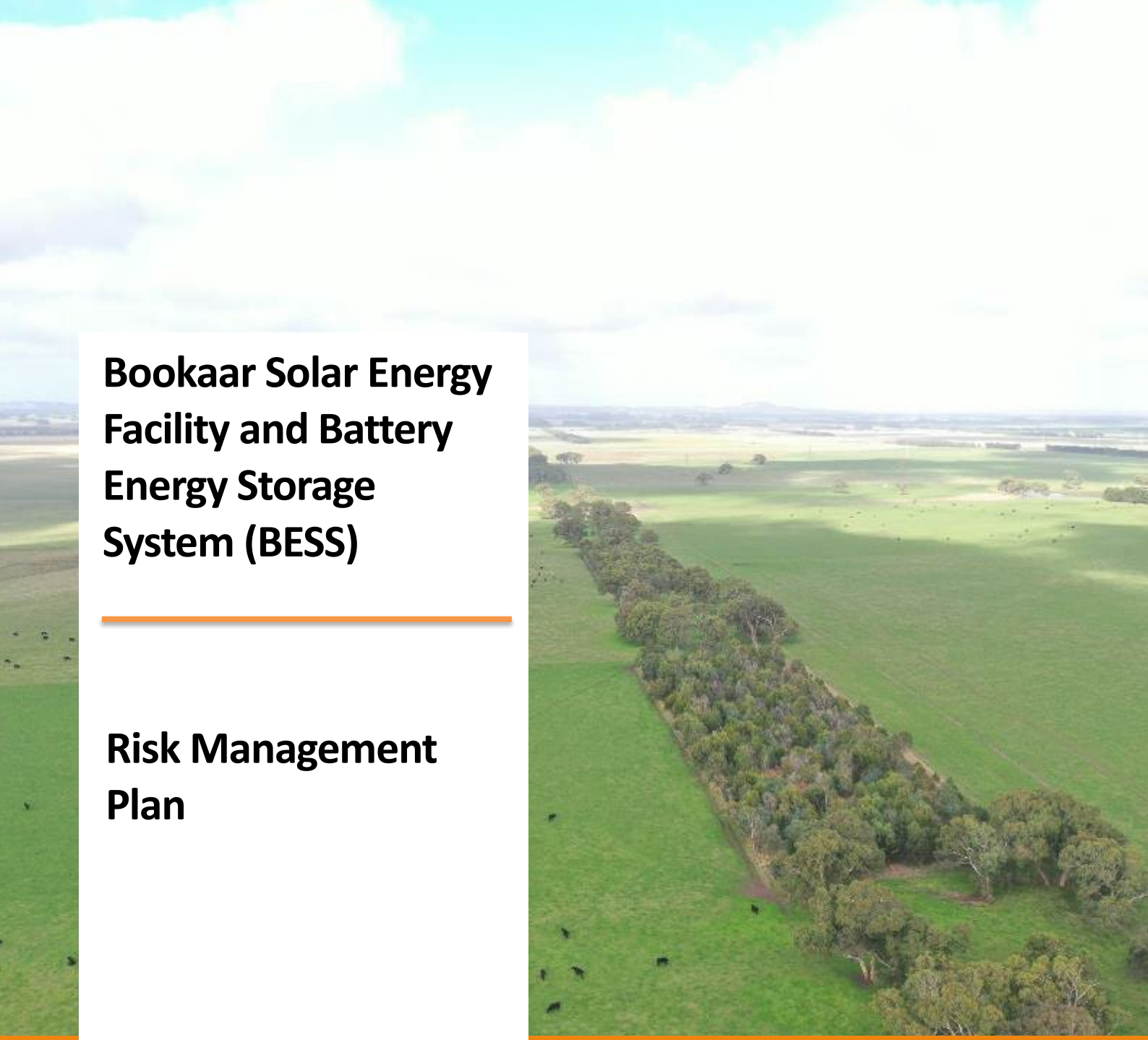
Bookaar Solar Energy Facility and Battery Energy Storage System (BESS)



Risk Management Plan

June 2022

FIRE RISK Consultants

Document history and revision date

Revision	Date	Description	By	Review	Approved
V1	5/6/2022	First draft	M. Potter	G. Taylor	G. Taylor
V2	9/6/2022	Additional feedback from the client.	M. Potter	G. Taylor	G. Taylor
V3	12/6/2022	Additional feedback from the client.	M. Potter	G. Taylor	G. Taylor
V4	15/6/2022	Final version following feedback from the client.	M. Potter	G. Taylor	G. Taylor

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Glossary of Terms & Abbreviations

Within the National Framework of fire risk mitigation, the fire protection industry has placed fire outcomes into four main themes and areas of focus. These areas are:

- **Prevention:** Prevention activities aim to minimise the occurrence of bushfires, particularly those of human origin, occurring during periods of extreme weather conditions.
- **Preparedness:** Preparedness actions are undertaken in anticipation of fires. Effective preparedness arrangements are implemented to improve bushfire response performance.
- **Response:** Bushfires are suppressed and managed to reduce the risk to human life, communities, essential and community infrastructure, industries, the economy and the environment. The protection of human life will be assigned priority over all other considerations.
- **Recovery:** Returning community, economic and business activities to a healthy state that result in a sustainable and economically viable community.

The bushfire risk assessment will largely deal with prevention, preparedness and response.

The following terms, abbreviations and acronyms have been used throughout this report:

Term	Meaning
APZ	Asset Protection Zone – utilises extensive fuel management to provide the highest level of protection to human life, property, key community assets and critical infrastructure. The goal of this aggressive fuel treatment is to reduce radiant heat and ember attack in the event of a bushfire surrounding assets. Can also be referred to as a 'Fire Break'.
AS 3959 – 2018	Australian Standard 3959 – 2018 Construction of Dwellings in Bushfire Prone Areas.
BESS	Battery Energy Storage System container/enclosure. Dedicated enclosure, often but not always resembling a shipping container, containing the battery system and associated battery system components.
Bushfire	An unplanned fire in vegetation, including grassfires.
Bushfire Attack Level (BAL)	Means the bushfire attack level as defined in AS3959-2009 *Construction of Buildings in Bushfire Prone Areas* as a "means of measuring the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact, using increments in radiant heat expressed in kilowatts per metre squared, and the basis for establishing the requirements for construction to improve protection of building elements from attack by bushfire".
Bushfire Hazard	Materials that can fuel a fire.
Bushfire Prone Vegetation	Means continuous vegetation including grasses and shrubs but not including maintained lawns, parks and gardens, nature strips, horticultural areas, vineyards and orchards.

Term	Meaning
Fire Risk	The probability of a fire starting and spreading, but it can also be used to describe the likelihood of an asset, such as a building, being damaged or destroyed by a fire. The term may also include bushfire.
CFA	Country Fire Authority Victoria.
Crown fire	Burns in the tops of trees ahead of and above intense ground fires. As they are exposed to the wind, where canopy continuity is maintained, they can travel ahead of a ground fire.
Defendable Space	An area of managed vegetation around an asset likely to be at risk from bushfire that protects it from direct flame contact and intense radiant heat, as well as providing an area where firefighters can defend the asset.
FFMVic	Forest Fire Management Victoria.
Fine Fuel	Dead plant matter less than 6mm in diameter.
FRC Pty Ltd	Fire Risk Consultants Pty Ltd, also known as FRC.
Fire Break	See definition for APZ.
Fuel Break	Synonymous with “firebreak”; any natural or constructed change in fuel characteristics, which affects fire behaviour so that fires burning into them can be more readily controlled. Fuel breaks will not stop a major bushfire but provide a fire control line from which to suppress a fire.
Fuel Structure	The quantity and type of fuel at different heights above the ground usually separated into surface, near surface, elevated and bark. Canopy fuels may also be expressed.
Hazard Reduction	Reducing fuel loads in any given area. Generally, by burning, mechanical, manual or chemical means.
Managed Vegetation	Combustible material that is permanently maintained in a minimal fuel state. Generally, mechanically treated in an APZ.
Minimum Fuel Condition	A condition where fine fuels are minimised to the extent that the passage of a fire will be prevented or severely restricted. This generally requires the removal of dead fine fuel and the control of live fuel, breaks in the continuity of any fuel, maintenance of a high moisture content in vegetation, or replacement of vegetation with roads, tracks, paths etc.
OFH	Overall Fuel Hazard (Hines, et al 2010). Classes used to quantify OFH are Low, Moderate, High, Very High and Extreme.
Solar Energy Facility	A facility where solar panels convert sunlight into direct current (DC) electricity; then power conversion equipment (Inverters) convert the power into alternating current (AC). The facility may include grid connection infrastructure to feed power into the electricity grid. Solar energy facilities may utilise either solar photovoltaic or solar thermal technologies.
VFRR	Victorian Fire Risk Register.

Executive Summary

Fire Risk Consultants was engaged by Bookaar Renewables Pty. Ltd. (the 'Proponent') to undertake a fire risk assessment and provide recommendations on mitigation strategies to manage the fire risk at the proposed Bookaar Solar Energy Facility (the 'Proposal') on land at 520 Meningoort Road, Bookaar, Victoria (the Site).

The Site is located approximately 10km north west of the Camperdown town centre within the Corangamite Shire Council footprint.

This report provides a detailed assessment of the fire risk across the Site with analysis of fires originating from both within and external to the property. The description and assessment of fire risk is not confined to the property, rather it considers the wider landscape bushfire potential as well.

The primary consideration for all fire mitigation and suppression efforts in Victoria is the preservation of life and property. This analysis will inform the Proponent to make sound decisions regarding fire risk management and assist them to prevent, prepare and respond to bushfires.

The assessment summarises the identified risks and makes mitigation recommendations that are intended to provide a greater level of protection to the Proposal, the surrounding property owners, and the community generally. The assessment considers the relevant policies, guidelines and other available information including clause 13.02-1S of the Victorian Planning Scheme, CFA renewable energy guidelines and a previous VCAT decision (Bookaar Renewables Pty Ltd v Corangamite SC [2019] VCAT 1244) regarding a proposed Solar Energy Facility on the same Site with the same footprint (the 'Previous Application').

Other recommendations in the areas of static water storage, emergency preparedness, training, fire coverage during construction and pre Fire Danger Period works are all made as part of this report. Partitioning the grassland vegetation within the Site with fire access tracks and areas of managed vegetation (low overall fuel hazard) will significantly reduce the ability for a fire to ignite and spread into, through, or from the Site.

The fire risk associated with the construction and operation of the Proposal can be mitigated to an acceptable level with the implementation of sound mitigation strategies. The Proposal does not increase fire risk in the landscape or preclude emergency service operations.

1 Introduction

Fire Risk Consultants Pty Ltd ('FRC') was originally engaged by Bookaar Renewables Pty Ltd (the 'Proponent') to provide a Bushfire Risk Assessment and Mitigation Plan ('BMP'). The BMP in line with the then current CFA Guidelines for Renewable Energy Installations, V2, March 2019 supported a Planning Permit application for the Bookaar Solar Energy Facility in November 2020. Following the release by CFA of their updated Design Guidelines and Model Requirements: Renewable Energy Facilities 2022 (CFA Guideline). In response to the changes within the CFA Guideline, this report has been updated to a Risk Management Plan (RMP) as outlined within section 5.2 of the CFA Guideline.

As per the CFA Guideline, this report also aligns with NSW Planning's Hazardous Industry Planning Advisory Paper 2: Fire Safety Study Guidelines (2011). The various requirements outlined within the Advisory Paper have been included within this report where it relates to the proposal.

The report will reduce potential impacts of fires to life, property and environmental assets resulting from the proposed Bookaar Solar Energy Facility (the 'Proposal') encompassing part of 520 Meningoort Road, Lots 51 and 52 and Res 1 on LP4677 and adjacent parts of Meningoort Road, Bookaar (the 'Site').

Victorian emergency management policy[1] prioritises the protection of human life, including the lives of both community members and of emergency response personnel, above all other considerations, and this has been emphasised throughout this report.

This RMP and accompanying Fire Management Plan (FMP, Appendix 1):

- Analyses the risk to the surrounding community, the facility itself and workers and visitors at the Site.
- Prioritises the reduction of risk to communities and the protection of human life in all aspects of the assessment.
- Provides a detailed assessment of the fire risk across the Site with analysis of fires originating from both within and external to the Site, including the bushfire potential of the broader landscape.
- Identifies the potential fire risk of the Proposal's infrastructure including a Solar Energy Facility (including a substation) and a Battery Energy Storage Facility (BESS) and associated mitigation strategies.
- Assesses the bushfire hazard at the Site and identifies performance standards for managing fuel loads.
- Identifies strategies to reduce the vulnerability of neighbouring communities to the bushfire risk originating from the Site.
- Identifies planned on-Site firefighting capability, including minimum standards for water supply, firefighting equipment and the training of on-Site workers.
- Assesses the design with the incorporation of identified mitigation treatments.
- Provides information to ensure the workplace health and safety of firefighters and Site personnel when responding to any fires at the Site.
- Demonstrates that the requirements in the CFA Guideline, *Design Guidelines and Model Requirements: Renewable Energy Facilities 2022* are addressed.

[1] State Emergency Management Priorities in the *State Emergency Response Plan* page 3-3 https://www.emv.vic.gov.au/policies/emmv

- Demonstrates concerns raised in a VCAT hearing regarding a previous proposal for a Solar Energy Facility at the Site are addressed.
- Demonstrates that concerns raised by WorkSafe Victoria about deficiencies relating to fire risk and dangerous goods in the application material have been addressed.
- Demonstrates that, with the adoption of the mitigation measures advocated from this assessment, the Proposal is able to meet the Policy strategies of Clause 13.02-1S of the Corangamite Planning Scheme.

1.1 Previous Application

The Proponent previously applied for a planning permit for up to 700,000 Solar Panels to be installed on the same site, within the same footprint (the 'Previous Application'). The Previous Application was the subject of an unsuccessful 2019 Victorian Civil and Administrative Tribunal decision ('the VCAT decision'; Bookaar Renewables Pty Ltd v Corangamite SC [2019] VCAT 1244), following refusal of the planning permit application by the Corangamite Shire Council. The VCAT decision was due to a lack of information around hydrology and bushfire management. With regard to Bushfire management, the Tribunal stated that a full bushfire assessment should be undertaken as part of the design process, because it '*may impact on the design, layout and operation of the facility*' (para 11.).

In response, the Proponent has decided to submit a fresh application for a Solar Energy Facility at the Site addressing the deficiencies identified in the VCAT decision. This assessment addresses the fire management matters raised in the VCAT decision by incorporating the fire risk assessment into the design of the Proposal, and identifying mitigation measures to reduce fire risk during the construction and operation of the Proposal. The VCAT decision is discussed in Section 8.4.

1.2 The Proposal

The Proponent is proposing to develop a 200MW Solar Energy Facility including a BESS and substation (the 'Proposal') at the Site. The Proposal includes the following elements (see the 'Site Plan' which accompanies the 'Planning Report'):

- 'Array Areas', containing Photovoltaic (PV) panels mounted on a single axis tracking system with a maximum height of 4m above natural ground at maximum tilt. The tracking system would be supported by piles driven into the ground. Row spacing is either 12.75 m or 13 m (pile to pile);
- 82 Inverters located centrally throughout the Site in pairs at 41 locations across the Site (Inverter stations). Inverter stations are located at least 170 m from the Site boundary;
- Below ground cabling connecting the PV panels between trackers and Inverters;
- Below ground cabling connecting the Inverters to the substation;
- An internal track network of all-weather gravel tracks (4 m), including a perimeter track which forms part of a 10 m wide defendable Asset Protection Zone (APZ) that surrounds the Site;
- Four (4) gated main Site access points via Meningoort Road;
- Four (4) gated emergency access points along the western boundary of the Site;

- Eight dedicated water tanks for firefighting (maximum of 3.6m high), located adjacent to each access point;
- A perimeter security fence 2.5m high (chain mesh);
- Perimeter vegetation screens (20 m wide with 4 rows of trees and maintained to a height of at least 4m), planted on the outside of the security fencing;
- Agricultural style fencing 1.2m high with gate access, around the perimeter of the vegetation screens and around the perimeter of existing vegetation along the Site's western boundary;
- A SCADA system that will gather, monitor and analyse data generated through operating the Proposal;
- On-demand, downward facing lighting (restricted to 4m in height); and
- Sensor triggered CCTV security cameras located around the perimeter of the Site and adjacent to key infrastructure.

Substation Area (1.76 ha):

- Substation connecting the Proposal to the on-Site 220KV transmission line, via two (2) new high voltage (HV) 220 kV transmission lines;
- Two 100MVA Transformers located on bunded hardstands;
- A Control building (up to 5 m high);
- Substation Operations and Maintenance building (up to 5 m high);
- A security fence (chain mesh) up to 2.5m high, enclosing the Substation;
- A 10m wide defendable APZ around the perimeter of the Substation; and
- Parking for 5 vehicles.

Battery Area (0.91 ha):

- 88 lithium-ion containerised battery units (Tesla Megapack), located in pairs, connected by underground cables to the Substation (approximately 2.5 m high) referred to collectively as the BESS.
- An IR heat and Flame detection system installed separately and externally to the battery units that will provide the ability to detect hot gases, smoke or flames.
- The provision of a fire water runoff capture system including:

    - an impervious concrete surface with a 150mm high rollover edge with drainage to enable stormwater to drain from the area (referred to as the 'Fire Water Runoff Capture Area' on the Site Plan).
    - A 150,000 litre tank is installed adjacent to the BESS to store captured fire water runoff.
    - A static water supply for firefighting purposes of 450,000 litres supplied in three separate tanks located around the BESS.

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- A static water supply for firefighting purposes of 450,000 litres supplied in three separate tanks located around the BESS.
- Access to a firefighting pump that in the event of a fire, will pump the fire water runoff from the BESS area to the 150,000 litre storage tank.
- A separate Transformer adjacent to each battery; and
- A 10m defendable APZ around the perimeter of the Battery Area.

Operations Buildings Area (0.96 ha):

- A Site office building including amenities with a height of 3.6 m;
- A maintenance building and workshop with a height of 5 m;
- 3 Storage sheds with a height of 4.1 m;
- Car parking for twelve (12) vehicles;
- A septic tank and potable water tank;
- A defendable APZ of 20 m, which allows the area to function as the nominated 'Shelter in Place' location.

In addition to the key components outlined above, there will be a temporary construction compound (1.44 ha) to facilitate the construction phase of the Proposal. The construction compound would include:

- Temporary construction offices (up to 5m high);
- Car and bus parking areas for construction vehicles (51 workers cars, 5 mini vans; and additional parking space provided for delivery vehicles and construction machinery);
- Staff amenity block including portable toilets, showers and a kitchen, designed for peak staff numbers during the construction period; and
- Laydown areas.

Once the Proposal is operational, the construction compound will be decommissioned and revegetated.

The Proposal has a lifespan of 30 years. The construction phase would take approximately 12 months and require up to 150 full-time staff. The operational phase would be approximately 28 years and will generate between 8 and 12 full time positions nationally, with six positions likely to be based locally. Decommissioning is expected to take 12 months and would require a similar workforce to the construction period. Following decommissioning all infrastructure associated with the Solar Energy Facility would be removed from the Site.

In the context of bushfire risk, the introduction of a Solar Energy Facility into any landscape can generate issues both perceived and actual. Whilst this report addresses a range of requirements for this type of proposal, based on consideration of the Proposal as described above and illustrated in Figure 1 below, the key risk areas that have been identified are:

- Ensuring the safety of staff, contractors and visitors in the event of a bushfire threatening the Site.
- Limiting bushfires from entering the Site.
- Preventing fires from starting.
- Limiting or eliminating the potential for fires to exit the Site.
- Protecting infrastructure from the effects of fire.

Figure 1a provides the Site Plan for the Proposal and Figure 1b the Site Plan Appendix A, which illustrates the substation and BESS areas in detail (a scale version of the 'Site Plan' and Site Plan Appendices is provided in the application material supporting the Planning Report).

1.2.1 Nomenclature

For the purposes of this report and in line with the CFA Guidelines the following definitions have been adopted in this assessment:

1. Solar Energy Facility - refers to all the infrastructure summarised in Section 1.2 excluding the components in the Battery Area.
2. Battery Energy Storage System (BESS) – refers to all the infrastructure outlined in Section 1.2 within the Battery Area.

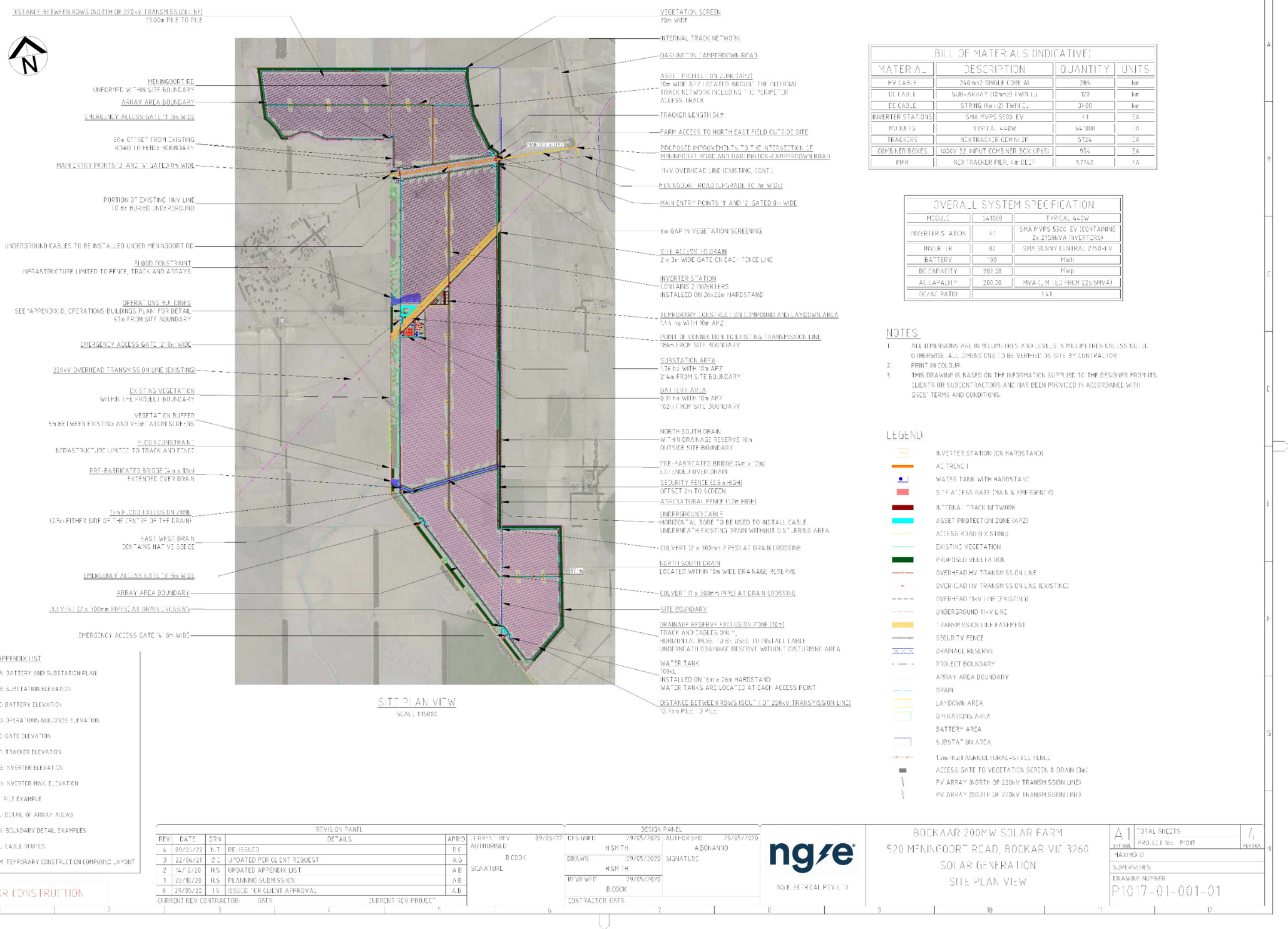

Figure 1a - Proposed Bookaar Solar Energy Facility – Site plan (See the 'Site Plan' that accompanies the planning application for a scaled version)

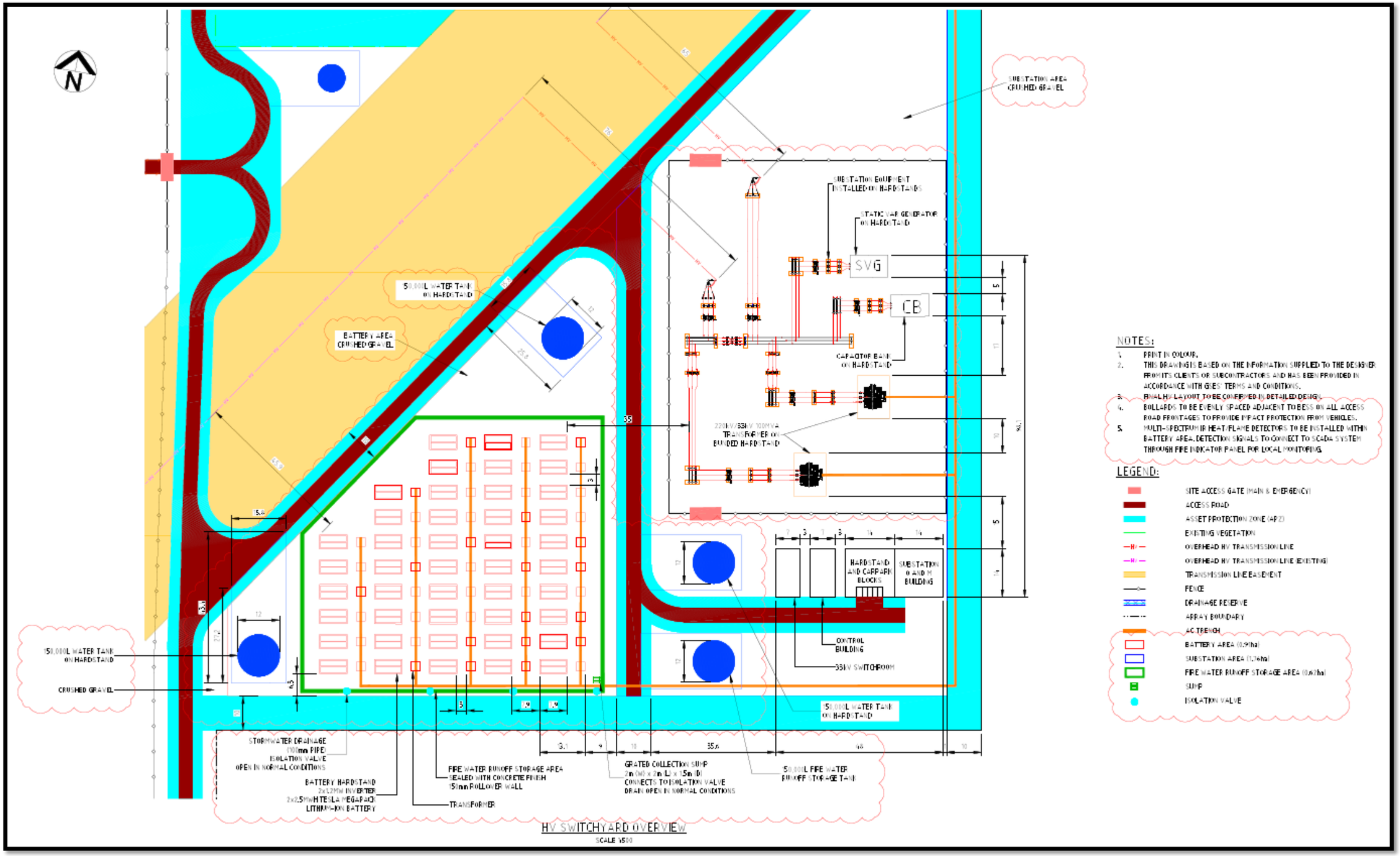

Figure 2b - Proposed Bookaar Solar Energy Facility – Site plan (See the 'Site Plan' that accompanies the planning application for a scaled version)

2 Methodology

This section outlines the methodology followed by FRC for the assessment.

