this stage because there is no case history available (see also Section 2.2).

2.4 Life and Asset Risk

2.4.1 Fire-fighter and public safety

The usage of the general area surrounding the site is mostly limited to residents and employees who are involved in agricultural enterprises, persons living in residential premises within proximity of the proposed solar farm, people using Warminster Road and the operators of the solar farm site.

The fire-fighters likely to respond to a bushfire in this area would be FRNSW fire fighters (located in Tamworth, Manilla and Gunnedah) and/or volunteers from the NSWRFS (located at Tamworth). Potential risks to fire-fighter safety associated with a fire burning the solar panels and associated equipment include:

- Electrocution – solar panels would be energised under any natural or artificial light conditions – isolation of DC current can only occur external to any solar array because there is no single point of disconnect internally (Backstrom and Dinni 2011);
- Safe use of water spray or foam application is only possible from the perimeter of the solar panelled portion of the farm and could not reach the 250 to 500 m required to reach the furthest internal distance (without an aerial ladder platform appliance); and
- Inhalation of potentially toxic fumes and smoke from any plastic components such as cables (although the main structure of the panels will be glass and aluminium) or other decomposed products of the panels (Allianz Risk Consulting 2012).

The materials for individual components within the solar farm infrastructure have not yet been finalised, therefore, the flammability and toxicity of burning components cannot be determined in detail at this time. The proponent, however, advises that '*the burning of materials such as the backing sheet and ethylene vinyl acetate (EVA) will produce hazardous gasses and therefore may require breathing apparatus*'. Thus, the level of risk from burning solar panel components is difficult to quantify, exacerbated by the limited experience in Australia with bushfires in similar installations. Any fire-fighters attending a fire at the solar farm should be equipped with breathing apparatus and trained in structural and electrical fire-fighting.

2.4.2 Assets

The following assets are located on site or within two kilometres of the proposed solar farm:

ASSETS LOCATED ON-SITE

The proposed solar farm consists of the following:

- Approximately 170 ha of solar PV modules on ground screw or similar mounting structures;
- 10 Power Conversion Units (PCUs);
- Control room within the 33 kV switching room;
- Battery storage;
- Underground cabling;
- One substation and connection to existing 132 kV Transmission Lines;
- Temporary Construction Laydown area;
- Security fencing;
- Maintenance and access tracks; and
- Landscaping and tree planting

ASSETS LOCATED OFF-SITE

The following assets are located within two kilometres of the proposed solar farm:

- 10 Rural residences;
- Agricultural enterprises including cropping, and livestock (and associated infrastructure);
- Warminster Road and Soldiers Settlement Road;
- 132 kV high voltage powerline; and
- Fences.

These assets, including the PV panels and other components of the solar farm, are potentially at risk from a bushfire that may propagate within the solar farm and spread from the site, or from an external fire threat.

3. Mitigation strategies

3.1 Overview

Mitigation strategies presented are guided by the Aims and Objectives of *Planning for Bush Fire Protection* (NSWRFS 2018) in the context of the bush fire risk factors present at the site. They include requirements for asset protection zones and defendable space, site landscaping, access, water and utilities, and fire preparedness and response.

3.2 Asset Protection Zones

3.2.1 Description

An Asset Protection Zone (APZ) is defined (NSWRFS 2018) as:

> *A fuel reduced area surrounding a build asset or structure which provides a buffer zone between the bushfire hazard and an asset. The APZ includes a defendable space within which fire fighting operations can be carried out. The size of the required APZ varies with slope, vegetation and fire danger index.*

An APZ can be maintained as a lower fuel hazard area through mowing/slashing or grazing grass, creating a fire break of ploughed/ fallow ground or mineral earth break (such as fire trail). APZs do not eliminate the fire risk and under adverse conditions fire may spot over, or embers travel through asset protection zones. However, they may lower fire risk it to an extent where fire control is more feasible under most conditions or damage to the asset is reduced or eliminated. They can assist in reducing the potential for a fire to impact the site, as well as spread from the site.