2.1 Assessment approach

The following was taken into account throughout the assessment:

- Reduction of the fire risk and protection of the community and the health and safety of firefighters as a priority.
- The role and responsibilities of key stakeholder agencies.
- Factors that affect bushfire risk including existing levels of risk at the Site and in the surrounding areas, and the elements of the Proposal that may change bushfire risk.
- Accepted best practice policy and management for fire management.

The assessment involved the following steps:

- Literature reviews.
- Desktop assessment.
- Review of existing conditions at the Site and associated risk factors.
- Field work including both on ground and aerial assessments.
- Stakeholder consultation and review.
- Assessment of fire risk.
- Assessment against the CFA Guidelines, and the Department of Environment, Land, Water and Planning 'Solar Energy Facilities, Design and Development Guideline' (the DELWP Guideline).
- Consideration of the VCAT decision.
- Assessment against Clause 13.02-1S of the Corangamite Planning Scheme.
- Development of mitigation recommendations for the design, construction and operation of the Proposal.

Each of these steps is summarised below.

2.2 Literature review

FRC undertook the following literature review:

- Review of the application history and the VCAT decision relating to the Previous Application.
- Review of key policy and planning documents for fire management in south-west Victoria.
- Review of the legislative and planning framework regarding the assessment of fire risk for proposed solar energy facility developments.
- Review of international literature relating to fires in solar energy facilities and BESSs.
- Review of the Peat assessment carried out to support this Bushfire assessment.
- Review of the bushfire risk including bushfire history, fire management plans, etc in south-west Victoria and at the Site.

2.3 Desktop assessment

FRC then carried out a desktop-based assessment to determine:

- Design factors for the Solar Energy Facility and BESS installations.
- Fuel, weather and topographic factors affecting fire behaviour at the Site's location and in the wider landscape.
- The general fire risk in south-west Victoria and for the Site.

2.4 Review of existing conditions

FRC assessed the following characteristics of the Site and surrounding area:

- Landscape features and land use.
- Communities, property and other values vulnerable to the fire risk.
- Possible ignition sources.
- CFA firefighting resources in the area.

2.5 Field work

FRC personnel carried out a Site visit to assess:

- The Site context, particularly with respect to potentially vulnerable nearby communities.
- Adjoining land use.
- Fuel hazard of the Site and neighbouring properties (through ground investigations, and a drone survey capturing high resolution landscape images).
- Topography.
- Access and egress.
- Water supply on site and in the surrounding area.

2.6 Stakeholder consultation

A variety of stakeholders have been engaged to gather information to inform this fire risk assessment. The stakeholders have represented the following organisations:

- CFA.
- Corangamite Shire Council.
- The property owner's representative (Farm Manager).
- Bookaar Renewables Pty Ltd.

2.7 Assessment and Recommendations

Using the information collected through the literature review, the desktops assessment, Site visits, and discussion with key stakeholders, FRC prepared a Risk Management Plan that incorporates a Fire Risk Assessment that includes a Clause 13.02 Assessment.

The development of mitigation recommendations to reduce the level of risk to a satisfactory level and ensure that the CFA Guidelines and other standard requirements are achieved by the Proposal are key

outputs of the assessment process. Mitigation recommendations include the development of a Fire Management Plan and an Emergency Management Plan. The Fire Management Plan is provided in Appendix A, and it outlines the activities, processes and accountabilities for the ongoing management of fire risk at the facility.

Overall, the assessment methodology has been designed to ensure that potential fire risk has been evaluated at all stages of the lifecycle of the Proposal with mitigation measures identified and incorporated into the final design to ensure that the introduction of the Proposal will not increase fire risk at the Site or in the surrounding area.

2.8 Key documents

The design has been informed by the following key documents:

- The CFA *Design Guidelines and Model Requirements: Renewable Energy Facilities 2022*. The CFA Guidelines outline the minimum requirements for the development of renewable energy facilities including Solar Energy Facilities and BESSs and is the Guidance referred to by the Department of Environment Land Water and Planning in its Guideline '*Solar Energy Facilities, Design and Development Guideline, July 2019*'.
- The VCAT decision (Bookaar Renewables Pty Ltd v Corangamite SC [2019] VCAT 1244) for the Previous Application. While the VCAT decision pertained to the Previous Application on the Site, it raised issues relating to Bushfire Risk Assessment and contained advice on what a future bushfire risk assessment for a proposal at the Site should include.
- *Solar Energy Facilities, Design and Development Guideline* (the DELWP Guideline).
- Worksafe submission to VCAT (20 May 2022) outlining concerns that there was insufficient information with the application material for it to make a recommendation regarding the permit application.

3 The Bushfire Environment

3.1 Bushfires in Australia and Victoria

Australia is one of the most fire prone areas in the world. Victoria has a history of catastrophic bushfires such as Black Friday (1939), Ash Wednesday (1983), Central Victorian grassfires (1985), Alpine Fire (2003), Great Divide Fire (2006) and recently, Black Saturday (2009).

Victoria's high bushfire risk is the result of several factors that increase the likelihood and consequences of fire. These factors include large areas of the state comprising highly flammable dry eucalypt forest, native and introduced grassland, protracted droughts and an increasing population in bushfire-prone areas.

The spread of a bushfire is a direct result of the weather, fuel hazard (including dryness, quantity and arrangement of the fuel) and the topography in which the fire is burning. Fuel is the only factor it is possible to modify.

Bushfires can occur from October through to April, but historically the most devastating have occurred in January and February. Extreme fire conditions typically follow a dry winter and spring.

The 2019 / 2020 season was significant in Victoria with many bushfires impacting the eastern half of the State. Damaging fires to life and property in East Gippsland and north east Victoria killed 5 people and destroyed over 300 homes.

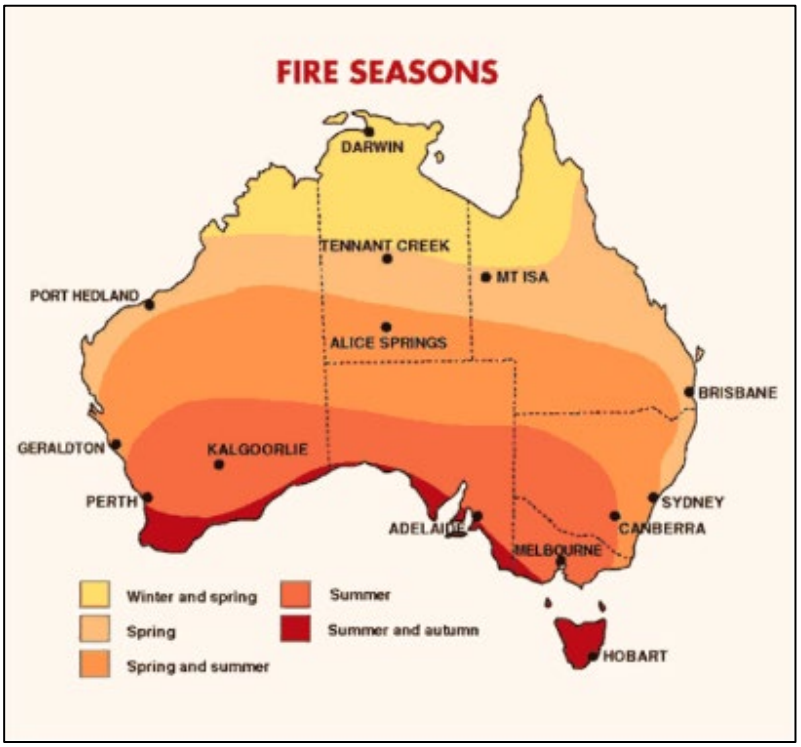

Figure 3 - Bushfire Seasons in Australia. Source: Australian Government BOM

3.2 Bushfires in south-west Victoria

Over the last 100 years there have been several significant fires in the Western District of Victoria and south west Victoria generally.

A significant threat to the Corangamite Shire community, every Fire Danger Period is the potential for fast-moving grassfires.

On the 17th and 18th March 2018, a series of fast-moving grassfires in western Victoria destroyed 26 residences, 66 outbuildings and burned approximately 24,000 hectares of grassland. The destruction included numerous sheep and cattle. Fortunately, no lives were lost[2].

A typical fire pattern in south west Victoria can result in a fire moving quickly under the influence of strong, gusty north westerly winds. The fire can rapidly change direction when the subsequent south westerly wind change arrives.

Fires that start under these conditions can reach a very high intensity, even in areas of relatively low fuel loads and can be difficult to control until the weather conditions abate.

[2] 2018 South West Fires – Community Report – Emergency Management Victoria (2018): https://www.emv.vic.gov.au/Sites/default/files/embridge_cache/emshare/original/public/2020/01/1e/0719672d5/2018-South-West-Fires-Community-Report.pdf

4 Fire Risk Assessment Framework

4.1 Introduction

The risk assessment process involves identifying, analysing, evaluating and mitigating the identified risks. The overall risk assessment process requires a consistent approach and follows *AS ISO 31000:2018 Risk management – Guidelines* as incorporated into the National Emergency Risk Assessment Guidelines (NERAG). Figure 1 provides an overview of the risk assessment process as outlined within *AS ISO 31000:2018 Risk management – Guidelines*.

Risk management is the process of recognising risk and developing methods to both minimise and manage the risk. This requires the development of a method to identify, prioritise, treat (deal with), control and monitor risk exposures.

A risk assessment is a function of the likelihood of an adverse event occurring and the consequence of the event. A comprehensive risk assessment will identify potential risks and consequences and therefore assist with the development of mitigation actions.

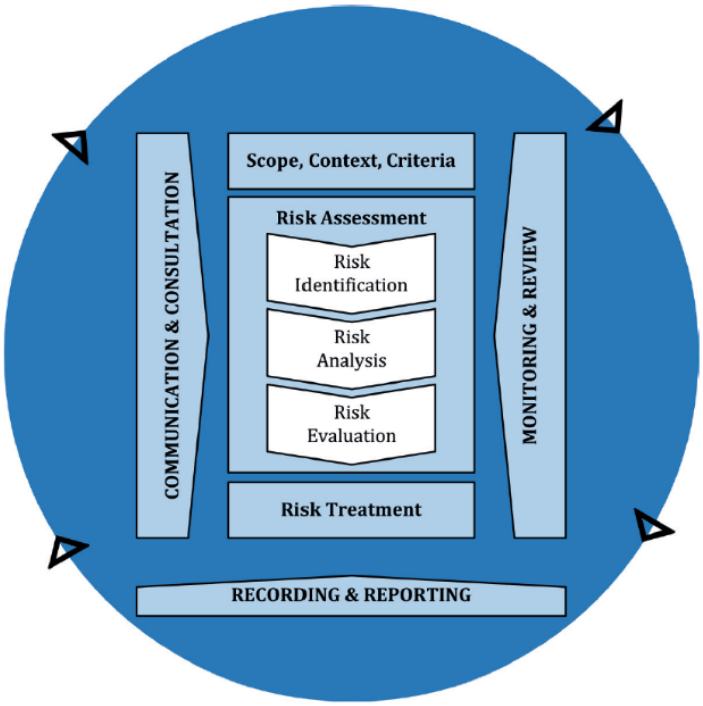

Figure 4 - Overview of AS/NZS ISO 31000-2018 risk assessment process

The fire risk assessment process results in a number of outputs that will assist the Proponent with managing fire risk at the Site. These outputs guide recommendations to manage the risk from fires during the whole lifecycle of a project. Outputs include:

- Clause 13.02-1S hazard identification, landscape assessment and strategy response.
- Fire risk assessment.
- Fire Management Plan.
- Emergency Management Plan.

4.2 Benefits

Benefits of the risk assessment process for the Proposal include:

- Adoption of the protection of life as the highest priority.
- Identification of the existing fire risks on the Site.
- An opportunity to work collaboratively with other stakeholders to reduce fire risk across the broader landscape.
- Justification of the investment in resources, systems and processes to lower the consequence of fires impacting on the Bookaar Solar Energy Facility.
- Determination of a suitable nominated Shelter-in-Place location.
- Development of a Fire Management Plan.
- Development of an Emergency Management Plan.

4.3 Risk assessment outputs

4.3.1 Fire Risk Assessment Matrix

The Fire Risk Assessment Matrix uses all available information to define the likelihood and consequence of fire at the Site.

The matrix uses the following definitions:

- **Likelihood** is the chance that something might happen (level of probability). The assessment of likelihood includes reviewing the potential fire frequency and ability for the fire run to reach the Site and nominated Shelter-in-Place building. The outputs of the likelihood assessment are expressed as Almost Certain, Possible, Likely or Unlikely.
- **Consequence** determines the level of impact and for the risk assessment we have defined it as the threat and vulnerability of the Site.
- **Threat** is the fire threat to the particular asset that may be expressed as a Bushfire Attack Level (BAL) for the Site and Shelter-in-Place area or a description of the particular fire risks.
- **Vulnerability** relates to the vulnerability of the Site, and is divided into five levels:
    - The asset, landscaping, plantings and maintenance.
    - Access and egress for evacuation and emergency services.
    - Water supply including presence of an adequate / specified water supply and pumping equipment.
    - Building suitability to resist ember attack / preparedness against fire.
    - Human behaviours to respond including policies, procedures and plans.

A level of bushfire risk is already present in the landscape and practical actions to reduce this risk are defined.

Some strategies to reduce bushfire risk are not within the control of the Proponent. For example, the vulnerability of the Bookaar community to bushfire[3]. The DHHS *Vulnerable people in emergencies policy*[4] encourages planning for vulnerable people and funded agencies have a responsibility to support them to undertake this planning.

The role of the Proposal in protecting the Bookaar community and its vulnerable community members is limited to:

- Ensuring the Proposal does not increase the fire risk to the community beyond the inherent risks already present in the landscape.
- Ensuring that the Proposal design, construction and operation prioritises the prevention of fires at the Site and, in the event a fire does start, from leaving the Site.

4.3.2 Clause 13.02-1S – Bushfire Planning

Clause 13.02 of the Victorian Planning Provisions is clear that the primacy of life is the key focus of the Victorian Planning Scheme. This is supported by Clause 71.02-3 which requires the prioritisation of the protection of human life over all other policy considerations.

The objectives for Settlement Planning as outlined within the Clause 13.02 policy includes:

- Ensuring the availability of, and safe access to, areas assessed as a BAL-LOW rating under AS 3959:2018 Construction of buildings in bushfire-prone areas (Standards Australia, 2018) where human life can be better protected from the effects of bushfire.
- Ensuring the bushfire risk to existing and future residents, property and community infrastructure will not increase as a result of future land use and development.
- Achieving no net increase in risk to existing and future residents, property and community infrastructure, through the implementation of bushfire protection measures and where possible reducing bushfire risk overall.
- Assessing and addressing the bushfire hazard posed to the settlement and the likely bushfire behaviour it will produce at a landscape, settlement, local, neighbourhood and site scale, including the potential for neighbourhood-scale destruction.

Addressing this clause is a requirement of the Planning Scheme and allows the assessment of the Proposal against clearly defined strategies.

4.3.3 Dangerous Goods (Storage and Handling) Regulations

The Dangerous Goods (Storage and Handling) Regulations[5] (DG Regulations) outlines the duties of occupiers regarding consultation, information provision, training and supervision. Occupiers are obligated to manage the risk at their premises by identifying hazards and implementing risk controls to satisfy their general and specific risk control duties. Occupiers also have duties to prepare a fire protection system, as well as other emergency preparation and response duties.

[3] The *Otway District Strategic Fire Management Plan* identified that there were four people in the Bookaar area who, due to age of disability, would require assistance in the event of an emergency.

[4] https://providers.dhhs.vic.gov.au/vulnerable-people-emergencies-policy

[5] https://content.legislation.vic.gov.au/Sites/default/files/2021-07/12-132sra008%20authorised.pdf

The Victorian Worksafe – *Code of Practice for the storage and handling of dangerous goods*[6] provides an overview of the regulatory requirements. In relation to this development, the requirements would include:

1. Consultation with those likely to be affected from exposure.
2. Induction, information, training and supervision
3. Obtaining Safety Data Sheets
4. Provision of safety signs
5. Dangerous Goods Register
6. Marking
7. Risk management plans

The activities undertaken to achieve the requirements of the CFA Guideline would also meet the requirements of DG legislation in relation to the completion of a risk management plan and the development and maintenance of an Emergency Management Plan.

In the context of a Solar Energy Facility and BESS, both the construction and operations phases of the project need to be considered in the assessment of risk. This would extend to ensuring that the storage of infrastructure prior to installation is in accordance with separation distances specified by the manufacturer.

4.3.4 Fire Management Plan

In response to the requirements outlined within the CFA Guidelines, a Fire Management Plan has been developed (Appendix A) to outline the following:

Table 1 - Excerpt from CFA Guidelines - Fire Management Planning requirements

Fire Management Plan Requirements	
A summary of fire hazards and risks to and from the Site, specific to its location, infrastructure, activities and occupancy.	Based on sound hazard identification and risk management processes. This must include risks to firefighter safety during emergencies.
Description of control measures to prevent fire occurring and limit the consequences of fire at the facility.	Fire permits, ignition source controls, hot work permits, job hazard analyses, infrastructure/vehicle/equipment/road/fence/access maintenance, waste management, compliant dangerous goods storage and handling, vegetation/fuel reduction and management, peat management, Emergency Management Plan.

[6] https://content.api.worksafe.vic.gov.au/Sites/default/files/2021-06/ISBN-Code-of-practice-for-the-storage-handling-dangerous-goods-2021-06.pdf

Description of control measures to prevent and reduce the consequences of external fire impacting the facility.	Bushfire monitoring, bushfire preparedness, reduced personnel presence/ activities/travel on days of Severe and above Fire Danger Rating, creation and management of fire breaks at the Site perimeter and around infrastructure, vegetation/fuel reduction and management, Emergency Management Plan.
Details of equipment and resources to manage fire at the facility.	Fire detection and suppression systems, fire water supplies, automatic shut-down and isolation systems, monitored alarms, communications equipment, occupant warning systems, designated evacuation assembly areas, Emergency Information Container(s), Emergency Management Plan.
Policies and procedures that ensure all control measures are appropriate and effective, and remain so.	Performance standards for risk controls, specific activities to verify controls (serving/maintenance, housekeeping inspections, external audits), review processes for risk control effectiveness.
Procedures for review of the Plan.	Review triggers and schedule, organisational accountability for the Plan, allocated responsibilities (to persons or roles) for the ongoing development and review of the Plan.

The Fire Management Plan provides an overview of the fire mitigation activities and the minimum standard required.

4.3.5 Emergency Management Plan

An Emergency Management Plan (EMP) is required to be developed prior to the construction phase commencing. The EMP is required to induce the specifications outlined with Section 10 of the CFA Guideline along with AS3745 *Planning for emergencies in facilities.*

An Emergency Management Plan (EMP) details the structures, procedures, resources and the minimum level of training for managing emergencies. EMPs must be specific to the infrastructure, operations and location of facilities, and informed by this Risk Management Plan.

A preliminary Bushfire Response Plan (the 'preliminary BRP') was prepared to meet the previous CFA Guidelines. This preliminary BRP will now be incorporated into an EMP that will address all the risks identified within this Risk Management Plan. The content of the EMP will also be included within the Fire Management Plan and include the review and exercising requirements to ensure it remains current. The EMP will be completed before development starts and is required to be endorsed by the CFA.

4.3.6 Stakeholder consultation

FRC engaged with representatives from Corangamite Shire Council and CFA to discuss the Proposal and assessment process and seek feedback.

Table 2 - Overview of stakeholder consultation

Organisation	Summary of discussion
CFA **State Infrastructure and Dangerous Goods Department**	Initial consultation occurred on 8th May 2020 with additional information supplied via email on 9th June 2020 regarding: • Deficiencies of the Previous Application with respect to Bushfire Risk Assessment. • Application of CFA Guidelines.

	• Advice on when the Proponent should consult the Proposal with local the CFA. • Vegetation screening principles. • Design elements, for example, 'non-combustible mulch', internal track layout and design, and APZs; • Development and use of a Bushfire Mitigation Operational Works Schedule (BMOS). • Location and numbers of water tanks. • Emergency Access Points and general Solar Energy Facility layout. • Guidance on when to seek dangerous goods advice. • Advice on the spacing of the battery facility. Following the initial feedback from CFA, elements of the design were altered including improved track layout and the creation of guidelines to support the development and management of the Vegetation Screens. The draft report was supplied to CFA along with the BMOS and PBRP on 13th September 2020 with feedback indicating: • CFA believe that the document was very well put together and considered. • Seeking further clarification on the remote monitoring arrangements, safer location arrangements and isolation capabilities across the Site. In response to CFA's feedback, additional information has been provided within the report. Further consultation occurred with CFA during May and June 2022 in relation to the effect of the new CFA Guidelines on the proposed development and in particular the management of fire water runoff and the assessment of dangerous goods. Consultation also occurred in relation to the provision of fire water for the BESS. Their initial feedback indicated support for the proposed fire water runoff management, quantity of fire water and the assessment of dangerous goods within the BESS, Inverters and substations.
Corangamite Shire Council **Planning Department**	On 8th May 2020, briefed on Fire Risk Consultants engagement and the project scope. General discussion on: • Numbers of water tanks. • Emergency Access Points and general Solar Energy Facility layout. • The Previous Application with respect to Bushfire Risk Assessment. • The planning framework for solar energy facilities, the role of Council and the role of the Victorian State Government. • Development and use of a Bushfire Mitigation Operational Schedule (BMOS). • Application of CFA Guidelines. Council also stated that fire was an emotive issue in the local community. Council expressed a desire to look at the draft report before formal planning application.

5 Statutory Planning Framework

This section outlines the regulatory and planning context for fire management in the vicinity of the Proposal.

In Victoria, fire safety is considered a shared responsibility between the fire services, the Victorian and local Government, communities and individuals. All parties are responsible for bushfire preparedness prior to the fire danger period in order to protect themselves, their interests and their neighbours from the impact and effect of bushfires.

5.1 Victorian fire legislation

The *Emergency Management Act 1986* and *Emergency Management Act 2013* provide the emergency management framework for Victoria.

The *Country Fire Authority Act 1958* (the 'CFA Act') relates to fire prevention and suppression in the county area of Victoria (private property outside the metropolitan fire district). The CFA is responsible for the suppression of fire in this area. The CFA Act applies to fires and fuel management on the Site.

The CFA Act provides for the CFA to declare the Fire Danger Period (FDP) in individual municipalities and Total Fire Ban by weather districts. These declarations impose restrictions on the lighting of fires and activities that may cause a fire. The Act also authorises municipalities to issue fire prevention notices to landholders for fire hazard removal.

Section 43 of the CFA Act states

> '*it is the duty of every municipal council and public authority to take all practical steps (including burning) to prevent the occurrence of fires on, and minimise the danger of the spread of fires on and from – any land vested in it or under its control or management: and any road under its care and management*'.

Each municipality that has a bushfire risk appoints a Municipal Fire Prevention Officer, authorised by the CFA Act to issue Fire Prevention Notices on owners or occupiers of private properties to complete fire management works. A Municipal Fire Prevention Officer may enter private land to remove fire hazards if they are not treated within the time frame or manner stipulated on the Fire Prevention Notice. The Municipal Fire Prevention Officer is responsible for issuing permits to burn during the Fire Danger Period.

The CFA Act indicates that the onus is on individual owners and occupiers of land to ensure their properties are free of fire hazards that may put the lives and property of other people at risk.

The CFA has produced guidance which covers the development of utility scale solar energy facilities and is outlined in Section 5.4.1 below.

5.2 Regional fire management plans

The *Emergency Management Act 1986* and *Emergency Management Act 2013* provide the emergency management framework for Victoria. The Victorian Government is currently reviewing these arrangements and changes have been proposed to the emergency management structure and planning processes at the State, Regional and Municipal levels.

Currently, Regional Emergency Management Planning Committees prepare Regional Emergency Management Plans and Municipal Emergency Management Planning Committees prepare Municipal Emergency Management Plans. These cover all emergencies.

Where fire is a risk in the area, these committees establish Regional Strategic Fire Management Planning Committees and Municipal Fire Management Planning Committees as subcommittees to prepare integrated Regional Strategic Fire Management Plans and Municipal Fire Management Plans respectively. These committees engage all agencies with a role in fire management and develop a plan that outlines responsibilities.

The *Corangamite Municipal Emergency Management Plan 2017-20*[7] covers the Site and surrounding area. This plan identifies bushfire as an extreme risk to people, economy, environment and infrastructure across the entire municipality.

5.2.1 Otway District Strategic Fire Management Plan

The Corangamite Shire is included within the Strategic Fire Management Plan[8] for the Otway District. The plan is the result of collaboration between three municipalities that cover the Otway Ranges and surrounds.

The purpose of the plan is to enhance integration, coordination and effectiveness of fire risk reduction and community fire safety activities across the three shires and across all fire management agencies, groups and communities. It aims to reduce the risk to life and community values from the threat of fire, and facilitate the development of resilient and fire adapted communities which have an increased capacity to recover from fire.

Detailed risk analysis across the District was undertaken in the preparation of the plan. Bushfire modelling of 10,000 simulated fires were assessed to determine a broad range of fire interactions including the frequency that modelled fires reached each town in the district and the potential scale of the impact. From this work, bushfire risk across several criteria for all localities in the District were ranked, including:

- The influence of landscape topography and vegetation on the potential for unusual fire behaviour and intense ember drops on each town (termed drop-zone).
- Access and proximity of each town to a large, open and permanently low-fuel space for last resort bushfire shelter – often a wide accessible beach.
- The relative need each town has for assistance due to age (younger or older) and disability.
- The relative degree to which tourism is a feature of each town, understanding that tourists are likely to be more vulnerable and large visitor numbers can pose additional risk – e.g. traffic issues.

Bookaar is identified in a lower risk category when compared against other locations in the Corangamite Shire area. This was mainly due to the low overall risk of a bushfire in the area.

The key risk factors related to the vulnerability of the community, specifically:

- Lack of access to a low fuel area as a last resort bushfire shelter.
- The presence of four people in the area (at the time of the assessment) with a need for assistance in the event of an emergency, due to age or disability.

While the plan identifies there has been little fire history in the local area surrounding the Site, it does

[7] https://www.corangamite.vic.gov.au/files/assets/public/documents/plans-amp-strategies/emergency/corangamite-shire-memp-2019-2021.pdf

[8] https://www.corangamite.vic.gov.au/Council/Publications/Plans-Strategies-A-Z/Strategic-Fire-Management-Plan

identify fire history in similar grassland landscapes across the Western District of Victoria.

5.2.2 Strategic Bushfire Management Plan – Barwon Otway

Safer Together[9]*: A new approach to reducing the risk of bushfire in Victoria* (Victorian Government 2015) outlines the approach to reducing bushfire risk in Victoria through land, fire and emergency management agencies working with communities to manage fuel.

The Safer Together project has completed an assessment of bushfire risk and published this in the report *Barwon South West Bushfire Management Strategy (2020)* [10]. The report identifies priority communities at risk from bushfire. All priority communities are located adjacent to or within the forested areas to the south and east of the Otway Ranges footprint.

The area surrounding the Site has been categorised as a low priority risk in the Plan. Further, the community and has not been identified as a priority community as the primary risk is from grass fires. While grass fires can destroy property and cause significant loss of life, they are more able to be managed in the prevention phase through fuel management.

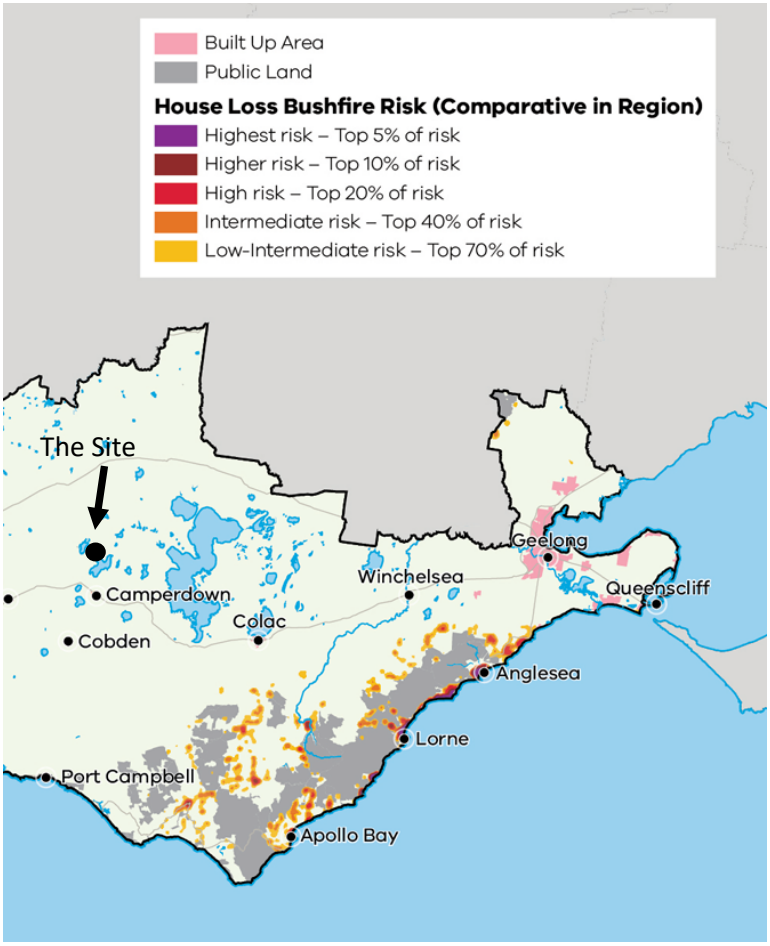

Figure 5 - Excerpt from *Barwon South West Bushfire Management Strategy (2020)* showing approximate Site location

[9] https://www.safertogether.vic.gov.au/

[10] https://www.corangamite.vic.gov.au/files/assets/public/documents/plans-amp-strategies/emergency/corangamite-shire-memp-2019-2021.pdf

5.3 Victorian Planning Scheme

The Corangamite Planning Scheme sets out policy objectives and strategies for managing bushfire risk in Victoria. This includes Clause 13.02-1s 'Bushfire Planning', which includes strategies to identify, assess and manage bushfire hazards.

The objective of Clause 13.02-1s is to strengthen the resilience of settlements and communities to bushfire through risk-based planning that prioritises the protection of human life. Clause 13.02-1s arrangements are aimed at reducing the future risk associated with land use developments and reducing the risk to the community created by previous land use decisions. As noted in Section 4, an assessment of the Proposal against Clause 13.02 is a core component of this BMP and is provided in Section 8.

5.4 Guidelines for Solar Energy Facility developments

5.4.1 DELWP Guideline

The Department of Environment Land Water and Planning (DELWP) has developed the *Solar Energy Facilities – Design & Development Guideline August 2019* (the 'DELWP Guideline') as the primary guide to assist Solar Energy Facility developers in the planning, development and operation of these facilities across Victoria.

The DELWP Guideline provides an overview of the policy, legislative and statutory planning arrangements for Solar Energy Facility projects in Victoria. In relation to 'Bushfire Management', it states that '*building a Solar Energy Facility should not increase the risk of bushfire in the area*' (25).

In terms of the assessment process, the DELWP Guideline states '*within rural and regional areas, a proponent should consult the CFA's Guidelines for renewable energy installations for information about bushfire risk management and other risk management matters*'.

The DELWP Guideline also identifies *Clause 13.02-1 Bushfire Planning* as the Policy that sets out the strategies and objectives to manage bushfire risk within Victoria.

This report has been developed with due consideration of the CFA Guideline and Clause 13.02. Furthermore, by integrating fire assessment into the design of this Proposal, it is demonstrated in Section 8 that the development of the Proposal would not increase the level of fire risk in the surrounding area.

5.4.2 CFA Guideline

CFA has updated its publication *Design Guidelines and Model Requirements: Renewable Energy Facilities 2022* (CFA Guideline), to provide the renewable energy industry guidance on the planning, construction and operation of renewable energy facilities.

The CFA Guideline does not provide information in relation to the risk posed by solar energy facilities and BESSs. Rather, it provides guidance on the treatments that should be implemented to reduce the risk posed to firefighters, the community and the asset generally. It can be implied from the CFA Guideline that there are risks associated with bushfires entering a Solar Energy Facility Site, and risks from the potential for fires to originate within the development and impact on neighbouring properties or other infrastructure. This CFA Guideline has been used to inform design and update the design, construction and operational mitigation solutions for the Proposal. An overview of the Proposal's consideration of the CFA Guideline is provided at Section 8.3, while a detailed analysis of the Proposal's adherence to it is provided in Appendix C.

6 Existing Site Conditions

Site conditions in the context of bushfire include a variety of elements. These need to be assessed individually to develop a detailed understanding of the bushfire risk associated with the Site. The CFA Guideline outlines the attributes for a low risk or high-risk location. The indicators provided by the CFA Guideline to assess if the location is a low risk includes:

- Grassland.
- No continuous other vegetation types within 1-20km of the project Site.
- Generally flat topography, some undulation may be present.
- Slopes are less than 5 degrees.
- Good road access with multiple routes available to and from the project Site.
- No BMO applies.

The property and surrounding landscape identified for this development meets the attributes to be considered a low risk location.

6.1 Location

The Site is located approximately 8 kilometres north west of Camperdown. It is located off Meningoort Rd off Darlington Camperdown Road. Lake Bookaar is located to the east of the Site with Mt Meningoort to its west.

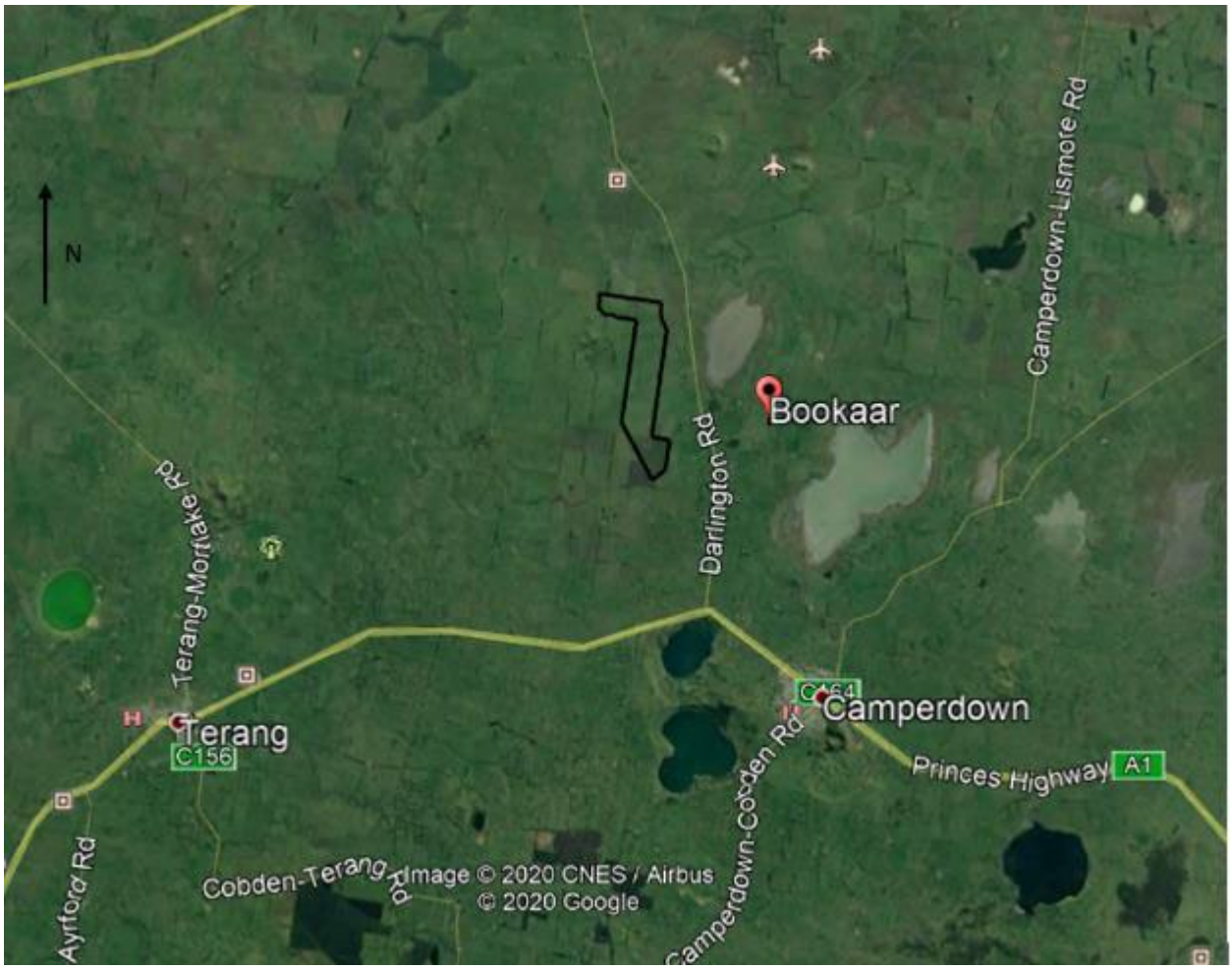

Figure 6 - Location of the Site

6.2 Adjoining land use

The land surrounding the Site for several kilometres is zoned 'Farming Zone (Schedule 1)' under the Planning Scheme. This land is primarily utilised for farming purposes with scattered dwellings and farming related infrastructure on these properties.

Farming operations will strongly influence the bushfire risk within the local area as various practices will result in higher or lower levels of fuel. It can be assumed that the risk will fluctuate through the fire danger period depending on the practices undertaken.

6.3 Topography and major geographical features

6.3.1 Topography and bushfires

Topography describes the nature of the land surface in terms of slope, steepness, aspect, elevation and landscape pattern. Changes in topography can cause dramatic changes in fire behaviour.

Fires travel upslope much faster than they travel on flat land with corresponding reductions in speed downslope. North facing slopes are drier than south facing slopes, and consequently fuels on north facing slopes can ignite and burn more easily than those on south facing slopes. Areas upslope of an approaching fire are considered highly dangerous.

6.3.2 Site topography and other features

There are minor changes in elevation across the Site (ranging from approximately 140m – 149m above sea level), however from the perspective of Bushfire Risk the Site can be described as flat. The Bushfire Management Overlay and AS 3959 classify slope in 5 degree classifications. The Site is within the 0 – 5 degrees category.

The Site is located near to the foot of Mount Meningoort (approximately 220 metres in height), which could influence the behavior of a bushfire burning from the north west by increasing its speed as it burns up its north face. However, the bushfire would also slow down as it burns down the south face. Due to the location of Mount Meningoort relative to the Site, changes in bushfire behaviour resulting from its topography are not expected to impact on the Proposal.

On the eastern side of Darlington Road is Lake Bookaar, which is a permanent salt lake. This will reduce the potential for bushfire from an easterly direction.

6.4 Bushfire fuel

6.4.1 Fuel hazard

Fuel hazard is assessed by combining all fuel sources. These fuel sources are categorised into four layers with differing effects on fire behaviour. The layers are:

Surface fine fuels (less than 6mm in thickness): leaves, bark, small twigs and other fine fuels lying on the ground. These fuels provide the horizontal continuity that allow a bushfire to spread.

Near surface fine fuels (less than 6mm in thickness): grasses, low shrubs, bracken etc. up to about .5 m above the ground surface. Fuels in this layer will burn when the surface fuel layer burns and will increase bushfire intensity.

Elevated fuels: larger shrubs and small saplings with most of the fuel closer to the top of this layer and a clear gap between them and the surface fuels. These interact with the surface fine fuels and near surface fine fuels to further increase bushfire intensity. They also contribute to the vertical continuity of fire that allows fire to 'climb' into the tree canopy with the potential to then become a 'crown fire'[11].

Bark fuels: includes flammable bark on trees, saplings and large bushes from ground level to the canopy. Loose fibrous bark on stringy-bark eucalypts and candle bark on some gums can generate large amounts of embers which can start spot fires ahead of the main fire front.

[11] A 'crown fire' burns in the tops of trees ahead of and above intense ground fires. As they are exposed to the wind, where canopy continuity is maintained, they can travel ahead of a ground fire.

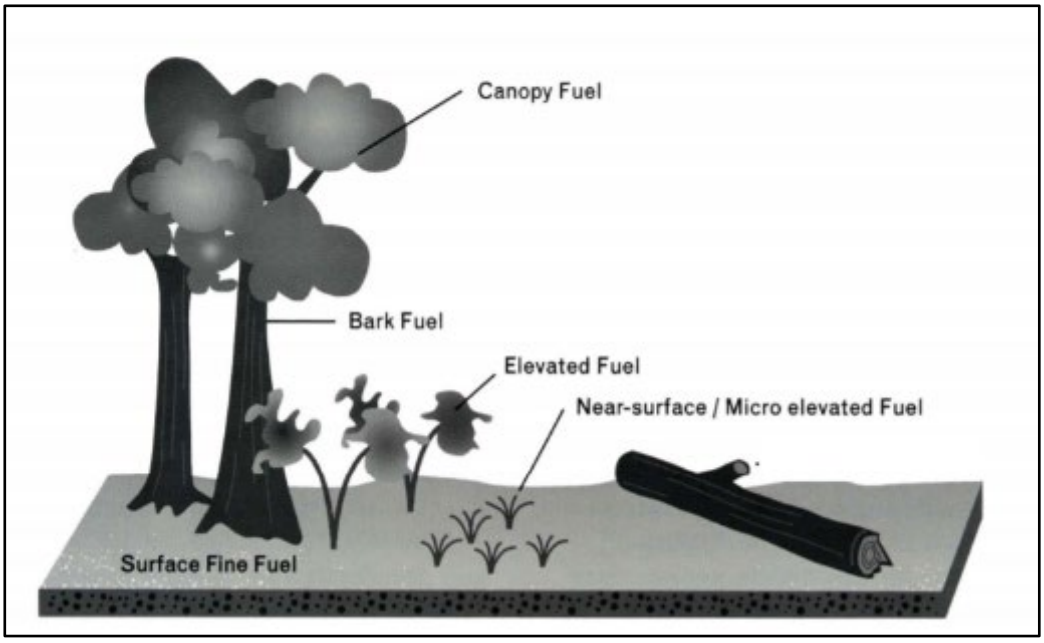

Figure 7 - Forest layers affecting bushfire behaviour

6.4.2 Fuel on the Site and surrounding area

The dominant vegetation on and surrounding the Site is agricultural grassland and crops. This fuel type is classified as fine fuel as outlined in the previous section. The bushfire risk is lower in this environment when compared to a forested environment where there is ample elevated bark or fuels that can generate extreme bushfire behaviour.

During the Site inspection, there was clear evidence of existing bushfire mitigation works in the surrounding area that are undertaken by Regional Roads Victoria, Corangamite Shire Council and adjoining landowners. These works will aid in reducing the bushfire risk in the local area and it is expected that they will continue to occur in the future. The majority of these mitigation works relate to roadside vegetation management.

The Site is currently utilised for farming activities. Along the perimeter of the Site, there are patches of trees that have been planted to provide protection for stock from the wind. Some of these patches are approximately 35 – 45 metres wide. Figure 7 shows the location of the various patches that are deemed to be relevant to bushfire risk, including other areas identified on adjoining land that may influence bushfire behaviour in close proximity to the Site.

Patches of vegetation in the landscape, depending on their overall structure, can influence bushfire behaviour. Tolhurst & Cheney (1999)[12] outline how fine fuels (<6mm in dimeter) contribute to the bulk of flames. For heavier fuels to ignite, they usually require fine fuels to be present.

The establishment of shelter belts or windbreaks in the landscape can result in the increase of fine fuels as described above. However, in most cases, either allowing stock to graze within the shelterbelt or actively managing the fine fuels under the tree canopy can mitigate this risk. The patches of vegetation that are on the Site (Patch A, C, D, E and F) are periodically used by stock which graze under the tree

[12] Tolhurst K.G. & Cheney N.P., 1999, *Synopsis of the Knowledge Used in Prescribed Burning in Victoria*, Department of Natural Resources and Environment.

canopy, therefore the fuel loads are currently low. The remaining patches (B, G and H) on adjoining land are away from the Site and would only have limited effect on a bushfire approaching the Site.

Figure 8 - Vegetation patches in relation to the Site boundary.

Reference	Approximate size	Perimeter	Distance to the Site
Patch A	0.27 Ha	274 metres	On the Site
Patch B	1.15 Ha	631 metres	19 metres
Patch C	1.27 Ha	715 metres	On the Site
Patch D	1.97 Ha	877 metres	On the Site
Patch E	0.78 Ha	444 metres	On the Site
Patch F	1 Ha	493 metres	On the Site
Patch G	1.88 Ha	920 metres	62 metres
Patch H	3.94 Ha	1,034 metres	95 metres

Tolhurst & Cheney (1999) state the need for an intense surface fire occurring to support a crown fire in eucalypt forests. As there is limited to no surface vegetation within the shelterbelts, it is highly unlikely for crown fires to occur.

AS3959:2018 is the Australian standard that outlines a risk assessment process to determine the appropriate level of construction for a building. It is noted that whilst this development is primarily not about constructing buildings, the standard is relevant to indicate the level of risk. The Standard allows

for all bushfire fuel present in Australia to be classified into one of seven fuel types. Fuel present within the Site can be classified as Class G Grassland under Table 2.3 of AS 3959:2018. While grass fires spread rapidly, they do not generate the level of ember attack or radiant heat that could be expected from fires in forested areas.

The existing shelterbelts and the areas of the Site perimeter that contain several existing trees do not meet the criteria outlined within AS 3959 – 2018 as being high risk vegetation. Figure 8 shows the shelterbelts along the western boundary of the Site. Whilst these patches are more than 20 metres in width, they are considered low risk vegetation due to the management of the ground fuel and the small size of the patches.

The Proposal outlines the creation of Vegetation Screens (see Figure 1) around the majority of the perimeter of the Site. The areas set aside for the Vegetation Screens will be no more than 20 metres wide. To allow for the canopy to not extend beyond the perimeter of the 20 metre width, the plantings will be set back 2.5m from the sides of the screen (see the 'Landscape Plan', Appendix C of the 'Landscape and Visual Impact Statement'). Within AS 3959, clause 2.2.3.3 (d) outlines what can be considered excluded vegetation:

> *Strips of vegetation less than 20 m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the Site or each other, or other areas of vegetation being classified vegetation.*

The Vegetation Screen will be developed with guiding principles to ensure the screen will, in combination with other mitigation methods, not increase fuel loads to the extent where overall bushfire risk is increased. Appendix D provides these principles and this topic is addressed further in Section 9 (Mitigation).

Figure 9 - Examples of shelter belt tree plantings on and surrounding the property

The management of ground fuels, in particular fine fuels along the ground is a key mitigation strategy for the Proposal both within the shelterbelts, the newly created Vegetation Screens, and across the entire Site. All on site patches noted above (A, C, D. E and F) and the new Vegetation Screens will be maintained to reduce fine fuels in accordance with the following principles (described in Appendix D):

- Removal of dead vegetation in the Vegetation Screens before the fire danger period.
- Maintenance of groundcover to 100mm or less in the Vegetation Screens during the fire danger period.
- Removal of branches within 2m of the ground.

To further reduce the risk, where these patches connect, a 5m gap between the canopies of the proposed Vegetation Screen and the existing shelterbelts will be maintained.

6.4.3 Peat fuel

Peat in Western Victoria is defined as a brown deposit resembling soil, formed by the partial decomposition of organic matter. It poses significant issues for fire suppression and can burn for many months after the initial main fire has been extinguished. Peat fires in Victoria normally occur when a Site containing peat is burnt during a bushfire event.

Ongoing issues with peat fire management include:

- Continued poor air quality in the area through smoke and fumes from the burning peat.
- An ongoing risk to firefighters of extended fire suppression operations.
- Loss of productive farming land due to the peat burning fertile soils away.
- Issues with water quality.

Extensive testing of the Site for peat deposits has been conducted by the Proponent. No peat soils have been found on site therefore the risk of a peat fire within the Site is negligible. It is acknowledged that there could be peat deposits surrounding the Site, in particular in low lying areas, however any Peat fire in the surrounding area would not impact directly on the Site, other than in the event that the smoke generated could affect staff and operations. The Peat Assessment is Appendix E to this report.

6.5 Weather

The main weather factors affecting fire behaviour are long-term climate trends and daily weather conditions such as temperature, relative humidity, wind speed and any wind direction changes.

The Site is subject to the same seasonal climate conditions as the rest of the Western District.

Data from the Bureau of Meteorology indicates this area is typical of south east Australia in that the months of January and February are traditionally very hot and dry. The area is also prone to cold winters and numerous frost events during June, July and August.

On high fire risk days, the combination of strong winds (generally north westerly winds preceding a cold front, followed by south westerly winds after the passage of a cold front), high temperatures and low humidity increase the likelihood of bushfires, resulting in high fire intensity and unpredictable fire behaviour.

Bushfires starting on days of Extreme or Code Red fire danger rating will be unpredictable and very difficult to contain.

The nearest active Bureau of Meteorology automatic weather station is at Mortlake, approximately 27 km to the west of the Site. The data sourced from this weather station indicates the potential for very high temperatures in the months of December, January, February and March. The data also indicates that on average, there are 31 days a year above 30° Celsius. There are nearly 11 days per year above 35° Celsius. It also demonstrates that high winds can be experienced in this area with the average maximum wind gust speed being 113 km/h.

Weather data observed from the Mortlake Weather Station is shown in Figure 8.

Statistic Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Mean maximum temperature (Degrees C) for years 1991 to 2020	26.3	26.4	24.1	20.1	16.3	13.5	13	13.9	15.8	18.3	20.9	23.7	19.4
Highest temperature (Degrees C) for years 1991 to 2020	44.9	46	41.1	36.9	27.9	23.2	19.1	23.4	27.9	35.8	38.3	44	46
Mean number of days >= 30 Degrees C for years 1991 to 2020	7.8	8.3	5.7	0.9	0	0	0	0	0	0.6	2.6	5.1	31
Mean number of days >= 35 Degrees C for years 1991 to 2020	4.2	3.2	1.2	0	0	0	0	0	0	0	0.4	1.7	10.7
Mean number of days >= 40 Degrees C for years 1991 to 2020	0.9	0.5	0.2	0	0	0	0	0	0	0	0	0.2	1.8
Mean minimum temperature (Degrees C) for years 1991 to 2020	10.9	11.6	10	7.9	6.7	4.9	4.6	4.8	5.6	6.4	8	9.3	7.6
Mean rainfall (mm) for years 1994 to 2020	32.9	33.1	31.5	44.2	56.9	52.3	63.6	66.2	56.7	49.8	48.2	40.2	576.4
Maximum wind gust speed (km/h) for years 2003 to 2020	91	89	93	102	80	87	100	106	113	93	102	98	113
Mean 9am temperature (Degrees C) for years 1991 to 2010	16.9	16.7	14.7	13.1	10.3	8	7.5	8.6	10.7	12.5	13.9	15.7	12.4
Mean 9am wind speed (km/h) for years 1991 to 2010	17.2	15.9	13.6	15.2	14.5	14.9	16.4	18.7	20.2	20.1	18.3	18.5	17
Mean 3pm temperature (Degrees C) for years 1991 to 2010	23.7	24.4	22	18.5	15.1	12.4	11.9	12.7	14.2	16.3	19.1	21.3	17.6
Mean 3pm wind speed (km/h) for years 1991 to 2010	22.7	21.7	21.3	20.1	19.6	20.9	21.8	23.8	24.1	22.9	21.9	22.6	22

Figure 10 - Historical weather conditions at Mortlake AWS (Source: Bureau of Meteorology)

6.6 Fire response considerations

6.6.1 Bushfire history

There are no recorded bushfires immediately adjacent to or surrounding (within 2km) the Site, however there may have been grassfires in the surrounding landscape that were not recorded on the government fire history database[13].

It is acknowledged that a grass fire on an elevated fire danger day could perform similarly to other major fires that have been recorded in the wider area.

Figure 9 outlines the available fire history in the area surrounding the Site.