3.2.2 Specifications

The specifications recommended for the perimeter APZ/fire break are shown in the table below.

Table 1: APZ and fire break requirements

APZ/fire break	Width	Specification
Perimeter fire break	20 m width from PV Panels and accompanying structures.	Setback 20m from PV panels and accompanying structures. Break maintained from the commencement of construction in perpetuity as an Inner Protection Area (PBP 2018 – Appendix 4) as follows: **Trees** - Canopy is less than 15% at maturity - Canopy at maturity mush not touch or overhang to any buildings on site including infrastructure - Lower limbs are removed to 2m above ground - Canopies should be separated by 2m – 5m - Preference should be given to smooth barked or evergreen trees **Shrubs** - Should not form a continuous canopy and not more than 20% of groundcover **Grass** - where present should be kept as mown <100mm in height

APZ/fire break	Width	Specification
		- leaf and other debris including woodchip should be removed Perimeter break also incorporates a mineral earth perimeter Category 1 fire trail (trafficable 4m width with passing bays every 250 metres) maintained in accordance with NSWRFS fire trail standards (NSWRFS 2017)
Substation APZ	20 m width from any substation infrastructure	The APZ is maintained from the commencement of construction in perpetuity as an Inner Protection Area (PBP 2018 – Appendix 4) as above. If established as a gravel surface it may reduce future ongoing vegetation management requirements
Temporary fire break	20 m width from construction footprint	Maintained for the duration of the fire season around the perimeter of construction works according to the perimeter fire break specifications above.

Despite the limitations of any APZ it is recommended that a perimeter APZ/fire break be established around the solar farm. An APZ/fire break will significantly reduce the likelihood of a bushfire spreading into the solar farm or from the solar farm into surrounding farmland.

These specifications will ensure the risk of a fire propagating across the APZ is minimised and that burning embers will not spot across the APZ, except under very high winds.

The objective for the setback of the APZ from the solar farm is to reduce the radiant heat to less than 10 kW/m^2 which is the level at which plastics and rubber components are expected to melt/burn. The placement of the access track on the inside of the APZ is to assist in providing additional safety to fire-fighters by reducing radiant heat exposure.

3.3 Site landscaping

3.3.1 Windbreaks and screen plantings

Trees and shrubs abutting the APZ on the side of an approaching fire may increase the risk of burning embers carrying across a fire break and creating the potential for a spot fire to spread on the other side (Cheney and Sullivan 2008). The planting of trees and shrubs for visual screening on the external side of the APZ may increase the risk of burning embers from an external fire entering the solar farm, and therefore the following mitigation measures are recommended for screen plantings: The following measures may mitigate the risk of planted or remnant trees carrying embers into the solar farm:

- Use species suitable for the environment that have low fire spotting characteristics (such as smooth bark or evergreen species) and avoid high flammability species;
- Plant as a continuous windbreak with no breaks of sufficient size to allow winds to funnel through;
- Plantings are placed on the outer side of the APZ (away from the asset); and
- Routine maintenance occurs prior each fire season to remove dead materials, dead plant growth and leaf litter from within the windbreak.

3.3.2 Fuel management within the solar farm footprint

Maintain pastures within the solar farm footprint (including under panels) during the bushfire season with minimal fuel load (<100mm grass height) through grazing, slashing, mowing and/or herbicide. Avoid overgrazing to maintain the groundcover and reduce the potential for erosion.

3.4 The substation and battery storage

The substation and battery storage building should have a 20 m APZ around all potentially critical components e.g. anything rubber or plastic or with a lower ignition point. There is to be no combustible vegetation within the substation APZ e.g. a gravel surface.

The battery storage building will have a fire detection and suppression system based on Novec 1230 or equivalent. This is considered appropriate for the battery storage building as the Novec 1230 system is suitable for suppressing fires in occupied spaces, in areas where an electrically non-conductive medium is required, where electronic systems cannot be shut down in an emergency and where clean-up of other agents poses a problem. Additionally, independent toxicity studies have established that the agent is low in both acute and chronic toxicity with high safety margins between its normal use concentrations and the No Observable Adverse Effect Level (NOAEL).