[13] Sourced from MapShareVic: https://mapshare.vic.gov.au/MapShareVic/index.html?viewer=MapShareVic.PublicSite&locale=en-AU

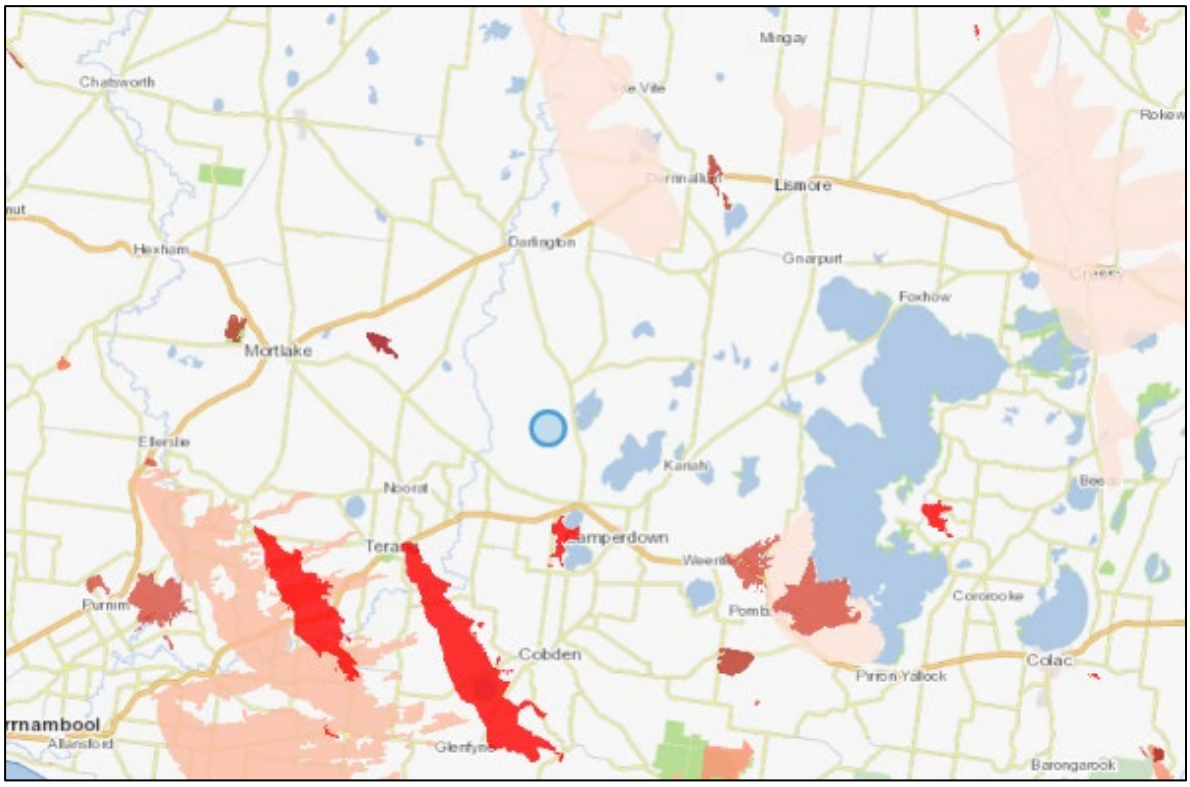

Figure 11 - Fire history surrounding the Proposal (approximate location indicated by blue circle). Previous fire runs and impacted area indicated by the different pink, red, and dark red shades.

6.6.2 Sources of ignition

For a fire to occur there must be an ignition source.

Bushfires can originate from both human activity and natural causes. Lightning is the predominant natural source of fire ignitions in Australia, accounting for about half of all ignitions.

Fires of human origin currently account for the remainder and these are classified as accidental or deliberate. Deliberately lit fires can be the result of arson or may be designed to achieve a financially beneficial outcome. Some farming practices use fire to manage vegetation recovery or control unwanted pest species.

The Otway District Strategic Fire Management Plan's analysis of ignitions in the district shows that anthropogenic ignitions (caused by humans) account for some 95% of all ignitions in the District and were correlated with locations of higher population density.

Given the low population density and fire history of the Bookaar area, the potential for fire ignitions in the area is extremely low.

Based on the analysis of previous fire history, stakeholder engagement and the author's experience, the following ignition sources are deemed possible:

1. Arson
2. Faulty machinery including farming vehicles and road vehicles
3. Lightning

6.6.3 CFA firefighting capability and capacity

CFA has an extensive network of fire stations containing firefighting appliances. Figure 10 shows the location of the nearest fire stations to the Site. Whilst the closest CFA fire station is at Bookaar, the response to any fire event at the Site or potentially threatening the Site will be from a number of CFA brigades.

CFA utilises a response model that ensures predetermined dispatch arrangements are in place to respond the closest firefighting appliances to any location. This allows for a rapid escalation and the dispatch of numerous firefighting appliances from different brigades without delay.

Bookaar Fire Station is approximately 3.5 km from the Site and is the closest fire station with a 'tanker' (bushfire firefighting appliance). Camperdown Fire Station, is approximately 10 km from the Site and is the closest fire station with a 'pumper' (urban firefighting appliance), however as noted above the CFA response may comprise of assets from other stations in the area.

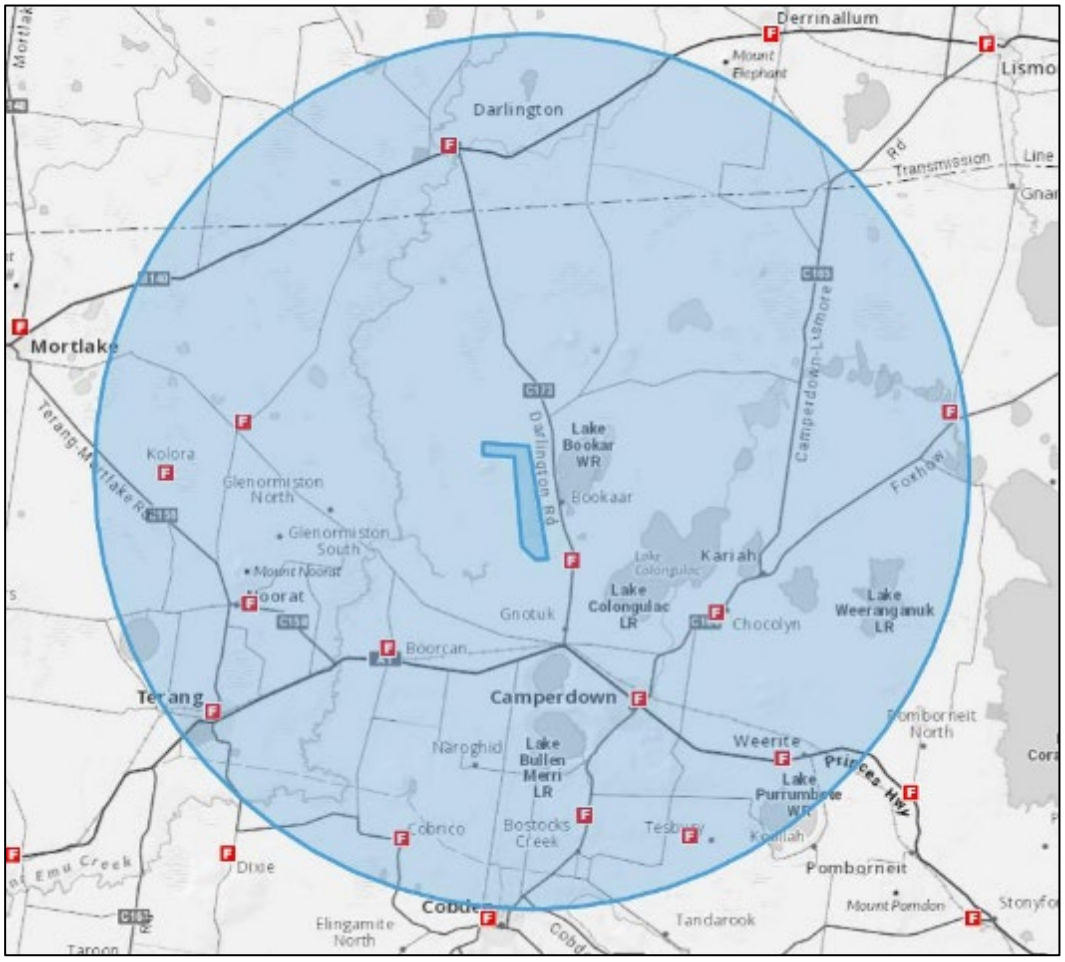

Figure 12 - Location of CFA fire stations within 20 km of the Site.

All brigades surrounding the Site are made up of volunteer firefighters. Response times to the Site will be governed by current fire activity in the district, volunteer availability and the condition of the road network, although a tanker responding from the Bookaar Fire Station could reach the Site quickly.

In support of fires involving solar energy facilities, CFA have published an Operations Bulletin and Safety First Alert (internal publications) that are relevant to fires involving solar panel fires. Both these documents provide guidance to their firefighters on the safety aspects of fires involving Solar Panels and suggest firefighting strategies to manage and extinguish these types of fires. The documents outline the risks associated with PV systems and provide recommendations to firefighters on how to manage these

risks. Although geared towards residential PV systems, the key message from these documents is to remind firefighters to assume the PV arrays and battery storage systems are electrically live, until otherwise advised.

As indicated in Section 7 and supported by the CFA internal publications, the importance of Site management regularly engaging with local CFA Brigades is acknowledged, and this requirement will be outlined within the Emergency Management Plan (see Section 9).

6.6.4 Site access and egress

An effective road and track network can:

- improve firefighter response times, which increases the likelihood of a fire being suppressed in minimal time and to a minimal area.
- improve firefighter safety, by providing a safer platform from which firefighters can prepare for and fight fires.
- provide greater protection for assets.
- improve the evacuation speed of an area, if required.

Site access and egress must take into account:

- Suitability for heavy (emergency) vehicles all year round.
- Access during periods of potential congestion.
- Ability for vehicles to turn around.
- Ability of heavy vehicles to access static water supplies.

The Proposal has been designed with the following considerations:

- Provision of suitable access and egress for emergency vehicles to and from the Site utilising different routes.
- Provision of suitable access and egress to the local road network, which is sufficient to allow a person to travel away from the bushfire threat on a planned route in the event of a fire.
- Provision of a suitable internal track network with prefabricated bridges and culverts over drain lines, including a perimeter track, that allows access throughout the Site on multiple access routes (see Figure 1).
- Maintenance of the internal track network will ensure it will always be suitable for emergency vehicle use.
- Location of the BESS in a ‘low risk’ environment as outlined within the CFA Guideline and adjacent to a Site vehicle entrance suitable for emergency service vehicles.

All roads surrounding the Site are suitable for access with CFA tankers, being either two-wheel drive (2WD) or four-wheel drive (4WD) units. Primary vehicular access to the Site will be via the northern part of Meningoort Road off Darlington Road (Darlington Road is a sealed road and is in good condition). As noted in the Proposal Description, to facilitate Site access the intersection of Meningoort Rd and Darlington Road will be upgraded with an additional turning lane and Meningoort Rd will be widened to 7m.

Meningoort Rd, via Blind Creek Rd to the south, also borders the Site to the west and south and will facilitate access during emergencies through the emergency access points along the Site’s western boundary (see Figure 1).

Figure 12 below shows emergency access and egress routes to the Proposal within the context of local CFA stations. The Main access points can also be utilised in an emergency and the figure demonstrates that the Site is well positioned to take advantage of different routes to and from the Proposal.

Figure 13 - Proposed access and egress routes from and to the Proposal (see Figure 1 for detail of access and egress points and the layout of the internal track network)

6.6.5 Firefighting water supply

The availability of water is critical to enable fires to be suppressed. Static water supplies that reduce the time taken for firefighters to travel to and from a fire is the best solution and enables efficient fire suppression.

There is an existing dam on the Site that will be filled in during the construction phase. In the area immediately surrounding the Site, there is no other water supply available for fire trucks to access. There are larger water bodies surrounding the Site that may be suitable for firefighting aircraft to draw water from.

As there is no suitable firefighting water supply on site, static water supplies will be provided. This is outlined in Section 9.

7 Fires in solar energy facilities and BESS research

7.1 Introduction

To support the assessment of risk associated with the proposed development, an analysis of previous fires in solar energy facilities and BESSs is important to inform the assessment of risk. Whilst the number of fire events is limited, they can provide an understanding of the risk from these types of developments and inform the risk assessment. This section is separated into Solar Energy Facility fires (Section 7.2) and BESS fires (Section 7.3).

7.2 Solar Energy Facility fires

As part of the assessment process, a review of literature relating to fires within Photovoltaic (PV) solar energy facilities has been undertaken. The review has considered the following topics:

- Examples of fires in solar energy facilities.
- The combustibility of major components.
- Ignition risks during construction and decommissioning.
- Risk to firefighters.
- The risk of fire spread within a Solar Energy Facility.

It should be noted that there is limited information regarding fires in solar energy facilities, and even less information relating to incidents within solar energy facilities in Australia. A comprehensive literature review by BRE (2017)[14] suggested that the reasons for this could be two-fold: firstly, the number of overall incidents *is* low; and secondly, there could be a number of unreported incidents.

This implies that any such unreported incidents are likely to have been controlled effectively, without resulting in significant damage to buildings, or harm to people. As media and social interest in this issue is high, it is considered that, in Australia, major incidents would result in the reporting of such events.

Where appropriate, media sources of fire events have been used along with information relating to the fire risk of Photovoltaic (PV) solar systems in general, to aid an understanding of fire risk within solar energy facilities.

Note, information on Concentrated Solar Power (CSP), which generates electricity by using mirrors or lenses to concentrate a large area of sunlight onto a receiver and is fundamentally different to PV Solar, has not been considered.

7.2.1 Examples of fires in PV solar energy facilities

A small number of fires involving PV solar energy facilities has been identified through the literature review. BRE (2017)[15] identified five examples of incidents not deemed to be serious in a UK based

[14] Building Research Establishment (BRE) National Solar Centre, 2017. *Fire and Solar PV System – Investigations and Evidence*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/630639/fire-solar-pv-systems-investigations-evidence.pdf. Accessed on 02 August 2020.

[15] *Ibid*.

review, and (relevant to this assessment), three more recent examples (a fire in a Queensland Solar Energy Facility[16] and two in California[17,18]) have been identified and are discussed below[19].

A key factor in the Queensland and Californian fires is that the fires were able to spread across the ground surface, and required firefighters to extinguish the fire. This indicates that there was sufficient vegetation remaining on the ground to support fire spread. The fire at Brigalow in Queensland, Australia and at Topaz Solar Energy Facility in California, USA are examples of where this occurred. In the Brigalow fire in Queensland, it was reported that damage had occurred to the Solar Panels. This could be an indicator that the vegetation under the panels was not maintained and was sufficient to generate enough radiant heat to ignite plastics and cabling associated with the panels (see 7.2 below). While the article on the Topaz Solar Energy Facility fire stated that the solar panels didn't burn[20]. This is a strong indicator that whilst the vegetation under the panels was sufficient to support fire spread, it was not sufficient to generate enough radiant heat to damage the underside of the panels or other infrastructure.

7.2.2 Lessons learnt from Solar Energy Facility fires

Despite the lack of case history in the public domain with regard to fires within solar energy facilities, it can be determined that:

1. The instance of fires in photovoltaic (PV) solar energy facilities is low overall.

2. A key issue is whether a fire has access to vegetation surrounding and underneath the panels. Vegetation that is left unmanaged could support fire spread along the underside of the solar panels.

Therefore, and with particular regard to the spread out and low-lying nature of PV solar energy facilities, it is clear that vegetation management is a key component in helping to reduce levels of fire risk within a Solar Energy Facility Site boundary. The treatment of vegetation in the context of the Proposal is discussed in Sections 8 and 9.

7.2.3 Combustibility of PV Solar Energy Facility components

The majority of a Solar Energy Facility by area is comprised of the arrays (the panels and their supporting tracking system, see Figure 1). The panels are considered to have a low level of combustibility[21] due to their high volume of glass (approximately 76% by weight)[22]. Indeed, as stated by the NC Clean Energy Technology Center:

> *…concern over solar fire hazards should be limited because only a small portion of materials in the panels are flammable, and those components cannot self-support a significant fire. Flammable components of PV panels include the thin layers of polymer encapsulates surrounding the PV cells,*

[16] https://reneweconomy.com.au/brigalow-solar-farm-caught-up-in-queensland-bush-fires-50604/
[17] https://www.bloomberg.com/news/articles/2019-06-19/-avian-incident-knocks-out-84-of-massive-california-solar-farm
[18] https://www.sanluisobispo.com/news/local/article39055539.html
[19] The examples provided do not necessarily constitute a full list, but were deemed to be most relevant to this assessment process.
[20] https://www.sanluisobispo.com/news/local/article39055539.html.
[21] TUV Rheinland Energie and Umwelt GmbH, 2015. Assessing fire risks in photovoltaic systems and developing safety concepts for risk minimization. Available at: https://www.energy.gov/Sites/prod/files/2018/10/f56/PV%20Fire%20Safety%20Fire%20Guideline_Translation_V04%2020180614_FINAL.pdf. Accessed on 02 August 2020.
[22] IRENA, 2016. *End of Life Management. Solar Photovoltaic Panels*. Available at: https://www.irena.org/DocumentDownloads/Publications/IRENA_IEAPVPS_End-of-Life_Solar_PV_Panels_2016.pdf. Accessed on 13 August 2020.

polymer backsheets (framed panels only), plastic junction boxes on rear of panel, and insulation on wiring. The rest of the panel is composed of non-flammable components, notably including one or two layers of protective glass that make up over three quarters of the panel's weight[23].

Provided that there is a limited heat source under the panel (which can be achieved through vegetation management), their low combustibility means that fires at a Solar Energy Facility are not likely to be supported by fuels associated with the Panels themselves.

Supporting the Solar Panels is the tracking system which is typically comprised of galvanized steel (NexTracker, 2020[24]) and therefore has very low combustibility. The tracking system is in turn supported on galvanized steel piles which are driven into the ground.

Cables within the array area may be exposed to flame contact if a fire were to spread within the Solar Energy Facility beneath the panels, again emphasising the importance of vegetation management. Due to this risk, it is recommended that the design should consider the following features:

- Cables should be installed underground where practical; and/or
- Above ground cables and circuitry should be installed as high as practicable.

The design of the Proposal includes DC wiring between panels that runs along the tracker at panel height. Wiring between individual trackers, from the trackers to the Inverters, and from the Inverters to the substation is designed to be installed underground. These measures significantly reduce fire risk associated with cabling.

It is noted that 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'.

The Inverters and substation components are critical electrical infrastructure that support the operation of a Solar Energy Facility which must comply with the relevant Australian Standards. Design consideration should be given to worker and firefighter safety through sufficient access and egress and by ensuring that each component can be isolated both electrically and physically (considered in Section 8). To support the safety of Solar Energy Facility Workers, all buildings will be constructed to comply with the National Construction Code. The Operation Buildings Area is discussed in more detail in Section 8.2.

The inverters and substation infrastructure may contain dangerous goods and an assessment of the relevant safety data sheets must be undertaken to ensure the relevant DG legislation requirements are being implemented and maintained (Appendix G).

7.2.4 Ignition sources during construction

Activities associated with construction that may cause or increase the risk of fire include[25]:

- Smoking and careless disposal of cigarettes on site.
- Hot works activities such as welding, soldering, grinding and use of a blow torch.

[23] NC Clean Energy Technology Center, 2017. *Health and Safety Impacts of Solar Photovoltaics*, NC State University. Available at: https://s3.amazonaws.com/ncsolarcen-prod/wp-content/uploads/2017/10/Health-and-Safety-Impacts-of-Solar-Photovoltaics-2017_white-paper-1.pdf. Accessed on 02 August 2020.
[24] Nextracker, 2020. Gemini Data Sheet. Available at: https://cdn2.hubspot.net/hubfs/1856748/Datasheets%202020/nxt_nx_gemini_datasheet.pdf. Accessed on 13 August 2020.
[25] See the web article '*Fire Safety on Construction Sites*' which provides an overview of the types of activities that could cause fires on construction Sites. Available at: https://backtobasics.edu.au/2020/02/fire-safety-on-construction-Sites/. Accessed on 13 August 2020.

- Use of petrol-powered tools.
- Operating a petrol, LPG or diesel-powered motor vehicle over land containing combustible material.
- Operating plant fitted with power hydraulics on land containing combustible material.
- Electrical faults during testing and commissioning.
- Unsafe storage of chemicals or hazardous materials.

These risks should be mitigated appropriately through the implementation of management strategies during construction and are discussed in Section 9.

7.2.5 Ignition sources during operation

As PV solar energy facilities are electrical in nature there is inherent fire risk from electrical faults. The majority of research identifies electrical faults as the key cause of fires involving Solar Panels[26,27,28]. This could occur in solar energy facilities through short circuits and arc faults caused by:

- 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.
- Miss match of inter module connectors causing insufficient electrical connections.

The issues listed above can be the result of incorrect installation and should be diagnosed during the DC testing phases of the installation, or during ongoing operational maintenance and testing.

It is conceivable that arc faults could melt components in wiring within or adjacent to the panels, and if conditions were suitable, ignite grass fuels under or surrounding installations. As noted, this is unlikely if active vegetation management is in place.

The use of remote sensing systems through the SCADA system would reduce this risk further and enable a quick response to fire ignitions, with the intention of preventing the instance of fire ignitions leading to an uncontrolled fire. Whilst these systems are not specifically for the purpose of detecting fires, they do detect rises in temperature and automatically notify the appropriate personnel.

7.2.6 Risks to firefighters

Specific risks to firefighters from a fire in a Solar Energy Facility involve:

- Inhalation of potentially toxic fumes and smoke from burning plastic components, such as cables and polymers within the panel[29].
- Electrocution - solar panels would be energised under any natural or artificial light conditions[30] (the risk of electrocution can be exacerbated by the use of water in firefighting).

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[26] TUV Rheinland Energie and Umwelt GmbH, 2015. *Assessing fire risks in photovoltaic systems and developing safety concepts for risk minimization*. Available at: https://www.energy.gov/Sites/prod/files/2018/10/f56/PV%20Fire%20Safety%20Fire%20Guideline_Translation_V04%2020180614_FINAL.pdf. Accessed on 02 August 2020.
[27] Allianz Risk Consulting. (2012). Understanding the Fire Hazards of Photovoltaic Systems. Allianz Global Corporate & Specialty.
[28] Sipe. J. (2016) Development of Fire Mitigation Solutions for Photovoltaic (PV) Systems Installed on Building Roofs, NFPA (2016).
[29] Allianz Risk Consulting. (2012). Understanding the Fire Hazards of Photovoltaic Systems. Allianz Global Corporate & Specialty.
[30] Backstrom, R., & Dini, D. (2011). Firefighter safety and photovoltaic installations research project. Underwriters Laboratories Inc.

The burning of plastic components, such as cables and polymers within the panels will produce hazardous gasses and therefore may require breathing apparatus. However, as noted the volume of these materials within the panels is low (approximately 10% of the overall panel weight[31]), and provided that vegetation is maintained effectively, a grass fire within the array area is unlikely to support a fire involving the panels themselves, which are raised above the ground.

Measurement of smoke gas concentrations from burning PV panels found that the thresholds for CO and CO_2 were significantly exceeded, whereas other products were not present in quantities that require attention[32]. While CO and CO_2 are present in smoke generated from burning PV panels, this would be unlikely to create issues for firefighters who will have the ability to approach the fire from multiple directions (see Figure 1), thereby avoiding the smoke plume. For people further away from the fire, the mixing effect enabled by the local wind conditions will likely reduce the concentration levels below what is considered safe levels.

In relation to the potential for electrocution, the general advice given to firefighters for large solar energy facilities is to treat them the same as any other power generation facility[33]. For these types of facilities, first responders should create robust pre-plans in conjunction with Site management and not enter secured high voltage areas (inclusive of the array areas), without clear guidance from the power generation plant operators.

In summary, acknowledging that a fire within a solar facility may present unique risks for fire fighters, it is critical for the Site operators to work with the local Fire Service to ensure that local firefighters are aware of the risks at solar energy facilities in general and of any particular Site specific risks. During Site familiarisation activities, firefighters should be made aware of the importance of not accessing the Site until they can be escorted or until the risk has been fully assessed.

7.2.7 The risk of fire spreading

The spread of fire in or out of a Solar Energy Facility directly relates to the fire behaviour factors: fuel, weather and topography on the Site and on neighbouring properties. These factors are discussed in relation to the Site through Section 6, and then through the assessment at Section 8.

While topography and weather are consistent across a landscape, management of a Solar Energy Facility provides an opportunity to reduce fuel on the Site and lower the intensity of a potential fire. Professor Blakers, director of ANU's center for sustainable energy systems noted that:

'*Where the grass is managed in the Solar Energy Facility, so that it had less grass than surrounding areas, but enough to avoid dust obscuring the sunlight, solar energy facilities lowered the chance of fire spreading'*[34].

With reduced fuel, fires are less likely to ignite within the installation and, any fires that do ignite would burn more slowly, taking longer to reach lower maximum intensities. Therefore, increasing the opportunity for successful fire suppression through the provision of static water supplies, a well-designed internal track network, and ongoing vegetation management will reduce the potential for spread within the property or into neighbouring properties. The idea described above, that a well-

[31] IRENA, 2016. *End of Life Management. Solar Photovoltaic Panels*. Available at: https://www.irena.org/DocumentDownloads/Publications/IRENA_IEAPVPS_End-of-Life_Solar_PV_Panels_2016.pdf. Accessed on 13 August 2020.

[32] TUV Rheinland Energie and Umwelt GmbH, 2015. Assessing fire risks in photovoltaic systems and developing safety concepts for risk minimization.

[33] SFPE (2014). https://www.sfpe.org/page/2014_Q3_4/Harnessing-the-Sun-Solar-Power-and-Fire-Protection-Engineering.htm

[34] https://www.canberratimes.com.au/story/6152076/solar-farms-will-cut-bushfire-risk/

managed Solar Energy Facility may actually reduce fire risk at the Site and in the surrounding area is consistent with the conclusions of the assessment of the Proposal (Section 8).

7.2.8 Summary

The occurrence of fires within solar energy facilities is low. This is demonstrated in part by the lack of material discussing solar energy facility fires, and that potentially unreported incidents are likely to have had effectively managed outcomes if they were not reported.

The research outlines that there are a number of management actions that can be taken during the design, construction and operation of a solar energy facility to mitigate bushfire risk and fire risk generally. In the context of the Proposal, the key opportunity to limit the potential for fires to spread is through the management of ground fuels, in particular under the Solar Panels. Other management actions discussed in the following sections compliment this action, and result in an overall reduction in the level of fuel at the Site.

Firefighting strategies should include the importance of engaging with the on site staff (and contractors if applicable) prior to undertaking any suppression efforts to ensure the system is isolated, and the risk of electrocution is clearly understood. It is the authors experience that this is consistent with how fire agencies manage other power generation sites regardless of the size. Site management should support the development of Pre Plans when requested.

The research has identified that solar energy facilities, when appropriately managed, can be considered low risk. In the event of a fire, there are numerous risks and challenges expected, however, with appropriate mitigation actions (discussed in Section 9), this risk can be effectively managed.

7.3 BESS fires

As part of the assessment process, a review of literature relating to fires within a BESS has been undertaken. The review has considered the following topics:

- Examples of fires in a BESS.
- Emergency risks during construction and decommissioning.
- Risk to firefighters.

There is limited information available regarding fires involving BESSs. This is consistent with the availability of information relating to solar energy facilities. As BESSs are relatively new to the renewable energy space, a range of reasons could explain the limited information including lack of fire events and that fires are largely unreported. Due to the complexities involved with a fire involving a BESS, it is highly likely that the fire brigade would be called to make the scene safe if a fire had occurred.

7.3.1 Examples of fires in a BESS

Whilst there is a range of newspaper reports that indicates fires involving Electrical Energy Storage Systems, there is a lack of reliable information that has been made available that can be used to inform a risk assessment. There are two fires that have been analysed with publicly available information that can be utilised to inform a risk assessment that explores the fire risk associated with this technology.

The first fire occurred on 19 April 2019 at a BESS that was in Arizona, USA[35]. The BESS had been in operation for approximately two years prior to the fire event. The fire and the circumstances leading up to the event was investigated by the Arizona Public Service who owned and operated the facility. The fire in Arizona was significant in that an explosion occurred, and several firefighters were injured.