3.5 Construction and design

Solar panels and other components (such as cables) may be exposed to flame contact if a fire were to spread within the solar farm footprint. Therefore, it is recommended that components that are vulnerable to damage from temperatures associated with flame contact are shielded as far as possible. Design should consider the following features:

- Burial of cables underground; and
- Shielding of above ground cables and circuitry.

All electrical equipment must comply with relevant construction standards and design; installation of electrical equipment such as junction boxes, inverters, transformer and electrical cabling is to be in accordance with AS 3000:2007 Wiring Rules.

Design of shielding could potentially be improved through experimental testing of components in a laboratory situation that simulates the flame temperature and residence time of a grass fire under extreme weather conditions (such as Grassland GDI (GFDI) 100) and low fuel load (1.5 t/ha).

Specifically, it is recommended that research be undertaken into the ignition, flammability and toxicity risks of the solar farm components once the design has been finalised. This information will be required to improve or streamline bushfire mitigation measures for the solar farm.

3.6 Solar Farm Construction

Should construction of the solar farm take place between 1 December and 31 March (see **Section 2**) for data on seasonal occurrence of fire weather), the following measures are recommended to control the risk of grass fire ignitions:

- The APZ/fire break is constructed as the first stage of development;
- All plant, vehicles and earth moving machinery are cleaned of any accumulated flammable material (e.g. soil and vegetation);
- A suitable fire appliance is present on site with at least two personnel trained in bushfire fighting;
- On days when Very High FDR or worse is forecast for Tamworth, the "fires near me' app is to be checked hourly for the occurrence of any fires likely to threaten the site; and
- A hot works permitting system is in place and all operations involving earth moving equipment, vehicles, slashers and hot works (e.g. grinders, welders) cease while the GFDI is or forecast to be 35 or greater, or high winds are forecast.

3.7 Solar Farm Ongoing Operations

Fuel management within solar farm

It is assumed that a grass fire may start and spread within the footprint of the solar farm (see **Sections 2.3** and **2.4**); ignitions could include lightning fires, human error or electrical faults. For this reason, it is recommended that vegetation fuels internal to the APZ and throughout the solar farm are maintained in a minimal condition by grazing, slashing or mowing. This will minimise the radiant heat exposure to solar farm components and reduce the risk of a fire spreading beyond the solar farm. If grazing or slashing is not possible under the panels other lower risk ground cover should be considered e.g. gravel or a non-curing ground cover and/or a very low above ground biomass.

Days of Very High or worse fire danger

To minimise the risk of grass fire ignitions, all operations on the site involving earth moving equipment, vehicles, slashers and hot works (e.g. grinders, welders) should cease while the GFDI is or forecast to be 35 or greater, or high winds are forecast. This will require establishing an operational procedure for onsite recording of temperature, relative humidity and wind speed, as well as associated training.

Fire-fighter safety

The safety hazards for fire-fighters from PV panels (**Section 2.4.1**) and local fire-fighting capability are such that fire suppression within the footprint of the solar farm cannot be expected or relied upon. The only exception to this would be aerial water bombing that is compliant with air operations safety procedures; however, these resources may not be available at short notice for a fire that could spread several kilometres within an hour. Fire suppression is most likely only to be feasible from the APZ or beyond and no internal access for fire-fighting is proposed.

Given the possible toxicity of smoke from burning solar farm components, fire-fighters, farm workers and neighbours should avoid working down wind of any fire burning within the solar farm.

An Emergency Response Plan (ERP) should be prepared for the solar farm that provides the following:

- Addresses foreseeable on-site and off-site fire events;
- Clearly states work health safety risks and procedures to be followed by fire-fighters, including
- personal protective clothing;

- minimum level of respiratory protection;
- minimum evacuation zone distances;
- a safe method of shutting down and isolating the PV system (or noting if this is not possible for safe internal access);
- any other risk control measures required to be followed by fire-fighters;
- Evacuation triggers and protocols; and
- Suppression response strategies and tactics, including aerial suppression options/management.