The second fire occurred on 30 July 2021 at the Victorian Big Battery (VBB) near Geelong, Australia. The VBB is a development that consists of 212 Tesla Megapacks and is considered one of the largest battery installations in the world. There were no injuries resulting from this event with the outcome of the investigation determining that the Megapack failed safely as per its design arrangements. The reports also identified that a key contributory factor was that the SCADA system took 24 hours to map to the control system and provide full data functionality and oversight to operators. This resulted in a lack of monitoring capability by Tesla and Site operators during this period. The fire was investigated by multiple parties including Neoen[36] who are the owners and operators of the VBB, Energy Safe Victoria (ESV)[37] and other government agencies. The two reports that have been published publicly have been considered through this assessment.

Both fires were influenced by a lithium-ion battery phenomenon called thermal runaway[38]. This can be caused by mechanical damage, an electrical fault or a manufacturing fault in the battery. Thermal runaway is triggered by a rise in temperature which exceeds the battery's ability to cool down. This can lead to the generation of flammable gases and smoke. If the gases are exposed to elevated temperatures or an ignition source, it can ignite.

The lessons learnt from these fires in the context of fire risk management and the management of an emergency include:

1. Effective pre incident planning including the development of an Emergency Management Plan and relevant Response Plans is critical in ensuring that the Site operators are aware of the appropriate procedures to follow during an emergency.

2. Understanding the importance of making available subject matter experts (SMEs) during an emergency to engage with the first responders.

3. In response to the VBB fire, Tesla have introduced a range of mitigations aimed at ensuring the Megapack monitoring system is connected to the SCADA system in one hour and not isolated during the commissioning and operations phase.

4. In both fires, the failure of the systems caused thermal runaway of the lithium-ion battery. Tesla have introduced changes to the Megapack monitoring system to ensure that the battery cannot be isolated during the construction and commissioning phase.

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[35] https://www.aps.com/-/media/APS/APSCOM-PDFs/About/Our-Company/Newsroom/McMickenFinalTechnicalReport.ashx?la=en&hash=50335FB5098D9858BFD276C40FA54FCE

[36] https://victorianbigbattery.com.au/wp-content/uploads/2022/01/VBB-Fire-Independent-Report-of-Technical-Findings.pdf

[37] https://esv.vic.gov.au/wp-content/uploads/2021/09/VBB_StatementOfFindings_FINAL_28Sep2021.pdf

[38] https://ul.org/research/electrochemical-safety/getting-started-electrochemical-safety/what-thermal-runaway

5. In relation to the Arizona fire, the emergency response plan did not have procedures that addressed fire extinguishment, ventilation of the battery enclosure and entry procedure.

7.3.2 Emergency risk during construction

The VBB fire in 2021 occurred during the commissioning phase of the project. The reports commissioned by Neoen and ESV were consistent with the cause of the fire and more importantly, the additional mitigation measures that should be included into future Tesla Megapack designs. These additional mitigation measures include:

1. Updated commissioning procedures including firmware changes to ensure that Tesla can maintain the ability to monitor the Megapack during the commissioning phase.

2. Increased testing requirements prior to the Megapack being put into service including ensuring the cooling system is fully functional and pressure tested followed by a physical inspection.

3. Changes to the key lock system to ensure the telemetry system is operational.

4. Introduction of a hardware mitigation that protects the overpressure vents from direct flame impingement or hot gas intrusion.

These changes have been implemented into the Tesla Megapack which is the same system that will be installed at this development.

7.3.3 Emergency risk during operations

The fire in Arizona occurred during the operations phase of the project. The BESS had been commissioned approximately two year's prior to the fire occurring and had operated safely during that period of time. There is some disagreement about the cause of the fire[39], in particular United Laboratories (UL) indicated that there were three reports with two causes. Regardless of this, the proposed mitigation treatments were consistent with the UL[40] focus being on the development of greater firefighter understanding of BESSs and how to respond effectively and safely. This is outlined further in Section 7.4.4.

Tesla have developed and provide on their Website the *Lithium-Ion Battery Emergency Response Guide*[41] (Tesla Guide, Appendix B). The Tesla Guide outlines the hazards associated with:

1. High voltage

2. Mechanical damage

3. Elevated temperature exposure

4. Leaked coolant

[39] https://collateral-library-production.s3.amazonaws.com/uploads/asset_file/attachment/31719/UL_Response_to_DNVGL_APS_Report.pdf

[40] https://fsri.org/Sites/default/files/2021-07/Four_Firefighters_Injured_In_Lithium_Ion_Battery_ESS_Explosion_Arizona_0.pdf

[41] https://www.tesla.com/Sites/default/files/downloads/Lithium-Ion_Battery_Emergency_Response_Guide_en.pdf

5. Leaked refrigerant
6. Leaked electrolyte
7. Vented electrolyte

The above hazards are deemed to be low risk by the Tesla Guide and with the various monitoring systems and other controls including heat sensors and current variation monitoring, the potential for an emergency to occur including either a fire or hazardous leak is considered a very low risk. The Tesla Guide indicates that cases of emergency include but are not limited to:

1. Suspicious odor observed.
2. Smoke or fire emanating.
3. Severe physical impact.

If any of the above are noticed or experienced, the Tesla Guide outlines the response procedures that should be implemented to manage the event (expanded on below).

7.3.4 Risk to firefighters

UL undertook a detailed investigation into the injuries sustained by four firefighters during the BESS fire in Arizona in 2019. As a result of an explosion, caused by the door to the BESS being opened, four firefighters sustained serious injuries with some of them requiring long term hospitalisation. The investigations identified arrange of contributing factors that mainly related to a lack of understanding of BESSs and the required response procedures to be followed.

The UL report outlined a number of recommendations that are focused on ensuring firefighters are informed and have access to additional information to inform their operational strategies and tactics. The impact on this development is the importance of developing an Emergency Management Plan that aligns with the Tesla Guide and is related to the local firefighting arrangements.

The Tesla Guide outlines clear procedures for various hazards and includes the firefighting measures that should be considered. These are:

1. If possible, shut off the unit/system
2. Evacuate the area
3. Contact Tesla Energy Technical Support
4. Maintain a safe distance from the unit and monitor
5. If a fire has not developed and only smoke is visible, take a defensive stance toward the system and be prepared to apply water spray to neighbouring exposures and neighbouring battery enclosures.
6. If a fire develops:
    a. Continue to take a defensive stance toward the burning unit
    b. If advised by Tesla, apply water to neighbouring battery enclosures.
    c. At the discretion of first responders, apply water to other neighbouring exposures.

7. Allow the battery pack to cool down.

7.3.5 Summary

The occurrence of fires within BESSs is considered low. There is a lack of material available that outlines the performance of these systems when impacted by fire. It can be assumed that as the number of BESSs increases the occurrence of fires will likely increase.

Whilst the information is limited, the two examples have enabled consideration of the impacts of fire during the construction and operations phases. Both fire events were investigated by independent organisations and the reports have been made available publicly.

The Tesla Guide is consistent with the learnings from the fire events. The Tesla Guide clearly outlines the required procedures to be followed in the event of a fire event involving a Megapack. Firefighting measures are outlined within the Tesla Guide (summarised above), which are aimed at informing responding firefighters of the safest and most efficient method to make the situation safe.

The research has identified that BESSs, when appropriately managed and maintained, can be considered low risk. In the event of a fire, there are numerous risks and challenges expected, however, with appropriate mitigation and response actions (discussed in Section 9), this risk can be effectively managed.

8 Fire risk assessment

As detailed in Section 4, to effectively assess the fire risk associated with the proposal, this report is structured to assess risk using the following frameworks:

- Risk assessment that meets the requirements outlined within section 5 of the CFA Guidelines.
- Clause 13.02 – Bushfire Planning – Corangamite Planning Scheme.
- Assessment against the requirements of the CFA Guideline.

The risk assessment collates and evaluates information from all aspects of the development, including bushfire risk from the surrounding environment and risk of fire from elements within the Site resulting in a complete set of recommendations that may be required to reduce risk to an acceptable level.

The outcomes of these assessments are utilised to develop mitigation recommendations for the design, construction and operational phases of the Proposal. These are outlined in Section 9.

8.1 Fire Risk Assessment

The following risk assessment considers the potential impact of the Proposal on the workers based at the Site, neighbours and farm workers in the surrounding areas. This report seeks to follow the steps outlined within AS ISO 31000-2018: Risk Management – Guidelines along with the process outlined within NERAG. The outcome of this assessment is a detailed understanding of hazards, the likelihood and consequence of a hazard becoming an emergency, and the treatments identified to manage this risk.

8.1.1 Context

The assessment of fire risk is a key requirement imposed on the development by CFA through the Planning Permit and the CFA Guideline. The CFA Guideline outlines the types of hazards that may need to be considered in relation to Solar Energy Facility and BESS infrastructure at the design, construction and operation phases.

8.1.2 Analysis of fire risk

Solar Energy Facility and BESS infrastructure is largely acknowledged as having limited potential to cause fires and is considered reasonably safe. There have been fires previously and these have been considered during the assessment of risk outlined within this report. It is important the assessment of risk considers the various stages of the project including construction and the operation phases.

Assessment of fire risk during construction

The construction phase consists of various stages including Site works, construction of footings and the installation of the Solar Energy Facility (including tracking infrastructure, PV panels, inverters, cabling, maintenance buildings and the substation) and the BESS. Construction also includes the commissioning of the technology and other systems including fire protection systems.

Assessment of fire risk during operations

The operations phase follows the commissioning stage of the project. The role of maintenance becomes critical to ensure that the system operates as it was designed, for the life of the development. The ongoing maintenance of the infrastructure and Site is critical to ensure the ongoing management of fire risk.

All system components are considered critical as they all contribute to the ongoing safe operations. The fire mitigation systems include monitoring connectivity, fire protection systems, vegetation management, Site access controls and other safety systems.

8.1.3 Risk identification

Through discussions with the client, reference to the CFA Guideline, review of various documentation and the consideration of previous fire history that involved solar energy facilities and BESS infrastructure, the following hazards have been identified:

Table 14 - Hazard identification and description

Hazard	Description
Electrical hazards causing a fire	Electrical faults and/or hazards can be a key cause of fire in the Solar Energy Facility and BESS infrastructure. BESS hazards including battery faults, overcharging, rapid discharge, loss of remote monitoring systems, internal short circuits and overheating. Solar Panel hazards include faulty wiring and connections. An outcome of these faults can include 'thermal runaway'.
Fire causing spread to adjoining infrastructure on the property	A fire that has started in the development may spread to adjoining infrastructure or surrounding areas within the facility. Rapid escalation of the fire size and complexity can create issues for on site staff and contractors, firefighters and the community.
Fire causing off-Site impacts	Any fire on the property that can spread to adjoining properties most likely through vegetation connectivity, on bushfire risk days can start fires in the surrounding landscape that can threaten the community.
Off-Site fire impacting on the Site	A bushfire burning through the surrounding landscape can enter the property and threaten the infrastructure by potentially starting new fires.
Dangerous goods	The dangerous goods that are stored within the BESS, substation and inverters may leak and either ignite or require clean up by either on site staff, contractors or firefighters.
Fire water runoff	In the event of a fire involving the BESS, firefighters will respond and use water to either extinguish or cool the surrounding area until the infrastructure is deemed safe. The fire water may be contaminated and if not contained may create environmental issues.
Staff and firefighters	The response to a fire by staff, contractors or firefighters can be dangerous due to the various safety hazards associated with a fire in this type of infrastructure.

The above list may not be exhaustive however following discussions with the client, assessment of the project against the CFA Guideline and review of various documentation, it is considered that the critical hazards that are likely to create the greatest risk have been assessed.

8.1.4 Risk analysis

The analysis of risk requires the consideration of the likelihood and consequence of an event occurring and measuring this against a predetermined matrix to enable the consideration of each risk both individually and collectively. For this assessment, a 3 x 3 matrix has been utilised that enables the effective consideration of risk.

Likelihood

An assessment of the likelihood of a fire occurring at this development including the potential to impact on people and other infrastructure/property is a key part of the risk assessment. The following will be considered during the assessment of an event occurring:

- Potential for an unplanned fire to occur
- Potential for this ignition to develop and exhibit significant fire behaviour
- Potential for that fire to destroy assets
- Potential for people to be affected or threatened
- The potential for it to develop into a major fire.

Recommendations for mitigation actions in the area may be determined by several approaches depending on the level of assessed risk. Strategies to lower risk are provided to ensure the risk is managed to an acceptable level.

An assessment of likelihood considers factors such as:

- Sources of ignition
- Use of the property and/or surrounding area
- History of ignitions within similar infrastructure
- Ability to spread from the property.

Table 3 - Likelihood table

Likelihood scale frequency	Description
Very Likely	Almost certain and will definitely occur, and /or high level of recorded incidents, or there is a strong likelihood that the event will occur.
Likely	High probability it may occur; and/or some recorded incidents.
Unlikely	It is not expected to occur, but it is not impossible.

Consequence

Consequence refers to the potential damage that could result from a fire occurring in relation to people and assets. In assessing the possible consequences, the assessment considers a variety of hazard, exposure and vulnerability factors including:

- The likely number of people at the facility

- The proximity of other assets
- The location of surrounding properties and the type of activities
- Response capability if an event occurred.

The consequence scale refers to the potential impacts which could occur should a fire occur.

Table 4 - Risk assessment consequence table

Consequence scale	Description
Major	• Significant consequences that may include long term closure of the Site, major damage or effect. • Loss of life and/or significant injuries that cause disability. • Major off-Site impacts causing destruction of other assets or life loss.
Moderate	• Moderate loss of property with the facility operating again in the short term. • Medical treatment may be required but no fatalities or long term affects. • Localised damage that can be rectified. • Some environmental impact with short to long-term effects.
Minor	• Minor or negligible consequences or effects. • Isolated damage to property with no ongoing impact on operations. • First aid injuries with no hospitalisations required. • Impact on the environment with short term effects.

The risk rating table is used to combine likelihood and consequence to obtain a risk score. The risk score is used to aid decision making by determining which areas are at the greatest risk of a fire starting and spreading through the estate. Actions can be prioritised using this method to determine where risk mitigation works will occur.

Table 5 - Risk rating table

RISK RATING TABLE			
	CONSEQUENCE		
	Minor	**Moderate**	**Major**
LIKELIHOOD	Minor or negligible consequences or effects. Isolated damage to property with no ongoing impact on operations. First aid injuries with no hospitalisations required. Impact on the environment with short term effects.	Moderate loss of property with the facility operating again in the short term. Medical treatment may be required but no fatalities or long term affects. Localised damage that can be rectified. Some environmental impact with short to long-term effects.	Significant consequences that may include long term closure of the Site, major damage or effect. Loss of life and/or significant injuries that cause disability. Major off-Site impacts causing destruction of other assets or life loss.
Very Likely: Almost certain and will definitely occur, and /or high level of recorded incidents, or there is a strong likelihood that the event will occur.	Medium	Very High	Extreme
Likely: High probability it may occur; and/or some recorded incidents.	Medium	High	Very High
Unlikely: It is not expected to occur, but it is not impossible.	Low	Medium	High

The outcomes of the risk assessment are used to inform the recommendations. These are aimed at providing guidance to management to reduce the fire risk at the property.

Risk analysis worksheets

The following worksheets assesses the hazards identified in section 8.1.3 and results in a risk classification along with strategies to lower risk if it is deemed required.

Table 6 - Risk assessment - Electrical hazards causing a fire

RISK	Electrical hazards causing a fire
CAUSE	**Solar Energy Facility** Electrical faults and/or hazards can be a key cause of fire in solar energy facilities. Hazards include panel/inverter electrical faults, power surges, water ingress and loss of remote monitoring system. There is the potential for limited emergency response due to the proximity of panel banks to each other, on site infrastructure and vegetation. **BESS** Electrical faults and/or hazards at a BESS can cause fires. The hazards include battery faults, overcharging, rapid discharge, internal short circuits and mechanical damage that may cause thermal runaway.
LIKELIHOOD	**Likely**
JUSTIFICATION	**Solar Energy Facility** Solar energy facilities have experienced fire events which are usually due to faulty wiring or connections as is identified in Section 7.2. To reduce the likelihood of electrical faults resulting in a fire in the Solar Energy Facility, (including the solar panels, connections, substation and inverters) the following will be applied: • Quality components will be selected for the Proposal • During construction and maintenance of the facilities, equipment will be installed in accordance with the manufacturer's specifications and relevant Australian Standards. **BESS** There are examples of fires within BESS technology that indicates that when faults occur they can escalate into challenging events including thermal runaway (Section 7.3). To offset the likelihood of a fault within the BESS that creates a flammable atmosphere in and around the BESS, escalates to a fire, or a fire that affects adjacent infrastructure, the following mitigation treatments are included: The design of the Tesla Megapacks includes: • Cooling systems that maintain the temperature of the battery packs during day-to-day operations. • Safety systems that send alerts to the monitoring centre if a sensor is activated. • Barriers between each of the 6 battery module bays within each BESS designed to reduce the possibility of thermal runaway from spreading to adjoining battery units. • Separation distances between individual Megapacks and other infrastructure in accordance with manufacture installation guidelines. • The BESS will be installed by qualified and competent people in accordance with the manufacturer's specifications to relevant Australian Standards, and including compliance with UL9540A – Energy Storage System Requirements.

	Refer to Appendix B, the 'Tesla Guide' which provides further detail of internal fire mitigation and safety features of the proposed BESS.
CONSEQUENCE	**Moderate**
JUSTIFICATION	**Solar Energy Facility** The consequence of an electrical hazard causing a fire in the Solar Energy Facility has been identified as moderate and has been identified as the main cause of fires in solar energy facilities. **BESS** The consequence of an electrical hazard causing a fire in the BESS has been identified as moderate and there are examples of this occurring (Section 7.3).
RISK RATING	**High**

STRATEGY TO LOWER RISK	**Solar Energy Facility**
	
	To reduce the identified risk of electrical faults causing fires various design treatments will be applied in line with the CFA Guideline including:
	
	• Adequate separation between infrastructure across the development to limit the risk of fire crossing between different areas of the Solar Energy Facility.
	
	• The solar farm will be compartmentalised into separate areas supported by a network of APZs including APZs protecting:
	
	  ○ The substation area.
	
	  ○ The operations buildings.
	
	  ○ Groups of arrays (separated into 13 distinct areas).
	
	  ○ The BESS.
	
	  ○ The Proposal as a whole.
	
	• The provision of access into and around the Solar Energy Facility complies with the requirements outlined within the CFA Guideline (refer to Appendix C).
	
	  ○ 8 access/egress points
	
	• The Solar Energy Facility provides separation between the panel banks of at least six metres.
	
	• Static water supplies are provided through the development in excess of the CFA Guideline requirements (total of eight x 100,000 litre water tanks) located adjacent to each emergency access points. The design of each water tank is in accordance with the CFA Guidelines. (See Appendix C).
	
	• All inverters can be accessed by the internal access tracks in the case of fires. Inverters are located on hardstands that can be accessed by the internal access tracks.
	
	Several operational protocols will be enacted to further reduce the risk of Electrical hazards causing a fire. These include:

- During the fire danger period, all ground cover vegetation across the Site will be maintained at 100mm or less at all times.
- Maintenance programs will be enacted to ensure all infrastructure within the Solar Energy Facility is maintained in accordance with the manufacturer's specifications and the relevant Australian Standards.
- The use of a SCADA system to monitor all system alerts and sensors that indicate the early stages of a fault or emergency event and provides the ability to commence shut down procedures remotely from the Site.
- Solar Energy Facility staff (and contractors where applicable) will complete bushfire behaviour and suppression training including dealing with electrical hazards.
- A Site induction outlining fire related risks and providing an overview of the emergency management plan to new staff, visitors and contractors.
- Local CFA Brigades to be invited to undertake an annual inspection to become familiar with access and egress to the Site and the emergency procedures.
- A Fire Management Plan (Appendix A) which outlines risk control measures required to be implemented within the development.
- The development of an Emergency Management Plan in consultation with the CFA before development starts and includes (in addition to the CFA Guidelines):
    - A system to communicate effectively between the monitoring centre and the on site staff and contractors.
    - Provision of 24/7 contact details for the fire brigade to contact in the event of an emergency or threat of an emergency.

BESS

To reduce the identified risk of electrical faults causing fires at the BESS various design treatments will be implemented in accordance with the CFA Guideline including:

- Multi-spectrum IR heat or flame detectors will be installed externally to the Megapacks and monitored locally through a Fire Indicator Panel.
- Emergency service access is provided that complies with the requirements of the CFA Guideline in and around the BESS area.
- Bollards will be installed around the BESS area to prevent mechanical damage occurring from vehicles or other machinery causing damage to the Megapacks.
- Each pair of Megapacks is placed on a concrete hardstand that sits above the fire water runoff level which will prevent water penetration.
- Megapacks will be installed on a non-combustible surface (concrete finished surface) that will prevent fire spreading along the ground.
- The battery area is surrounded by a 10m wide APZ.

	• A firefighting water supply of 450,000 litres is provided in three tanks to enable firefighters to deliver water at the BESS area in line with the CFA and Tesla Guidelines and includes:
	  ○ A fire water runoff management system designed so that fire water used at the BESS can be contained on site. The battery area is provided with fire water runoff provisions that will enable the collection of up to 450,000 litres of fire water runoff using a combination of the 150,000 litre fire water runoff tank and additional fire water tanks as they are depleted of water.
	  ○ The Emergency Management Plan will include a procedure for the management of fire water runoff during an emergency at the BESS.
	
	Several operational protocols will be enacted to further reduce the risk of Electrical hazards causing a fire at the BESS. These include:
	• Monitoring and Maintenance programs will be enacted to ensure all infrastructure within the BESS area is maintained in accordance with the relevant Australian Standards and the manufacturer's specifications.
	• Reference to the Tesla Guide for first responders to review prior to approaching the emergency.
	• The SCADA system will be used to monitor 24/7 all system alerts and sensors (including temperature) that could indicate the early stages of a fault or emergency event.
	• In the event of a detected fault or emergency the BESS can be shut down remotely by the SCADA system.
	• A procedure that requires a technician to be deployed to the Site when the Site monitoring communications are down.
	• A Fire Management Plan (Appendix A) which outlines risk control measures required to be implemented within the development.
	• The development of an Emergency Management Plan in consultation with the CFA before development starts and includes (in addition to the CFA Guidelines):
	  ○ A system to communicate effectively between the monitoring centre and the on site staff and contractors.
	  ○ Provision of 24/7 contact details for the fire brigade to contact in the event of an emergency or threat of an emergency.

RESIDUAL RISK	**Medium (unlikely/moderate)**

Table 7 - Risk assessment - Fire causing spread to adjoining infrastructure at the Site

RISK	Fire causing spread to adjoining infrastructure at the Site
CAUSE	**Solar Energy Facility** A fire that has started within the Solar Energy Facility may spread to adjoining infrastructure. Infrastructure includes other solar panels, substation, inverters or the BESS. Rapid escalation of the fire size and complexity can create issues for on site staff and contractors, firefighters and the community. **BESS** A fire that has started within a component within the BESS may spread to adjoining BESS components or other infrastructure within the Solar Energy Facility. Rapid escalation of the fire size and complexity can create issues for on site staff and contractors, firefighters and the community.
LIKELIHOOD	**Unlikely**

JUSTIFICATION	**Solar Energy Facility**
	
	The risk of fire causing spread to adjoining infrastructure at the Site is unlikely due to the low combustible nature of the components that make up the Solar Energy Facility, and the mitigation features incorporated into the design. These include:
	
	• The Solar Energy Facility has been designed in accordance with the CFA Guidelines (see Appendix C for a detailed list of design features).
	
	• Most of the supporting infrastructure that supports the Solar Energy Facility is non-combustible or has low quantities of combustible materials (the substation, the inverters, the panels, the tracking system, and the maintenance building.
	
	• The solar farm will be compartmentalised into separate areas supported by a network of APZs including APZs protecting:
	
	  ○ The substation area.
	
	  ○ The operations buildings.
	
	  ○ Groups of arrays (separated into 13 distinct areas).
	
	  ○ The BESS.
	
	  ○ The Proposal as a whole.
	
	• Access provisions into and around the Site achieve the dimensions required by the CFA Guidelines and provide access to all areas of the development.
	
	• Multiple access points from different directions are provided to all areas of the Solar Energy Facility.
	
	• The solar panel banks are separated by at least six metres to prevent fire spread and to allow for emergency vehicle access (The Site Plan which shows how the Site has been divided into 13 distinct array areas).

- All infrastructure is installed with separation distances from other infrastructure in accordance with the CFA Guidelines and the manufacturer's specifications.

- Static water supplies are provided throughout the development in excess of the CFA Guideline requirements (total of eight x 100,000 litre water tanks) located adjacent to each emergency access points. The design of each water tank is in accordance with the CFA Guidelines. See Appendix C).

BESS

The risk of fire spreading to adjoining infrastructure within the BESS and to adjoining infrastructure with the Solar Energy Facility is unlikely due to the design of the components within the BESS (Table 6), and the mitigation features incorporated into the design. These include:

- Quality components selected for the Proposal. Most of the infrastructure that supports the BESS is non-combustible or has low quantities of combustible materials.

- The Tesla Megapacks are contained within a non-flammable enclosure and have several features incorporated within the design that limits the potential for fire spread between components (see Appendix B).

- The separation between the Megapacks and supporting infrastructure (Transformers) is in accordance with manufacturer specifications (3m).

- Megapacks will be installed on a non-combustible area (concrete finished surface) that will prevent fire spreading along the ground.

- The battery area is surrounded by a 10m wide non-combustible APZ.

- There is sufficient space surrounding the battery area to enable access for firefighters and technicians. The Tesla Guide outlines the importance of remaining at least 20 metres from a Megapack whilst there are signs of fire or elevated temperatures. There is sufficient space provided around the BESS area to enable firefighters to position themselves with a firefighting hose at least 20 metres from the Megapack.

- The substation is 35 metres away from the Megapacks and is separated by a road and other non-combustible surfaces

- The solar panels are separated from the nearest Megapack by approximately 24 metres (detail is provided in the Site Plan).

- A firefighting water supply of 450,000 litres is provided in three tanks to enable firefighters to deliver water at the BESS area in line with the CFA and Tesla Guidelines and includes:

    - A fire water runoff management system designed so that fire water used at the BESS can be contained on site. The battery area is provided with fire water runoff provisions that will enable the collection of up to 450,000 litres of fire water runoff using a combination of the 150,000 litre fire water runoff tank and additional fire water tanks as they are depleted of water.

	○ The Emergency Management Plan will include a procedure for the management of fire water runoff during an emergency at the BESS. • The monitoring systems that will be installed will send alerts to the monitoring station. The monitoring systems includes IR heat or flame detectors along with the day-to-day monitoring by the SCADA system that will trigger an immediate response.
CONSEQUENCE	**Minor**
JUSTIFICATION	**Solar Energy Facility** The consequence of a fire affecting adjoining areas of the infrastructure is likely to be minor. The various protection systems, separation between the infrastructure and early notifications and other treatments will ensure that early intervention can occur. The Solar Energy Facility is provided with greater than six metre separation between the solar panel banks as per the requirements of the CFA Guideline. Along with the management of vegetation under the solar panels during the fire danger period, the ability for a fire to spread to other areas is very limited. The inverters, substation and operations and maintenance areas are all provided with non-combustible surfaces along with Asset Protection Zones around them that also assist with reducing fire spread (see the Site Plan). There are static water supplies for firefighting purposes at each of the property entrances. The provision of static water supplies exceeds the requirements specified within the CFA Guidelines. In the case of a fire the EMP will outline the process to contact the fire brigade and provide clear direction to the fire location. **BESS** The consequence of a fire spreading between components within the BESS or between the BESS and adjoining infrastructure in the Solar Energy Facility is likely to be minor. The various protection systems, separation between the infrastructure and early notifications and other treatments will ensure that early intervention can occur. The separation between the components of the BESS and the infrastructure within the Solar Energy Facility has been design in accordance with the Manufacturer specifications and the CFA Guideline. The substation is 35 metres away from the nearest Megapack and is separated by a road, and APZ, and other non-combustible surfaces. There is sufficient space provided surrounding the BESS area to enable access for firefighters and technicians. The BESS is separated from the nearest solar panels by approximately 24 metres and 130 metres to the Operations Buildings. A firefighting water supply of 450,000 litres is provided in three tanks to enable firefighters to deliver water at the BESS area. This is in addition to the static water supplies mentioned above that is provided for the Solar Energy Facility.
RISK RATING	**Low**
STRATEGY TO LOWER RISK	**Solar Energy Facility** The risk rating of a fire affecting adjoining infrastructure has been assessed to be low. Several operational protocols will be enacted to further reduce the risk of a fire spreading between infrastructure within the Solar Energy Facility. These include:

- Maintenance programs will be enacted to ensure all infrastructure within the Solar Energy Facility is maintained in accordance with the manufacturer's specifications and the relevant Australian Standards.

- The Site procedures will include a provision that ensures all alerts from the monitoring systems are addressed within two hours of activation. This will also include an immediate response to the IR heat or flame detectors. Upon activation of the fire protection systems, the monitoring centre will determine an appropriate response that may include:

    - Alert on-Site staff and contractors (if present).
    - Notify the on-call technician to attend the Site.
    - Remote shutdown of the system.
    - Call 000 and report the activation to the fire brigade in addition to notifying the on-call technician to attend.

- Solar Energy Facility staff (and contractors if applicable) will complete fire behaviour and suppression training.

- A Site induction outlining fire related risks and providing an overview of the emergency management plan to new staff, visitors and contractors.

- Local CFA Brigades to be invited to undertake an annual inspection to become familiar with access and egress to the Site and the emergency procedures and plans.

- During the Fire Danger Period, all employees and contractors have firefighting equipment (9 litre water fire extinguisher or knapsack) installed within their vehicles along with communications devices.

- Have appropriate "initial" suppression equipment available on site, this will include two 4WD vehicles fitted with 'Slip On' units that contain a water tank and firefighting pump. Additional equipment including fire extinguishers, hoses and branches to be provided.

- On-Site risk reduction strategies including no smoking, limitations on hot works during elevated fire danger days and other measures to reduce the potential for a fire to start on the Site.

- A Fire Management Plan (Appendix A) which outlines risk control measures required to be implemented within the development.

- The development of an Emergency Management Plan in consultation with the CFA before development starts and includes (in addition to the CFA Guidelines):

    - A system to communicate effectively between the monitoring centre and the on site staff and contractors.
    - Provision of 24/7 contact details for the fire brigade to contact in the event of an emergency or threat of an emergency.

BESS

The risk rating of a fire spreading between components within the BESS or between the BESS and adjoining infrastructure in the Solar Energy Facility has been assessed to be low.

Several operational protocols will be enacted to reduce this risk. These include:

- Maintenance programs will be enacted to ensure all infrastructure within the BESS is maintained in accordance with the manufacturer's specifications and the relevant Australian Standards.

- Reference to the Tesla Guide for first responders to review prior to approaching the emergency.

- The BESS is provided with a detailed operating manual that will include a provision that ensures all alerts from the monitoring systems are addressed within two hours of activation. This will also include an immediate response to the IR heat or flame detectors. Upon activation of the fire protection systems, the monitoring centre will determine an appropriate response that may include:

    - Alert on-Site staff and contractors (if present).
    - Notify the on-call technician to attend the Site.
    - Remote shutdown of the system.
    - Call 000 and report the activation to the fire brigade in addition to notifying the on-call technician to attend.

- The BESS operational manual will also include procedures to follow if any of the following is identified:

    - Suspicious odour observed
    - Smoke or fire emanating
    - Severe physical impact
    - The IR heat or flame detectors send an alarm.

- All Site staff (and contractors if applicable) will complete fire behaviour and suppression training.

- A Site induction outlining fire related risks with respect to the BESS, providing an overview of the emergency management plan to new staff, visitors and contractors.

- Local CFA Brigades to be invited to undertake an annual inspection to become familiar with access and egress to the Site and the emergency procedures and plans.

- During the Fire Danger Period, all employees and contractors will have firefighting equipment (9 litre water fire extinguisher or knapsack) installed within their vehicles along with communication devices.

- On-Site risk reduction strategies including no smoking, limitations on hot works during elevated fire danger days and other measures to reduce the potential for a fire to start on the Site.

- A Fire Management Plan (Appendix A) which outlines risk control measures required to be implemented within the development.

- The development of an Emergency Management Plan in consultation with the CFA before development starts and includes (in addition to the CFA Guidelines):

	○ A system to communicate effectively between the monitoring centre and the on-Site staff and contractors. ○ Provision of 24/7 contact details for the fire brigade to contact in the event of an emergency or threat of an emergency.
RESIDUAL RISK	**Low**

Table 8 - Risk assessment - Fire causing offsite impacts

RISK	Fire causing offsite impacts
CAUSE	Any fire at the Site that can spread to adjoining properties most likely through vegetation connectivity, on elevated bushfire risk days can start fires in the surrounding landscape that may threaten surrounding properties. The likely risk area is the Solar Energy Facility. It is highly unlikely for a fire in the BESS area to cause offsite impacts (refer Section 7.3).
LIKELIHOOD	Unlikely
JUSTIFICATION	The risk of fire causing offsite impacts is unlikely due to the low combustible nature of the components that make up the Solar Energy Facility, and the mitigation features incorporated into the design. These include: • The Solar Energy Facility has been designed in accordance with the CFA Guidelines (see Appendix C for a detailed list of design features). • Most of the supporting infrastructure that supports the Solar Energy Facility is non-combustible or has low quantities of combustible materials (the substation, the inverters, the panels, the tracking system, and the maintenance building). • The Solar Energy Facility has been designed to prevent the spread of fire between infrastructure within the facility (see Table 8). This greatly reduces the risk of a fire that originates on site leaving the Site. • The solar farm is separated into separate areas supported by a network of APZs including an APZ around the perimeter of the facility. • Additional managed area between the APZ and the boundary fences. • Access provisions into and around the Site achieve the dimensions required by the CFA Guidelines and provide access to all areas of the development. • Multiple access points from different directions are provided to all areas of the Solar Energy Facility. • The solar panel banks are separated at least six metres to prevent fire spread and to allow for access (The Site plan which shows how the Site has been divided into 13 distinct array areas). • All infrastructure is installed with separation distances from other infrastructure in accordance with the CFA Guidelines and the manufacturer's specifications. • Static water supplies are provided throughout the development in excess of the CFA Guideline requirements (total of eight x 100,000 litre water tanks) located adjacent to each emergency access points. The design of each water tank is in accordance with the CFA Guidelines. See Appendix C). • All infrastructure is setback at least 10 metres from the boundary fence.

	• The perimeter vegetation screen has been designed to limit fire propagation through species selection and maintenance programs (see Appendix D) The ongoing maintenance programs that are outlined within the Fire Management Plan (Appendix A) and the planned maintenance programs for the infrastructure in accordance with the manufacturer requirements will also limit the likelihood of a fire starting and leaving the property.
CONSEQUENCE	Minor
JUSTIFICATION	The Clause 13.02 assessment (see Section 8.2) has identified the limited risk for a fire to spread from the Site into the surrounding landscape. This is due the lack of vegetation connectivity between the Site and the low risk surrounding grassland dominated landscape. The design features within the Site that limit the potential for fire to spread between infrastructure (Table 7) coupled with the requirement to manage on site vegetation during the fire danger period will reduce the potential for a bushfire to burn with elevated intensities and spread off Site. This includes the provision of eight 100,000 litre fire water tanks at each entrance. The entire Site is provided with a perimeter access road and asset protection zone. The Fire Management Plan (Appendix A) outlines the maintenance program which is required for ongoing management of the risk of a fire spreading from the development Site.
RISK RATING	Low
STRATEGY TO LOWER RISK	The risk rating of a fire causing offsite impacts has been assessed as low. A number of operational protocols will be enacted to further reduce the risk of a fire spreading between infrastructure within the Solar Energy Facility. These include: • Maintenance programs will be enacted to ensure all infrastructure within the Solar Energy Facility is maintained in accordance with the manufacturer's specifications and the relevant Australian Standards. • The Site procedures will include a provision that ensures all alerts from the monitoring systems are addressed within two hours of activation. This will also include an immediate response to the IR heat or flame detectors. Upon activation of the fire protection systems, the monitoring centre will determine an appropriate response that may include: o Alert on-Site staff and contractors (if present) o Notify the on-call technician to attend the Site. o Remote shutdown of the system. o Call 000 and report the activation to the fire brigade in addition to notifying the on-call technician to attend. • Solar Energy Facility staff will complete fire behaviour and suppression training. • A Site induction outlining fire related risks and providing an overview of the emergency management plan to new staff, visitors and contractors. • Local CFA Brigades to be invited to undertake an annual inspection to become familiar with access and egress to the Site and the emergency procedures and plans.

	• During the Fire Danger Period, all employees and contractors have firefighting equipment (9 litre water fire extinguisher or knapsack) installed within their vehicles along with communications devices. • Maintenance of groundcover to 100mm or less in the Vegetation Screens during the fire danger period. • Have appropriate "initial" suppression equipment available on site, this will include two 4WD vehicles fitted with 'Slip On' units that contain a water tank and firefighting pump. Additional equipment including fire extinguishers, hoses and branches to be provided. • On-Site risk reduction strategies including no smoking, limitations on hot works during elevated fire danger days and other measures to reduce the potential for a fire to start on the Site. • A Fire Management Plan (Appendix A) which outlines risk control measures required to be implemented within the development. • The development of an Emergency Management Plan in consultation with the CFA before development starts and includes (in addition to the CFA Guidelines): o A system to communicate effectively between the monitoring centre and the on site staff and contractors. o Provision of 24/7 contact details for the fire brigade to contact in the event of an emergency or threat of an emergency. o The Site Emergency Management Plan will include a procedure for contacting the Municipal Fire Prevention Officer (MFPO) if the vegetation on adjoining properties becomes a fire risk. The MFPO may, following an assessment issue a Notice requiring the vegetation to be managed. o Notification procedures for adjoining landowners to advise them of a bushfire in the local area.
RESIDUAL RISK	Low

Table 9 - Risk assessment – Off Site fire impacting on the Site

RISK	Offsite fire impacting on the Site
CAUSE	**Solar Energy Facility** A bushfire burning through the surrounding landscape can enter the property and threaten the infrastructure or generate embers and land within the Solar Energy Facility and potentially start new fires. **BESS** A bushfire burning through the surrounding landscape can enter the property and threaten the BESS or generate embers and land within the BESS and potentially start new fires.
LIKELIHOOD	Unlikely
JUSTIFICATION	The Clause 13.02 assessment (Section 8.2) has identified the low-risk landscape that the Proposal is located within. This finding is supported by the review of the various bushfire strategies outlined at Sections 5 and 6 and is due the lack of vegetation connectivity between the Site and the surrounding low risk grassland dominated landscape. As outlined in Section 6.4.2, If a bushfire approaches through the adjoining grassland, it is unlikely the fire would produce elevated radiant heat due to normally low fuel loads in the landscape. In addition, there are several roads and other landscape features surrounding the development that if a bushfire occurred, would influence bushfire behaviour and in some cases reduce the intensity. A bushfire in the surrounding landscape is unlikely to generate embers that will travel well ahead of the bushfire front. The likely scenario is for embers to be generated as the bushfire burns through the treed areas identified in section 6.2. This will limit the time that the Solar Energy Facility and BESS will be exposed to embers landing on and around the Site. A perimeter vegetation screen has been provided within the design of the Solar Energy Facility and it has been designed to limit fire propagation through species selection and maintenance programs (see Appendix D)
CONSEQUENCE	Minor
JUSTIFICATION	The consequence of a fire entering the Solar Energy Facility and the BESS has been assessed as minor. The design features within the Proposal including the perimeter APZ will help prevent fire from entering the Site and spreading within the Solar Energy Facility and the BESS area (see Table 8 and Appendix C). The operational procedures to manage fire risk described in Table 8 further reduce the likely consequence of an offsite fire impacting on the facility. The consequence of embers from a bushfire in the surrounding landscape impacting the Solar Energy Facility and the BESS is low. However, if embers were to impact the Site, the design features within the Proposal, including that most components are not readily combustible and therefore help lower risk of fire propagation within the Site and limit the risk of embers starting a fire (see Table 8). The operational procedures to manage fire risk described in Table 8 further reduce the likely consequence of an offsite fire impacting on the BESS.
RISK RATING	Low

STRATEGY TO LOWER RISK	The risk rating of an offsite fire impacting on the Solar Energy Facility and the BESS has been assessed as low. Several operational protocols will be enacted to further reduce the risk of an off-Site fire impacting on the Solar Energy Facility and the BESS. These include: • Solar Energy Facility staff (and contractors if applicable) will complete fire behaviour and suppression training. • A Site induction outlining fire related risks and providing an overview of the emergency management plan to new staff, visitors and contractors. • Local CFA Brigades to be invited to undertake an annual inspection to become familiar with access and egress to the Site and the emergency procedures and plans. • During the Fire Danger Period, all employees and contractors have firefighting equipment (9 litre water fire extinguisher or knapsack) installed within their vehicles along with communications devices. • Have appropriate "initial" suppression equipment available on site, this will include two 4WD vehicles fitted with 'Slip On' units that contain a water tank and firefighting pump. Additional equipment including fire extinguishers, hoses and branches to be provided. • Solar Energy Facility management to engage with CFA to encourage residents to prepare Bushfire Survival Plans as per CFA standard practice and prepare themselves for bushfire. • Solar Energy Facility management share information with adjoining landowners to help ensure they are aware of pre-summer fire prevention and preparedness activities. • Monitoring of the local area during elevated fire danger conditions to detect bushfires early. • On days of elevated fire danger, ensure staff and contractors are aware of the importance of early notification to emergency services of a bushfire in the local area. • Where possible, the use of technology solutions to support remote operation to reduce the number of employees on site during 'extreme' and 'code red' fire risk days will be implemented. • Maintenance of the 'Safer Location' situated in the Operations' Buildings Area. • A Fire Management Plan (Appendix A) which outlines risk control measures required to be implemented within the development. • The development of an Emergency Management Plan in consultation with the CFA before development starts and includes (in addition to the CFA Guidelines): o Provision of 24/7 contact details for the fire brigade to contact in the event of an emergency or threat of an emergency (including bushfires in the area). o The Site Emergency Management Plan will include a procedure for contacting the Municipal Fire Prevention Officer (MFPO) if the vegetation on adjoining properties becomes a fire risk. The MFPO may,

	following an assessment issue a Notice requiring the vegetation to be managed. ○ Notification procedures for adjoining landowners to advise them of a bushfire in the local area ○ Notification procedures for adjoining landowners to advise them of a bushfire in the local area. On days of elevated fire danger, ensure staff and contractors are aware of the importance of early notification to emergency services of a bushfire in the local area. Section 8.2 (below) provides a Clause 13.02 assessment detailing the Proposal's Bushfire hazard identification and assessment, as well as the Clause 13.02 response.
RESIDUAL RISK	Low

Table 10 - Risk assessment – Dangerous goods

RISK	Dangerous Goods
CAUSE	With reference to the Dangerous Goods (Storage and Handling) Regulations 2012, there are quantities of Dangerous Goods at the Site within various components of the Proposal (the assessment of Dangerous Goods is provided at Appendix G). There is the potential for a leak of Dangerous Goods to occur that may cause a threat to people, the environment or be involved in a fire.
LIKELIHOOD	Unlikely
JUSTIFICATION	**Solar Energy Facility** Dangerous goods associated with the Solar Energy Facility are found within the following infrastructure: • Switch room (part of the substation) The Dangerous Goods are installed within the infrastructure during the manufacturing process prior to commissioning. This means that Dangerous Goods within infrastructure at the Solar Energy facility are contained, sealed within the infrastructure and not readily accessible. Following transportation to the Site, any infrastructure with dangerous goods will be inspected to ensure it has not been damaged during transportation. If infrastructure with Dangerous Goods is to be stored prior to installation, it will be stored in line with manufacturer's specifications to ensure its integrity. Infrastructure will be installed in line with manufacturer's specifications (including inspection and testing). Dangerous Goods located within the Solar Energy Facility will be listed within the Site's Dangerous Goods register, and the site operators will be aware of their locations and quantities. Maintenance programs will be enacted to ensure all infrastructure that contains dangerous goods within the Solar Energy Facility will be maintained in accordance with the manufacturer's specifications and the relevant Australian Standards. This will include checking for physical and electrical faults that could result in leaks. **BESS** Dangerous goods associated with the BESS are found within the following infrastructure: • Mega Packs The Dangerous Goods are installed within the infrastructure during the manufacturing process. This means that Dangerous Goods are contained and sealed and not readily accessible at the site. This includes separate steel housing around each of the 6 battery module bays within each Megapack. Following transportation to the Site, any infrastructure with Dangerous Goods will be inspected to ensure it has not been damaged during transportation. If infrastructure with Dangerous Goods is to be stored at Site prior to installation, it will be stored in line with manufacturer's specifications to ensure its integrity. Infrastructure will be installed in line with manufacturer's specifications (including inspection and testing). Together, these measures will prevent the likelihood of leaks outside the infrastructure footprint. The design of the BESS including the installation of bollards around the perimeter of the BESS will prevent vehicles from impacting the infrastructure and potentially causing a leak. The products classified as a Dangerous Good located within the BESS will be listed within the Site's Dangerous Goods register and the site operators will be aware of the locations and quantities of Dangerous Goods. Maintenance programs will be enacted to ensure all

<table>
<tr><td></td><td>infrastructure that contains Dangerous Goods within the BESS will be maintained in accordance with the manufacturer’s specifications and the relevant Australian Standards. This will include checking for physical and electrical faults that could result in leaks.</td></tr>
<tr><td>CONSEQUENCE</td><td>Minor</td></tr>
<tr><td>JUSTIFICATION</td><td>The assessment of the dangerous goods quantities at the Site (The Solar Energy Facility and the BESS) identified the following infrastructure with quantities of dangerous goods that exceed the Schedule 2 requirements under the Dangerous Goods legislation.
<table>
<tr><th>Infrastructure</th><th>Product</th><th>DG Class</th><th>Quantities</th><th>Schedule 2 requirements</th></tr>
<tr><td>Megapack</td><td>Lithium-ion</td><td>Class 9</td><td>(88 Megapacks x 5,940kg) 522,720kg</td><td>Placarding, Manifest and Fire Protection</td></tr>
<tr><td>Megapack</td><td>Refrigerant</td><td>Class 2.2</td><td>(88 Megapacks x 7.6kg)
668.8kg</td><td>Nil</td></tr>
<tr><td>Switch room</td><td>Insulating gas</td><td>Class 2.2</td><td>(1200 litres x 20)
24,000 litres*</td><td>Placarding, Manifest and Fire Protection</td></tr>
</table>
* - considered an estimate of the upper limit.

The listed quantities of Dangerous Goods above refer to products that are stored in separate components within infrastructure (Megapacks), or in separate infrastructure. It is therefore unlikely for the total quantities of Dangerous Goods listed above to be involved in an incident at the Site at the same time.

There are other goods that are being utilised within the various infrastructure at the Site, including transformer oil, however only the products listed above are deemed to be a Dangerous Good as per the Safety Data Sheet (SDS) issued by the manufacturer in accordance with Dangerous Goods Legislation (Appendix G).</td></tr>
<tr><td>RISK RATING</td><td>Low</td></tr>
<tr><td>STRATEGY TO LOWER RISK</td><td>In accordance with the Dangerous Goods (Storage and Handling) Regulations (2012), the fire brigade’s views must be sought if the quantities have exceeded the fire protection amounts listed in Schedule 2 as is the case for the Lithium-Ion and the Insulating gas listed in the table above. As noted earlier (Section 4.3.5) the fire brigade (CFA) has been consulted with in respect to the Dangerous Goods in relation to the Proposal. Further consultation to confirm the outcomes of this assessment will occur prior to construction and will be ongoing throughout the life of the Proposal.

The Emergency Management Plan will include details of the hazards associated with dangerous goods and appropriate procedures in response to this RMP, including leak management and other response arrangements to Dangerous Goods related emergencies.</td></tr>
<tr><td>RESIDUAL RISK</td><td>Low</td></tr>
</table>

Table 11 - Risk assessment - Fire water runoff

RISK	Fire water runoff
CAUSE	In the event of a fire involving the BESS, firefighters will respond and use water to either extinguish or cool the surrounding area until the infrastructure is deemed safe. The CFA Guideline outlines the need to provide capacity for the management of fire water runoff for the BESS to ensure this water does not enter the environment.
LIKELIHOOD	Unlikely
JUSTIFICATION	The risk of a fire within the BESS that would result in fire water runoff is unlikely due to the design of its components, particularly the Mega Packs and the mitigation features incorporated into its design (see Table 6 for further detail). This includes: • Quality components will be selected for the Proposal. Most of the infrastructure that supports the BESS is non-combustible or has low quantities of combustible materials. • The Tesla Mega packs are contained within an enclosure and have several features incorporated within the design that limits the potential for fire spread between components (see Appendix B). • The separation between the Megapacks and supporting infrastructure (transformers) is in accordance with manufacturer specifications (3m). • Megapacks will be installed on a non-combustible area (concrete finished surface) that will prevent fire spreading along the ground. • The IR heat and flame detection system that will be monitored 24/7 will also alert technicians and if required, the fire brigade to the site early (this is in addition to the internal 24/7 monitoring of the Tesla Megapacks and associated infrastructure). Due to the design features incorporated into the BESS the likelihood of a fire occurring at the BESS is low. As such, the likelihood of requiring fire water to extinguish a fire at the BESS is also low.
CONSEQUENCE	Minor
JUSTIFICATION	The BESS has been designed with the following to enable the management of fire water runoff in order to prevent it from entering the external environment: 1. The battery units will be within an impervious concrete area (the Fire Water Runoff Storage Area). This area incorporates a 150mm rollover kerb around its periphery to support the containment of fire water runoff and will store, without impacting on the infrastructure, approximately 400,000 litres. Note that under normal operational conditions drainage along the southern edge of the Fire Water Runoff Storage Area will be open to allow stormwater drainage. 2. A sump is provided in the south eastern corner to allow for a hard suction hose to be inserted to collect fire water. 3. A 150,000 litre empty tank is located to the east of the BESS that will receive the fire water runoff that is pumped from the sump. 4. When this tank is full, the fire water tanks that have been emptied by firefighting operations will then be used to pump fire water into. Following the emergency being declared safe, the fire water will be tested, and if

	required disposed of through an accredited organisation. (in total the Fire Water Runoff System has the capacity to store 400,000 litres in the BESS area, 150,000 litres in the Fire Water Runoff Storage tank, and a further 450,000 litres in the Fire Water tanks surrounding the BESS if used. 5. The Emergency Management Plan will outline the procedures for the Fire Water Runoff Storage System and the process to contain the water during an emergency.
RISK RATING	Low
STRATEGY TO LOWER RISK	The Emergency Management Plan will provide procedures to manage fire water runoff using the installed infrastructure: • On-Site staff (and contractors if applicable) will be trained in the procedures to use the Fire Water Runoff Storage System. • The Fire Water Runoff Storage System will be regularly checked and maintained to ensure its integrity and that is remains in working order. • The Fire Water Runoff Storage System has been designed to allow its safe operation during an emergency event. The Tesla Guide outlines the importance of remaining at least 20 metres from a Megapack whilst there are signs of fire or elevated temperatures. There is sufficient space provided around the BESS area to enable firefighters to position themselves with a firefighting hose at least 20 metres from the Megapack.
RESIDUAL RISK	Low

Table 12 - Risk assessment – Staff and firefighters

RISK	Staff and firefighters
CAUSE	The response to a fire by staff, contractors or firefighters can be dangerous due to the various safety hazards associated with a fire in this type of infrastructure.
LIKELIHOOD	Likely
JUSTIFICATION	The potential for a fire to occur and develop at the Site is low risk due to the various design features and treatments that will be implemented into the Proposal, for example the majority of the solar farm infrastructure is of low flammability (i.e. the solar panels, see Section 7.2), and APZs will be installed around all key infrastructure and the Site as a whole. These design features have been discussed at Tables 6, 7 and 9 and are also detailed in Appendix C. In addition, active management practises such as the maintenance of all ground cover within the Site (including within the drains) to 100mm or less during the Fire Danger Period will reduced the risk of fire causing a hazard to firefighters. However, if fire does occur at the site, there is the potential for a firefighter to be injured or die particularly given the complexities of dealing with a potential electrical fire at the Solar Energy Facility (Section 7.2.6) or the specific hazards associated with a fire or thermal runaway event at a BESS (Section 7.34). This risk could be exacerbated by the potential for somebody who is unfamiliar with the property and the technology installed. The CFA Guideline does impose a variety of controls onto the management of the Site through the Emergency Management Plan and how CFA interacts with the Site if they are called to a fire. The Emergency Management Plan will be in the Emergency Information Container located at each entrance to the Site.
CONSEQUENCE	Major
JUSTIFICATION	The consequence of injury or death to a firefighter would be major.
RISK RATING	High
STRATEGY TO LOWER RISK	Several strategies to reduce the risk of a fire causing harm to staff, contractors or firefighters have been integrated into the design and operation of the Proposal. **Solar Energy Facility** As detailed in the previous tables, the design and construction of the Solar Energy Facility ensures that: • Risk of electrical fault is minimised through correct equipment selection, installation to manufacturer's regulations and Australian Standards. • The Site has been design to minimise the risk of fire spreading within components and between different parts of the Site and to off site (Table 7 and 8). • The Site has been designed to limit the risk from bushfire and/or offsite fires from impacting on the Site (Table 9). • Should a fire occur careful provision has been made to ensure sufficient and accessible static water supplies throughout the site (8 x 100,000 litre water tanks at each site entry location, and 3 x 150,000 litre water tanks at the battery area).

- Maintenance programs will be enacted to ensure all infrastructure within the Solar Energy Facility is maintained in accordance with the manufacturer's specifications and the relevant Australian Standards.

Due to the design features and operational systems incorporated into the Solar Energy Facility the likelihood of a fire occurring is low.