Two copies of the ERP should be permanently stored in a prominent 'Emergency Information Cabinet' to be located at the main entrance point to the solar farm (Warminster Road), external to any security fence or locked gate, and a copy provided to local emergency responders (**see Figure 2**).

Once constructed and prior to operation, contact should be made by the site operator with the Local Emergency Management Committee to establish emergency management procedures with relevant authorities for the safety hazards presented by the site. The operator of the solar farm should brief the local volunteer fire brigades and neighbouring farmers at appropriate intervals, for example, at annual pre-season fire meetings, on safety issues and procedures.

3.8 Access

The main access to the site is proposed via Soldiers Settlement Road with secondary access also provided by the existing access, on Warminster Road (**Figure 2**). A perimeter Category 1 fire trail is to be constructed around the solar farm footprint, from the commencement of construction and maintained in perpetuity on the site perimeter, in accordance with NSWRFS standards for fire trails (NSWRFS 2017). A number of internal management tracks provide internal access within the solar farm. Depending on the fire size and its behaviour fire suppression is most likely to be staged from the perimeter fire trail, and not the internal access tracks. As such internal trails dedicated specifically for fire-fighting are not proposed (although the internal management tracks may be utilised if approved by the fire agency incident controller).

3.9 Water and Utilities

Whilst the likelihood of a damaging fire impacting the solar farm is considered low, the consequence could be significant (such as the potential loss of panels and/or related electrical systems are damaged). The risk of a fire starting from the solar farm and spreading to surrounding areas is also considered low.

Although it is a lower risk site, the availability of water supplies to assist with initial fire attack and fire suppression operations will further reduce the risk of a fire spreading into or from the site by reducing the time fire crews will spend away from an active fire to refill water supplies. It is therefore recommended that a dedicated water supply of 20,000 litres fitted with NSWRFS compatible Storz couplings is provided as a filling points for fire tankers, located near the existing farm dwelling.

No new transmission lines will be installed as part of the development. The development will not impact on the existing transmission easement of management in accordance with National electrical transmission line standards including the specification in ISSC3 Guideline for Managing Vegetation Near Power Lines (Resources and Energy NSW 2016).

3.10 Fire Preparedness and Response

It is recommended a bushfire management plan is prepared for the site identifying:

- **Potential Ignition reduction strategies**, including hot works permitting and Total Fire Ban requirements.
- **Fire suppression equipment** both onsite and offsite during construction and operation.
- Storage and maintenance of **flammable materials**.
- **Preparedness procedures** in response to increasing fire danger such standard equipment required during the fire season and the suspension of activities as the FDI rises. To minimise the risk of grass fire ignitions, if grasses have the potential to catch alight (cured and not eaten out) all operations on the site involving earth moving equipment, vehicles, slashers and hot works (e.g. grinders, welders) should cease while the GFDI is or forecast to be 35 or greater. Hot works, earth moving and slashing should cease when on days when total fire ban is declared, or on Very-High fire danger days when high winds are forecast.
- **Recommended training** for onsite personnel.
- Due to the unique electrical hazards associated with solar farms it is recommended that procedures for **responding to and reporting a bushfire** are documented in a discrete **ERP** (as a sub-plan of the bushfire management plan).

  The ERP should include consideration of personnel working on site during construction and operations, as well as responding fire authorities. The safety hazards for fire-fighters from ignited PV panels may potentially limit options for or prevent fire suppression within the internal footprint of the solar farm. The possible toxicity of smoke from burning solar farm components, fire-fighters, farm workers and neighbours is also a consideration. Aerial water bombing that is compliant with air operations safety procedures should also be addressed noting the high voltage transmission lines nearby which may pose a risk to aerial operations.