BESS

The following design and operational mitigation treatments will reduce risk to firefighters attending an emergency at the BESS:

- The Tesla Megapacks are contained within an enclosure and have several features incorporated within the design that limits the potential for fire spread between components (see Appendix B).
- The separation between the Megapacks and supporting infrastructure (transformers) is in accordance with manufacturer specifications (3m). This prevents a fire from escalating at the BESS and allows space for respondents to deal with an emergency safely at the BESS.
- Should a fire occur careful provision has been made to the supply of static water at the battery area via 3 x 150,000 litre water tanks (see Table 11 for procedures on the safe operation of the Fire Water Runoff Storage System).
- Megapacks will be installed within a non-combustible area (concrete finished surface) that will prevent fire spreading along the ground.
- The IR heat and flame detection system that will be monitored 24/7 will also alert technicians and if required, the fire brigade to the site early (this is in addition to the internal 24/7 monitoring of the Tesla Megapacks and associated infrastructure).
- Maintenance programs will be enacted to ensure all infrastructure within the Solar Energy Facility is maintained in accordance with the manufacturer's specifications and the relevant Australian Standards.

Due to the design features incorporated into the BESS the likelihood of a fire occurring at the BESS is low.

While there is the potential for firefighters and/or staff and contractors to be present during an emergency event and not be familiar with the Site's infrastructure and emergency procedures, the risk associated with this is reduced through the extensive training and management protocols that are included in the design and operation of the Solar Energy Facility and BESS. These include:

- A Site induction process outlining fire related risks and providing an overview of the emergency management plan to new staff, visitors and contractors.
- Staff and contractors will complete fire behaviour and suppression training including dealing with electrical hazards associated with the infrastructure at the Site.
- Local CFA Brigades to be invited to undertake an annual inspection to become familiar with access and egress to the Site and the emergency procedures.
- An Emergency Management Plan, developed in consultation with the CFA for all stages of the development in line with the CFA Guidelines.

- The provision of an Emergency Information Book and Emergency information containers at each access point to the Site. As per section 10.2.1 of the CFA Guidelines (2022), the Emergency Information Book will include:
    - *A description of the premises, its infrastructure and operations.*
    - *Site plans that include the layout of the entire site, including buildings, internal roads, infrastructure, fire protection systems and equipment, dangerous goods storage areas, battery energy storage systems, substations/terminals, grid connections, drains and isolation valves, neighbours and the direction of north.*
    - *Up-to-date contact details for site personnel, regulatory authorities and site neighbours.*
    - *A manifest of dangerous goods (if required) as per Schedule 3 of the Dangerous Goods (Storage and Handling) Regulations 2012.*
    - *Safety Data Sheets (SDS) for dangerous goods stored on-site.*
    - *Procedures for management of emergencies, including evacuation, shelter-in-place (for facilities at risk of bushfire/grassfire), containment of spills and leaks, and fire procedures (including infrastructure/plant fires, vehicle fires, grassfire/bushfire).*

  Specific to the BESS the Emergency Information Book will provide information on hazards to emergency responders including:
    - *Specifications for safe operating conditions for temperature.*
    - *Schematics and technical data for battery energy storage system containers/enclosures, the number of containers/enclosures on-site, and the number of battery racks or modules within each container/enclosure.*
    - *Details of the hazards for the battery energy storage system, including thermal events/runaway, electrical safety hazards, explosion hazards, dangerous goods hazards (including off-gassing), and the effects of fire on the battery energy storage system (eg., explosion, release of toxic gases).*
    - *Details of all provided battery failure/safety and protective systems, including a description, the activation process/automatic trigger, and any hazards associated with these systems.*
    - *The shut down and/or isolation procedures if the batteries are involved in fire, and appropriate personnel contact details for verifying that the battery enclosure/container system has been isolated/shutdown and de-energised during emergencies.*

  The Emergency Information Containers will be:

	○ *Painted red and marked 'EMERGENCY INFORMATION' in white contrasting lettering not less than 25mm high.* ○ *Located at all vehicle access points to the facility, installed at a height of 1.2 metres – 1.5 metres.* ○ *Accessible with a fire brigade standard '003' key.* ○ *Kept clear of obstructions, including products, rubbish, vehicles, vegetation and any hazards (eg. pest infestation).*
RESIDUAL RISK	Medium

The risk assessment has identified the importance and requirement to implement strategies to mitigate or lower the risk. These strategies are discussed in full in Section 9 of this report.

8.2 Clause 13.02 assessment

The assessment against Clause 13.02-1S of the Corangamite Planning Scheme requires the analysis of the bushfire risk across the landscape, the development of bushfire scenarios, and to then address the strategies outlined within the Policy.

8.2.1 Bushfire hazard identification and assessment

Clause 13.02 suggests the assessment of landscape risk be undertaken at multiple levels. For the purpose of this assessment, both 1 km and 20 km landscape assessments have been completed.

Both assessments (illustrated in Figures 12 and 13) have identified the traditional bushfire risks that would be present in the western districts of Victoria. As described previously, the influence of the north westerly winds followed by the south westerly wind change often influences major fires in this area. This can be seen clearly in Figure 10 where the major fires within south west Victoria have been as a result of an initial north westerly followed by the south westerly wind change.

The assessment considered the type of vegetation, topography and any other landscape features that may affect fire behavior.

1 kilometre landscape assessment

Figure 13 illustrates potential fire scenarios for the area within 1 km of the Site. Because grass is the predominant vegetation in this area, fast running grass fires would be the most likely bushfire type that would impact on the Proposal. Because of the wind patterns typical of high fire danger days, the primary threat would be from the north west (prior to the wind change) or south west (following the wind change).

At the 1 km level, the potential for a fire to impact on the Site from the east, starting along Camperdown Darlington Road or nearby and traveling towards the Proposal, is also present. Grassfires tend to not be as damaging under an easterly influence as this usually coincides with high levels of humidity and cooler temperatures.

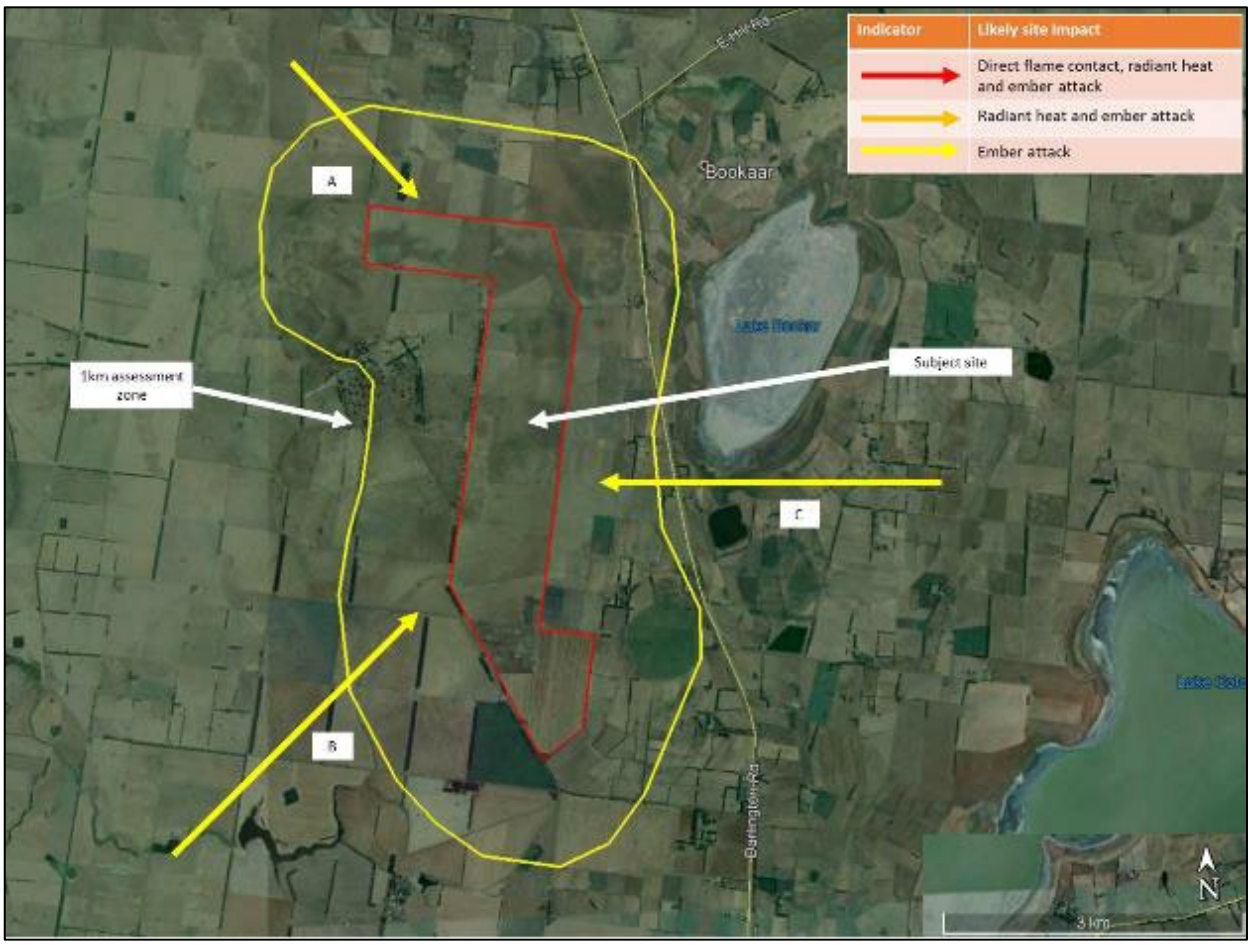


Figure 15 – 1 kilometre landscape assessment

Using aerial imagery provided from the drone survey to confirm the landscape to the north and north west of the Site, figure 14 shows the typical vegetation that will affect bushfire behavior within 1km of the Site. This supports the landscape assessment that confirms that the likely bushfire attack is from embers. In addition to this, due to the flat nature of the landscape, grassfires will be influenced by vegetation changes with limited influence by slope or aspect.

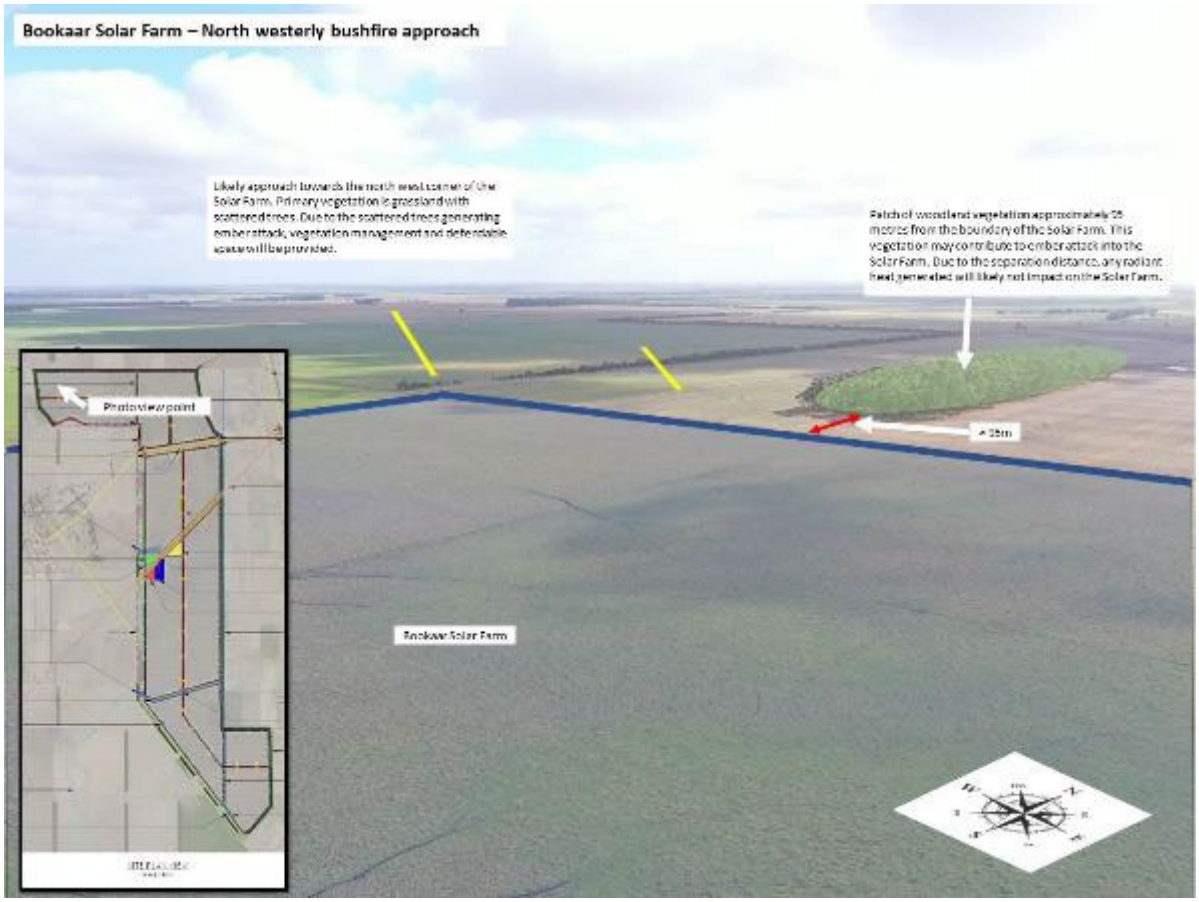


Figure 16 - north westerly approach

Due to the numerous variables including wind strength, fuel loads and other factors it is difficult to predict a timeframe for the (within 1km) bushfire to impact on the Proposal. Therefore, in times of high fire danger, there is a requirement for staff to monitor the surrounding landscape for fires to ensure they can respond quickly, as noted in the Fire Management Plan.

20 kilometre landscape assessment

Figure 14 illustrates potential fire scenarios for the area up to 20 km from the Site. It is most likely that a bushfire threatening the Site will come from either the north west or south west.

When burning under a strong north westerly influence in this region, a fire tends to burn in a very narrow front but spreads rapidly. When the south westerly change occurs, the eastern flank will become a wide fire front and travel to the north east, and can become very difficult to control. Fire conditions can also become very erratic before, during and after the wind change.

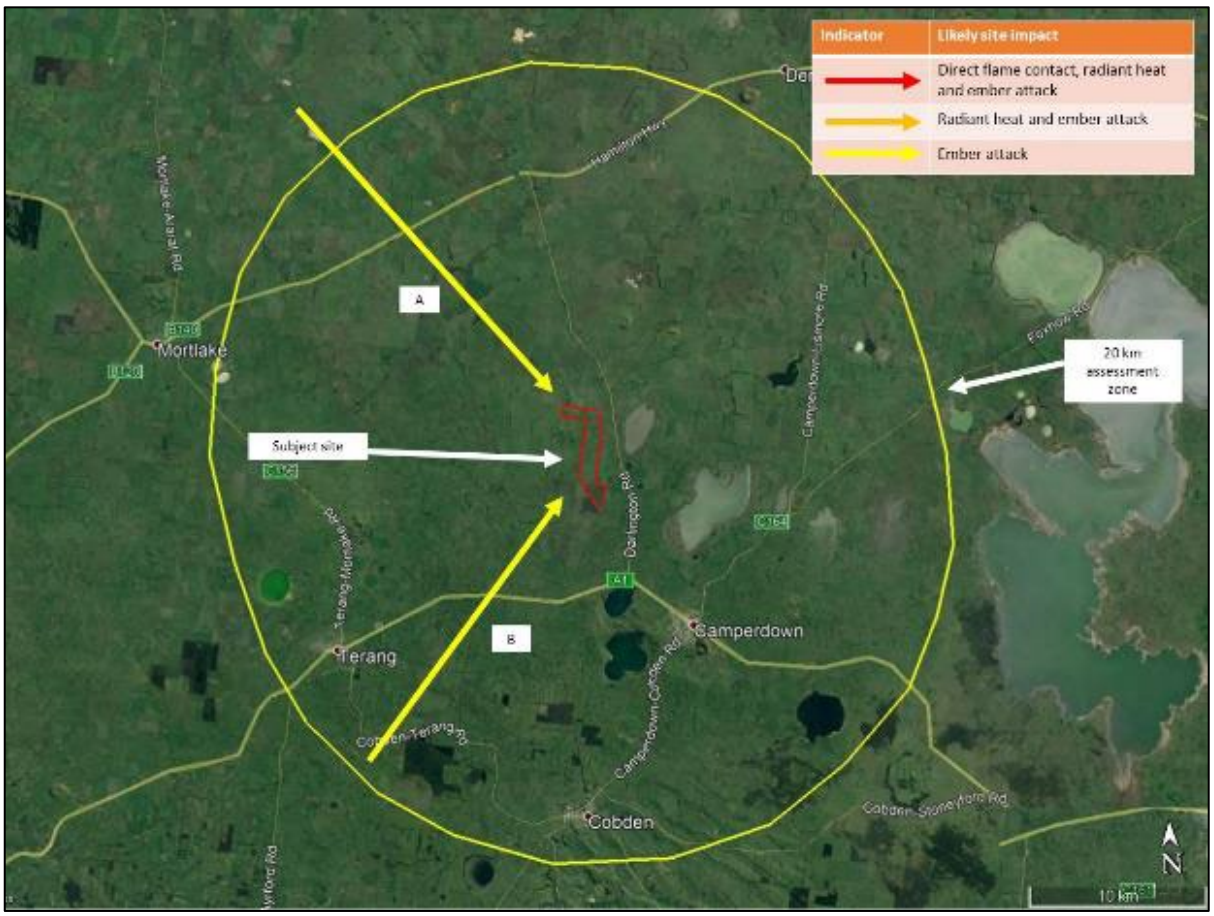


Figure 17 - 20-kilometre landscape assessment

Variability of fire behaviour

Fire behaviour can be highly variable depending on a range of factors. These include temperature, wind direction and strength, vegetation type and topography. As wind strength and direction can change rapidly, the ability to predict bushfire behaviour is often difficult.

During periods of extreme fire conditions, it is expected that bushfires could travel through the surrounding landscape rapidly. Consequently, the Proposal design process has considered this potential risk and introduced mitigation strategies into the design, construction and ongoing operation of the Proposal. These are discussed in more detail below and in Section 9, which provides a comprehensive list of mitigation developed for the Proposal.

Landscape assessment outcome

The area surrounding the Site is dominated by grasslands, which can support fast running bushfires but not usually of a high intensity when compared to forested environments. The advantage of grasslands is that vegetation continuity can be interrupted through the installation of fuel reduced areas including roads and managed zones.

The assessment is also consistent with the Otway District Strategic Fire Management Plan and the Strategic Bushfire Management Plan – Barwon Otway Region (outlined in sections 5.2.1 and 5.2.1) in that the area is a lower risk for bushfires when compared to other parts of the Barwon Otway Region.

The development of an effectively managed Solar Energy Facility (and BESS) in this type of landscape will likely reduce the risk to the surrounding areas through active management of grassland on the Site. The Proposal, being a managed area of 588 ha, will effectively provide a firebreak within the landscape that is large enough to positively influence (i.e. reduce) bushfire behaviour.

Bushfire hazard assessment

Using the outcomes of the landscape assessment, the following table outlines different fire scenarios and identifies mitigation considerations to offset these scenarios. As noted, mitigation strategies for each stage of the Proposal, are discussed in full in Section 9.

Bushfire hazard type	Description	Likely scenario/s	Mitigation Considerations
Landscape conditions - Bushfire originating within 20km of the Site	The landscape hazard up to 20 kilometres from the Site identifies the presence of grass land associated with farming activities. This land is a mix of cropping and other farming activities.	Roadways, operating machinery at farms and small communities can all be considered areas where fires can start. The likely scenario is a bushfire that starts to the north west of the Site and impacts on the Site from the north west or south west. The bushfire will spread rapidly through the grassland. At lower fire danger conditions, roads and other cleared areas will likely slow the fires spread. These areas are less likely to slow the fire at higher fire danger levels. Due to the presence of trees on road sides and in adjoining farmland, embers may be generated which could start spot fires within the Proposal.	Perimeter tracks within an APZ will reduce the potential for a bushfire to enter or exit the Site to be established and maintained throughout the Proposal's lifetime. An Emergency Management Plan to be developed and implemented to guide the actions taken by Solar Energy Facility staff and how they interact with emergency service agencies. Provision of firefighting water supply at strategic locations within the Site that enables both on site firefighting capability and external firefighting resources to access static water. On site vegetation management to reduce the potential for embers to start spot fires within the Proposal.

Bushfire hazard type	Description	Likely scenario/s	Mitigation Considerations
Local conditions - Bushfire originating within 1km of the Site	Within one kilometre of the Site the dominant vegetation is grassland. There are patches of shelterbelts and wind breaks of varying sizes along the western boundary of the Site and on adjoining properties. There is a main road to the east of the Site. Operating machinery is likely to be present in the local area. There is evidence that roadside vegetation in the local area is managed.	A bushfire starting within close proximity is likely to impact on the Site with a very narrow fire front if still burning under a north westerly influence. A bushfire that is burning to the west of the Site and is influenced by a south westerly change could impact on the Site in multiple areas. Due to the presence of trees on road sides and in adjoining farmland, these could generate embers if the ground fuel around them is not maintained. Fires starting along roadsides adjoining the property may also support fire spread into the Site, in particular this could occur along the Darlington Road. As this is located to the east of the property the fire may not reach the Site and is likely to be a low intensity bushfire.	Perimeter tracks within an APZ will reduce the potential for a bushfire to enter or exit the Site to be established and maintained throughout the Proposal's lifetime. On days of elevated fire danger, ensure staff and contractors are aware of the importance of early notification to emergency services of a bushfire in the local area. Reduce high risk activities on days where the bushfire risk is elevated. In this scenario, evacuation may no longer be an option for those who are located at the Proposal. The design should incorporate a cleared area that can be considered a 'safer location'. An Emergency Management Plan to be developed and implemented to guide the actions taken by Solar Energy Facility staff and how they interact with emergency service agencies. Due to the potential rapid approach of the bushfire, a dedicated firefighting water supply along with the ability for trained staff (and contractors if applicable) to extinguish small fires should be provided.

Bushfire hazard type	Description	Likely scenario/s	Mitigation Considerations
Neighbourhood conditions – bushfires originating within 400 metres of the Site	Within close proximity to the Site, roadside vegetation exists which is primarily grassland with areas of trees.	The most likely scenario is a fire starting as a result of faulty machinery on adjoining property. Fires starting along roadsides adjoining the property may also support fire spread into the Solar Energy Facility, in particular this could occur along the Meningoort and Blind Creek Roads. As this is located to the east of the property the fire may not reach the Site and is likely to be a low intensity bushfire. The most likely scenario is a fire starting as a result of faulty machinery on adjoining property.	Perimeter tracks within an APZ will reduce the potential for a bushfire to enter or exit the Site to be established and maintained throughout the Proposal's lifetime. On days of elevated fire danger, ensure staff and contractors are aware of the importance of early notification to emergency services of a bushfire in the local area. In this scenario, evacuation may no longer be an option for those who are located at the Proposal. The design should incorporate a cleared area that can be considered a 'safer location'. This area will be clearly marked on the Site plan, include appropriate signage and protocols on the use and maintenance of the area outlined within the Bushfire Response Plan. Due to the rapid approach of the bushfire, a dedicated firefighting water supply along with the ability for trained staff (and contractors if applicable) to extinguish small fires should be provided.

Bushfire hazard type	Description	Likely scenario/s	Mitigation Considerations
The Site of the Proposal	The Site is currently grassland and utilised for farming activities. If construction occurs during the Fire Danger Period, consideration will need to be given to managing vegetation. Ongoing, vegetation will be present under the Solar Panels and along roadsides including a Vegetation Screen.	During the construction phase, fires could start and spread if the vegetation is not managed during this period. The presence of vehicles on the Site during construction and operation may cause an ignition in vegetation. Post construction, fires could travel through vegetation that has accumulated under the Solar Panels or along roadsides. Due to the electrically charged equipment on the Site, the potential for ignitions is increased as discussed in Section 7.2.	Ensure that for construction that occurs during the fire danger period, vegetation management is a priority activity. Implement a hot works system and consider limiting other high-risk activities including smoking. During the construction phase and prior to the installation of the permanent water tanks ensure firefighting water is made available during the fire danger period. On days of elevated fire danger, ensure staff and contractors are aware of the importance of early notification to emergency services of a bushfire in the local area. Internal track network to be established to allow for the movement of firefighting resources. Internal track network to act as internal fire breaks in conjunction with APZs, as well as creating multiple compartments within the Solar Energy Facility. Due to the rapid approach of the bushfire, a dedicated firefighting water supply along with the ability for trained staff and (contractors if applicable) to extinguish small fires should be provided. Ensure that vegetation screens are planted in accordance with risk reduction principles (outlined in Appendix D). Adhering to these principles will ensure the Vegetation Screens do not contribute to the overall bushfire risk through the ability for bushfires to get into the tree canopy and generate embers. Management of the groundcover to 100mm or less under the panels and in other cleared areas (including the drains) during the fire danger period. In particular, do not allow vegetation accumulation (> 100mm) to occur at the base of the solar panel support structures. All electrical infrastructure should meet relevant Australian standards, be installed correctly, and tested for faults through commissioning and as part of regular maintenance.

The bushfire hazard assessment has outlined the likely scenarios in relation to the proposed Site, including the potential for bushfires to impact on the Site. The mitigation considerations have identified a range of options that will limit the impact of these bushfires on the Site and the surrounding area. The adoption of the mitigation considerations will ensure that there is no increase in bushfire risk following the development of the Site.

8.2.2 Clause 13.02-1S strategy response

The response to the Clause 13.02-1S strategies has been developed based on the assessments above and is provided in the following table:

	Strategy	Response
1	Prioritising the protection of human life over all other policy considerations.	The Proposal is recognised as being within an existing bushfire risk area and therefore its design and proposed mitigation measures as a whole prioritise the protection of human life at all times: Specific examples include but are not limited to: • The construction and maintenance of an asset protection zone around the entire Site. This will greatly reduce or eliminate the potential for a fire to spread from the Site into adjoining land. • The provision of a 'shelter in place' location that can be utilised by staff, contractors and visitors in an emergency. • Where possible, the use of technology solutions to support remote operation to reduce the number of employees on site during 'extreme' and 'code red' fire risk days will be implemented. • The development of an Emergency Management Plan and Fire Management Plan (Appendix B). Adherence to these plans throughout all stages of the Proposal's lifecycle will ensure that ongoing fire risk over time continues to be reduced.
2	Directing population growth and development to low risk locations and ensuring the availability of, and safe access to, areas where human life can be better protected from the effects of bushfire.	It is acknowledged that the Proposal is being located in an existing bushfire risk area and additional mitigation measures are required to ensure life safety is not compromised. These measures include: • Development of an Emergency Management Plan that guides staff responses to elevated fire danger conditions including response procedures, mitigation obligations and emergency control organisation arrangements. • Construction and maintenance of a track network that provides multiple options to exit the development area during a bushfire. • Asset Protection Zones constructed and maintained around buildings and other infrastructure. • Implementation of a vegetation management program to maintain fuel loads across the entire Site. • Monitoring of the local area during elevated fire danger conditions to detect bushfires early. • A strong focus on eliminating high risk activities (e.g. hot works) during elevated fire danger conditions. • The creation of a 'safer location' that is within the Site and easily accessed.
3	Reducing the vulnerability of	The Proposal design has considered the risk to the community and will be implementing a range ongoing mitigation treatments to manage this risk.

	communities to bushfire through the consideration of bushfire risk in decision making at all stages of the planning process.	The key focus is to reduce the potential for the Proposal to increase the bushfire risk through: • Installing and maintaining asset protection zones around the entire Site (including a perimeter road), and around key infrastructure within the Site. • Managing vegetation throughout the array area during the Fire Danger Period to limit the ability for fires to start and spread. • Restriction on high risk operations during elevated fire danger conditions including hot works permit system, management of smoking and limitations on the use of grinders and welders. Limiting smoking and other naked flame activities within the Site.