  Other requirements to include in an ERP are procedures which:

  - Addresses foreseeable on-site and off-site fire events;
  - Clearly state work health safety risks and procedures to be followed by fire-fighters, including:
    - Identify personal protective clothing and minimum level of respiratory protection;
    - Specify a procedure to determine minimum evacuation zone distances;
    - Document a safe method of shutting down and isolating the PV system (or noting if this is not possible for safe internal access); and
    - Any other risk control measures required to be followed by fire-fighters.

  Two copies of the ERP should be permanently stored in a prominent 'Emergency Information Cabinet' to be located at the main entrance point to the solar farm, external to any security fence or locked gate, and a copy provided to local emergency responders. It is recommended the Plan is prepared for the duration of the operation phase and updated at least every five years detailing:
- Responses to an **emergency alert** being issued by fire authorities.
- **Incident management and control** arrangements.

Once constructed and prior to operation, contact should be made by the site operator with the Local Emergency Management Committee to establish emergency management procedures with relevant authorities for the safety hazards presented by the site. The operator of the solar farm should brief the

local volunteer fire brigades and neighbouring farmers at appropriate intervals, for example, at annual pre-season fire meetings, on safety issues and procedures.

3.11 Summary of Mitigation Actions

A summary of the bushfire mitigation strategies and recommendations made in this document are provided in **Table 2** below.

Table 2: Summary of recommended mitigation strategies and actions

Mitigation Strategy	Section of Report	Action
Create and maintain a perimeter fire break	3.2	A 20 m fire break is to be established around the PV Panels and accompanying structures. The perimeter break is to be maintained in accordance with the NSWRFS (2018) APZ requirements for an Inner Protection Area. The perimeter break is to incorporate a 4m Category 1 perimeter fire trail (see *Access* below).
Create and maintain an APZ around the Substation	3.2	A 20 m fire break is to be established extending from substation infrastructure. The APZ is to be maintained in accordance with the NSWRFS (2018) APZ requirements for an Inner Protection Area.
Implement appropriate site landscaping	3.3	Where windbreak and screen plantings are proposed they are to be: • Located on the external side of the APZ; • Consist of low flammability and spotting species; • Be planted as a continuous break; and • Maintained to remove any dead leaf litter, branches and dead vegetation. Within the solar farm layout maintain minimal fuel load by grazing, slashing, mowing or herbicides.
Construction and design	3.4	Consider shielding heat sensitive components in areas where potential flame contact may occur. Research ignition, flammability and toxicity risks of solar farm components.
Maintain emergency access/egress for fire fighters and site personnel	3.5	The perimeter break is to incorporate a 4m Category 1 perimeter fire trail, established and maintained in accordance with NSWRFS requirements (NSWRFS 2019) including provisions for passing bays and turn around points. A proposed new main access point is Soldiers Settlement and a secondary access point is via the existing access point on Warminster Road. Both roads are Council Maintained roads.
Water and utilities	3.6	Provide a dedicated water supply of 20,000 litres at the existing dwelling is fitted with Storz couplings as filling points for fire tankers.
Fire preparedness and response	3.7	A bushfire management plan is prepared (incorporating a discrete ERP) including: • Ignition reduction strategies; • Fire suppression equipment details; • Flammable materials storage requirements; • Fire preparedness procedures; • Fire reporting and response to formal emergency alerts; • A standalone ERP detailing fire fighting restrictions, potential hazards (such as smoke), specialised Personal Protective Equipment (PPE) requirements, shut-down procedures, evacuation zone distances, aerial suppression considerations and availability of the ERP (stored within a cabinet at the front gate).

4. Cumulative Impacts

The cumulative impacts related to bushfire mitigation and other major developments in the area are as follows:

- *Volunteer fire-fighter workload* – Response call outs should not increase because the ignition risk is very low and possibly lower than the risk from surrounding agricultural activities. There will, however, be an ongoing requirement for briefing on the ERP.
- *Construction stage transport and road use* – The bushfire mitigation infrastructure (i.e. fire breaks, and water storage) will add a small percentage to the total construction traffic and road use.
- *Ongoing operations* – there would not be any cumulative operational impacts.

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