Within Clause 13.02-1S, Settlement Planning objectives are outlined and how the development proposes to meet these is outlined in the following table.

Settlement Planning Objective	Project response	Achieved
Directing population growth and development to low risk locations, being those locations assessed as having a radiant heat flux of less than 12.5 kilowatts/square metre under AS 3959-2018 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009)	With the provision of the perimeter road, and the management of fuel within the Solar Energy Facility, when assessed against AS 3959 using vegetation type of grassland and slope as flat land, the separation distance between the surrounding grassland vegetation, and the Solar Energy Facility infrastructure is required to be 19 metres. The Solar Energy Facility infrastructure is set back at least 20 metres from the perimeter fence. In a number of locations, the separation distance far exceeds the 19 metre requirement. It is acknowledged that a Vegetation Screen is being established along much of the perimeter of the Site. However, providing this area is actively managed in accordance with the principles outlined in Appendix D, the additional risk to the Site as a result of the screen is low.	✓
Ensuring the availability of, and safe access to, areas assessed as a BAL-LOW rating under AS 3959-2018 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009) where human life can be better protected from the effects of bushfire.	The Proposal is providing access roads and asset protection zones across the entire Site. These access roads connect to public roads and provide multiple opportunities to access and egress the Site. This will provide workers with the ability to travel safely to locations that would achieve a BAL-LOW rating on the Site. With the predominant vegetation type on the adjoining land as grassland, the distance required to a BAL Low location is 50 metres. The vegetation type of grassland on adjoining properties and the managed vegetation on the Site means that there are numerous areas that could be classified as BAL-LOW. However, a 'safer location', has been incorporated into the design of the Proposal. The safer location is at the Operations Buildings area which is provided with a 20 metre asset protection zone, in addition to other mitigation treatments including roads, other infrastructure and vegetation management on the entire Site.	✓

Ensuring the bushfire risk to existing and future residents, property and community infrastructure will not increase as a result of future land use and development.	With the implementation of the bushfire mitigation recommendations into the Proposal's design, the bushfire risk will not increase. The design of the Proposal is strongly focused on preventing fires from entering the Site and limiting the spread of fire from the Proposal. The main mitigation treatments that work together to achieve this are: • Perimeter track within a firebreak/APZ. • Managed vegetation. • Compartmentalisation of the Solar Energy Facility through an extensive internal track network. • APZs surrounding all key infrastructure.	✓
Achieving no net increase in risk to existing and future residents, property and community infrastructure, through the implementation of bushfire protection measures and where possible reducing bushfire risk overall.	The Solar Energy Facility will reduce the potential for a bushfire to spread across the landscape due to the reduced vegetation compared to current Site conditions. A number of bushfire protection measures will be implemented including: • Vegetation management. • Internal road network including a perimeter road. • Restriction on high risk operations during elevated fire danger conditions including hot works permit system, management of smoking and limitations on the use of grinders and welders.	✓
Assessing and addressing the bushfire hazard posed to the settlement and the likely bushfire behaviour it will produce at a landscape, settlement, local, neighbourhood and Site scale, including the potential for neighbourhood-scale destruction.	Based on the detailed assessment contained in Section 8.2.1, along with the mitigation recommendations developed to reduce the identified risk (see Section 9), this Proposal does not increase the hazard compared to the current situation. The development of the Site will reduce the risk to the local area as the Site will now include an internal track network including a perimeter track, managed APZs and a large area of managed vegetation under and around the Solar Panels.	✓
Assessing alternative low risk locations for settlement growth on a regional, municipal, settlement, local and neighbourhood basis.	As the Proposal does not increase risk across the landscape, identification of alternative low risk areas is not required.	✓
Not approving any strategic planning document, local planning policy, or planning scheme amendment that will result in the introduction or intensification of development in an area that has, or will on completion have, more than a BAL-12.5 rating under AS 3959-2018 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009).	With the provision of APZs, buildings within the Substation area and the Operations Buildings Area, which are required to comply with AS3959, will not be exposed to radiant heat in excess of a BAL 12.5 rating under AS 3959.	✓

This section details how the Proposal responds to the strategies and objectives of Clause 13.02-1S. The Policy is focused on the protection of life and ensuring that new developments do not increase bushfire risk both on site, and in the surrounding area. The outcome of the assessment outlines that the development of the Proposal can occur in this location and in this landscape. The development will likely

reduce the risk to the surrounding area through the creation of a large area (588 ha) where existing grassland vegetation will be managed during the Fire Danger Period to 100mm or less reducing the ability of a fire to spread into, or out of, the Site.

8.3 CFA Guideline

The CFA Guideline for renewable energy installations provides guidance for a range of infrastructure including Solar energy facilities and BESSs. The CFA Guideline indicates a level of risk that is present depending on the type of installation and suggests minimum standards that a renewable energy development should consider along with suggestions for undertaking the design response to fire risk, including CFA consultation. As noted in Section 4.2.5, the CFA has been consulted as part of the design and assessment process, with consideration of CFA comments incorporated into the design. Appendix C provides a detailed analysis demonstrating that the Proposal is compliant with the CFA Model Requirements outlined in the CFA Guideline.

8.4 VCAT Decision

The design process of the new Proposal has accounted for the points raised in the VCAT decision on Bushfire Risk. First and foremost, the Proposal has been designed in response to a comprehensive bushfire assessment, demonstrating that the Site is appropriate for the development of a Solar Energy Facility from a bushfire risk perspective.

In paragraph 244 of the VCAT decision, the Tribunal notes that '*the CFA expects a Fire Management Plan to be part of the Emergency Management Plan*'. A Fire Management Plan (Appendix A) has been developed to fulfil this requirement, and an Emergency Management Plan will be developed and endorsed by CFA prior to construction commencing.

Other issues relating to bushfire risk noted in the VCAT decision are addressed in Appendix F.

8.5 Summary

The fire risk assessment concludes that, while unlikely, the Proposal Site could potentially be threatened by fire (as a result of actions by staff, contractors, visitors and residents on the property), deliberate ignition (arson) or lightning.

A fire on the property and in the surrounding landscape will be fueled predominantly by grassland vegetation or the installed infrastructure. The mainly flat topography will have minimal influence on bushfire behaviour in the surrounding landscape. The existing shelterbelts along with the proposed Vegetation Screens do not increase the overall bushfire risk, providing these areas are maintained in accordance with the design principles provided in Appendix D.

Grassland fuels are very responsive to any changes in weather factors particularly wind speed and direction changes. The greatest risk scenario relates to a day of high fire danger, where north west winds and a south west wind change are forecast. On these days a fire that starts on land surrounding the Site will quickly reach high intensity and be difficult to suppress. A fire that starts on the Site will be restricted in spreading due to the low fuel loads.

Where a fire ignites outside of the property, the continuous grasslands surrounding the property and wider area may cause the fire to approach the Site as a large grassfire.

The introduction of the Proposal into the landscape does not increase the bushfire risk that is currently present, providing appropriate mitigation measures are incorporated into the design, construction and operation. Mitigation solutions determined by the assessment are considered in detail in the following section.

9 Mitigation recommendations

Implementation of the following mitigation recommendations will ensure the risk from fire is managed to an acceptable level and that no increase in risk across the landscape is experienced throughout the Proposal's lifetime. Once implemented, the mitigation measures will significantly reduce the ability for a fire to ignite and spread into, through, or from the Site. The alteration of the current vegetation through the creation of managed grassland on the 588 ha Site will mean that the Site has the potential to reduce bushfire behaviour in the landscape.

9.1 Design Response

Following the detailed risk analysis, a design solution has been developed and adopted by the Proponent as summarised below.

1. Quality components that meet where applicable relevant Australian Standards will be selected for the Proposal.

2. Perimeter fire break (Asset Protection Zone, 'APZ') of 10 metres around the entire Site. The APZ will be non-combustible.

3. Provision of eight access points surrounding the Site to provide for emergency vehicle access. These locations have been identified to align with the existing public road network whilst enabling effective access to all parts of the Site. Whilst the access locations are influenced by adjoining land and access to public roads, they have been spaced to ensure that multiple access points at various locations are available. All of the access points connect to the internal track network and provide multiple options to traverse the Site.

4. Provision of emergency information containers at each entrance to the Site for use by firefighters.

5. Provision of eight firefighting water supply tanks, each with 100,000 litres of water. The water tanks are located adjacent to Site access points that can be readily utilised during an Emergency and have been designed to comply with CFA requirements for access and signage. To determine the amount of water required for firefighting purposes, it has been assumed that two CFA Strike Teams (10 firefighting appliances with 3,000 litres water capacity each) were present at the same time undertaking firefighting activities for the duration of the peak fire danger period (approximately 6 – 8 hours). This water supply is also available for on site workers to utilise for firefighting purposes.

6. Vegetation Screens will be developed that conform to the principles in Appendix D to prevent the vegetation creating a bushfire risk. Where the Vegetation Screen is located near an existing Shelterbelt, a 5 metre canopy separation will be provided.

7. A 20m wide gap will be managed between the Solar Panels and the Security fence around the entire Site. The Perimeter firebreak (Asset Protection Zone) will be within this space, with the Vegetation Screens on the outside of a security fence.

8. Site track network, consisting of a perimeter and internal tracks, 4m wide all-weather construction, and capable of supporting emergency and or firefighting vehicle movement around the Site. All internal tracks will be within 10m wide APZs. There will be overtaking lanes at least every 600 metres. The internal road network has been designed with a central spine with regular

side roads connecting to the perimeter road. This design ensures that there are multiple ways to each part of the Site, and that the Site is partitioned into multiple sections.

9. Provision of a 'safer location' as an area to be utilised in the event of a bushfire threatening the Site. The safer area is the main Operations Buildings area. An emergency access point has been located next to this area, and the internal road network from this location provides several routes to the main access points. The area is approximately 0.96 ha and provided with a 20 metre APZ around its entire perimeter. The protocols for the use of the 'safer location' is outlined within the BRP.

10. Asset Protection Zones of 10m wide around the substation and battery storage area which are located on non-combustible surfaces.

11. Provision of a 7m minimum APZ surrounding Inverter stations which are located on non-combustible hardstands that can be accessed by the internal access tracks in case of fire.

12. The BESS has been positioned adjacent to an emergency access with routes to other parts of the Site so as to be directly accessible to emergency responders.

13. The battery area is provided with 450,000 litres of fire water supply spread across three tanks at the north, east and west of the BESS area.

14. Solar arrays have been designed at spacing greater than 6m wide, allowing access within rows if required, and in accordance with the CFA Guidance. Row spacing will also allow for ease of vegetation maintenance as is discussed in the operational mitigation section below.

15. Install an IR heat and/or flame detection system within the BESS area.

16. Bollards around the BESS area to prevent mechanical damage occurring from vehicles or other machinery causing damage to the Megapacks.

17. Each pair of Megapacks is placed on a concrete hardstand that sits above the fire water runoff level which will prevent water penetration.

18. Megapacks will be installed on a non-combustible surface (concrete finished surface) that will prevent fire spreading along the ground.

19. The Megapacks are contained within a non-flammable enclosure and have several features incorporated within the design that limits the potential for fire spread between components. The battery area is provided with fire water runoff provisions that will enable the collection of up to 450,000 litres of fire water runoff using a combination of the 150,000 litre fire water runoff tank and additional fire water tanks as they are depleted of water, and the procedure that will be outlined within the Emergency Management Plan.

20. A Solar Energy Facility management system (SCADA) to be provided that will detect various fluctuations and provide early notification of faults.

21. In the event of a detected fault or emergency the BESS and Solar Energy Facility can be shut down remotely by the SCADA system. A Solar Energy Facility management system (SCADA) provided that will detect various fluctuations and provide early notification of faults.

22. Installation of CCTV cameras surrounding the Site to monitor activity at the access points and surrounding area. These CCTV cameras will provide Site management the ability to actively monitor the Site and should a fire occur gather information on a fire to report to the emergency services if required.

23. 24/7 on call capability to respond to emergencies or faults.

The measures listed above have been incorporated into the Site Plan, and Figures 17 and 18 highlight the main design features relating to bushfire risk mitigation. The full design is provided in Figure 1 and a scaled version supports the Planning Application (the 'Site Plan').

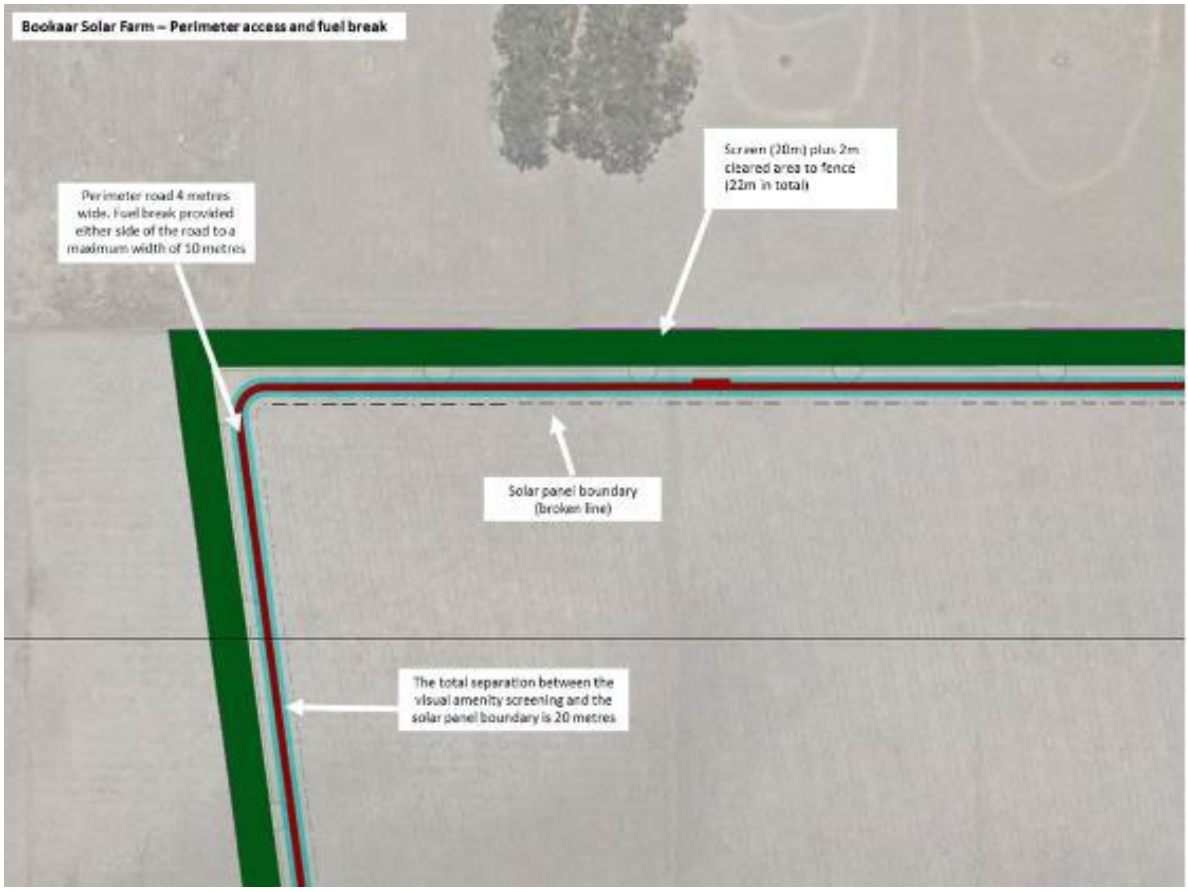


Figure 18 - Overview of management of bushfire risk along the north west Site boundary

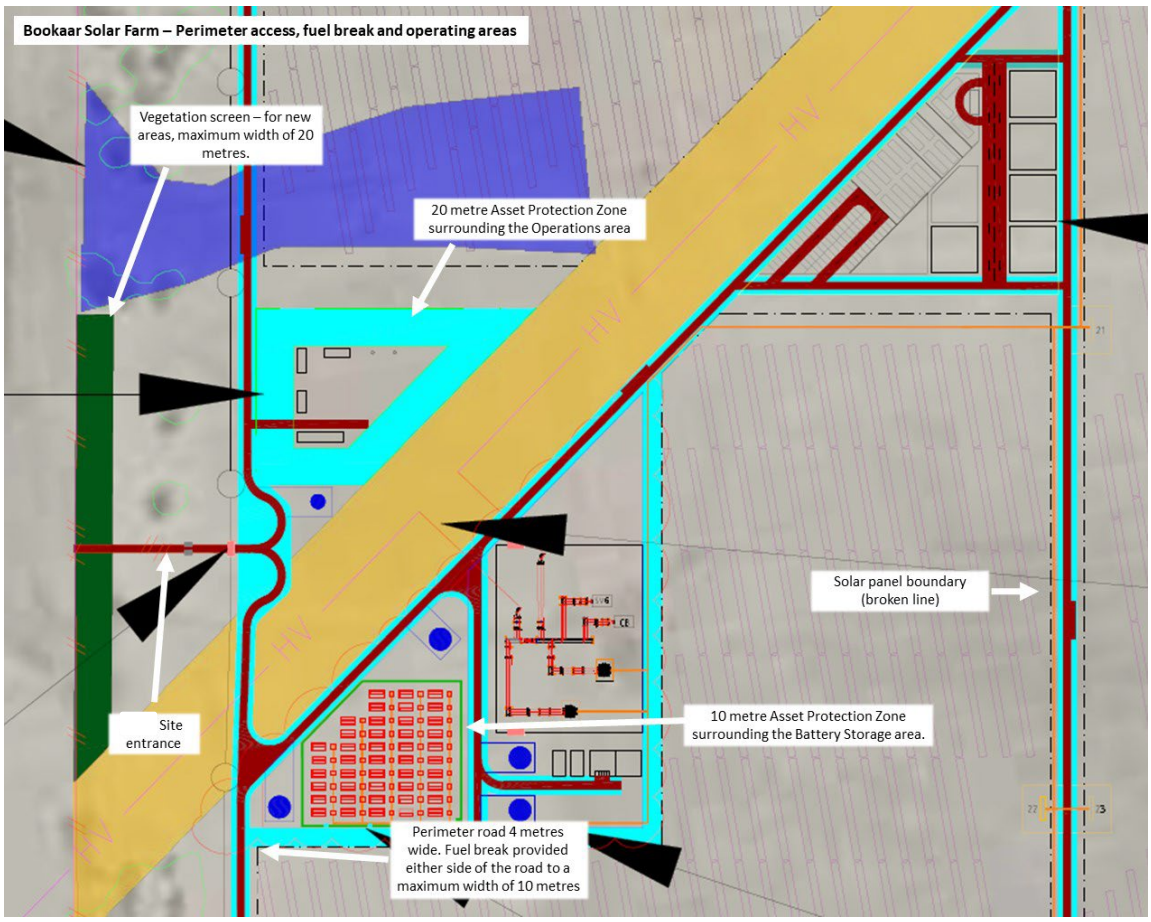


Figure 19 - Example of bushfire mitigation measures at the Substation and Operations Buildings location

9.2 Recommendations for the construction phase

Below is a summary of mitigation recommendations for the construction phase of the Proposal. These have been developed based on the Fire Risk Assessment, the assessment under clause 13.02, and the requirements of the CFA Guidelines.

1. A Fire Management Plan (see Appendix A) to be formulated and updated which outlines risk control measures required to be implemented within the development.

2. Ensure on site staff and contractors are familiar with the Fire Management Plan.

3. Ensure the development of an Emergency Management Plan in consultation with the CFA before development starts.

4. Ensure on site staff and contractors are familiar with and adhere to the Emergency Management Plan.

5. Establish emergency assembly areas as part of the Site's Emergency Management Plan.

6. The Site's policies and procedures must ensure that all activities undertaken during the Fire Danger Period are appropriate under the Corangamite Shire bylaws and CFA legislation

7. Install emergency information containers at all entry points that includes information required by CFA's Renewable Energy Guidelines.

8. Consider appropriate signage to be placed throughout the Site to guide visitors and emergency services personnel during emergencies.

9. Ensure all new staff, contractors and site visitors (as required) undergo a site induction informing them of the Site layout, fire response procedures that follow identified legislative requirements, policies and procedures.

10. Establish a primary contact person for the community to contact Bookaar Solar Energy Facility with fire concerns, questions or issues.

11. Solar Energy Facility management to engage with CFA to encourage residents to prepare Bushfire Survival Plans as per CFA standard practice and prepare themselves for bushfire.

12. Solar Energy Facility management share information with adjoining landowners to help ensure they are aware of pre-summer fire prevention and preparedness activities.

13. Monitoring of the local area during elevated fire danger conditions to detect bushfires early.

14. At regular intervals, engage with the local CFA Fire Brigade and inform them of the status of the construction and provide an opportunity to undertake Site familiarisation visits as required.

15. Provide appropriate bushfire training for contractors and staff.

16. During the Fire Danger Period, all employees and contractors have firefighting equipment (9 litre water fire extinguisher or knapsack) installed within their vehicles along with communications devices.

17. Ensure all contractors:

    a. Are appropriately briefed and understand their legal obligations in relation to managing bushfire risks.

    b. Have appropriate procedures, safe work practices, contingency plans, and Material Safety Data Sheets (MSDS) for the operation of all equipment, chemicals, and flammable materials that may contribute to bushfires.

    c. Have appropriate “initial” suppression equipment available on site, this may include two 4WD vehicles fitted with ‘Slip On’ units that contain a water tank and firefighting pump. Additional equipment including fire extinguishers, hoses and branches to be provided.

18. Enact On-Site risk reduction strategies including no smoking, limitations on hot works during elevated fire danger days and other measures to reduce the potential for a fire to start on the Site.

19. Ensure all building construction is in line with the relevant legislation including AS3959.

20. All equipment for the Solar Facility and the BESS will be installed in accordance with the manufacturer’s specifications and relevant Australian Standards.

21. Carryout a commissioning program for electrical equipment that includes checking for faults and incorrect installation.

22. Ensure maintenance of the 'Safer Location' situated at the location of the Operations' Buildings Area.

23. Ensure that all works undertaken during the fire danger season have appropriate permits.

24. Ensure the maintenance of grassland/groundcover within the Solar Energy Facility area (including within the drains) is kept at a height of 100mm or below during the Fire Danger Period.

25. On days of elevated fire danger, ensure staff and contractors are aware of the importance of early notification to emergency services of a bushfire in the local area.

26. Following transportation to the Site, any infrastructure with Dangerous Goods will be inspected to ensure it has not been damaged during transportation.

27. In response to the Dangerous Goods (Storage and Handling) Regulations (2012), prior to construction further consultation with the fire brigade will be sought to confirm the outcomes of the dangerous goods assessment in the RMP.

28. Dangerous Goods are to be stored in line with manufacturer's specifications to ensure its integrity.

29. The products classified as a Dangerous Good will be listed within the Site's Dangerous Goods register and the site operators will be aware of the locations and quantities of Dangerous Goods.

30. The Emergency Management Plan will include details of the hazards associated with dangerous goods and appropriate procedures in response to the RMP, including leak management and other response arrangements to Dangerous Goods related emergencies.

31. Ensure appropriate bunding in areas where there is potential for flammable fuels and oils to leak, including the battery area and beneath or within transformers.

9.3 Recommendations for the operational phase

Below is a summary of mitigation recommendations for the operational phase of the Proposal. These have been developed based on the Fire Risk Assessment, the assessment under clause 13.02, and the requirements of the CFA Renewable Energy Guidelines.

1. A Fire Management Plan (see Appendix A) to be formulated and updated which outlines risk control measures required to be implemented within the development.

2. The Fire Management Plan is to ensure all annual fire danger season preparedness activities and prevention works are completed before the annual Fire Danger Period (see Section 9.4 below).

3. The development of an Emergency Management Plan in consultation with the CFA before the operational phase starts.

4. The Site's policies and procedures must ensure that all activities undertaken during the Fire Danger Period are appropriate under the Corangamite Shire bylaws and CFA legislation.

5. The provision of an Emergency Information Book and Emergency information containers at each access point to the Site.

6. Ensure all new staff, contractors and site visitors (as required) undergo a site induction informing them of the Site layout, fire response procedures that follow identified legislative requirements, policies and procedures.

7. Ensure on site staff and contractors are familiar with and adhere to the Emergency Management Plan (see Section 9.5 below).

8. Liaise with the local CFA Brigades and Groups to familiarise them with the Proposal's construction programme to become familiar with access and egress of the Site. Ensure the CFA are aware of the contents of the emergency information containers and why this is important to review prior to accessing the Site.

9. Monitoring and Maintenance programs will be enacted to ensure all infrastructure within the Solar Energy Facility and BESS is maintained in accordance with the manufacturer's specifications and the relevant Australian Standards.

10. Implement fire detection systems, inbuilt fire protection systems, remote alarms and notification systems within the energy storage facility.

11. Implement remote shut down possibilities of Solar Energy Facility operations during high bushfire risk days, actual bushfires or during times of electrical fault.

12. Ensure maintenance of the 'Safer Location' situated at the Operations' Buildings Area.

13. Maintain the eight firefighting water tanks during the operation of the Solar Energy Facility and ensure they are capable of being filled within 24 hours post use.

14. Ensure the maintenance of grassland/groundcover within the Solar Energy Facility area (including within the drains) is kept at a height of 100mm or below during the Fire Danger Period.

15. Ensure all access roads and tracks are maintained to meet CFA standards for emergency vehicle access, including adequate signage.

16. Ensure vegetation screens on site are managed with bushfire risk considered. Species selected and planted should not increase the fire risk and the maintenance of screening should adhere to the guidance found in Appendix D.

17. Undertake regular inspections and maintain records of all solar installations, substations, electrical infrastructure (including lines within easements).

18. During the Fire Danger Period, all employees and contractors have firefighting equipment (9 litre water fire extinguisher or knapsack) installed within their vehicles along with communications devices.

19. The Fire Water Runoff Storage System will be regularly checked and maintained to ensure its integrity and that is remains in working order.

20. On site firefighting capability consisting of two first attack vehicles. The first attack firefighting capability will see the installation of 'slip on' units onto the rear of two 4WD vehicles (utes) during the fire danger period, that will consist of a water tank and pump. Appropriate fire extinguishers, hoses and branches will be provided.

21. Fire extinguishers to be provided to the office and other work areas.

22. Ensure staff and contractors are trained to use the firefighting equipment and have appropriate personal protective clothing.

23. On-Site staff (and contractors if applicable) will be trained in the procedures to use the Fire Water Runoff Storage System.

24. Enact On-Site risk reduction strategies including no smoking, limitations on hot works during elevated fire danger days and other measures to reduce the potential for a fire to start on the Site.

25. Liaise with the local CFA Brigades and Groups to familiarise them with the Proposal's operations and infrastructure including an annual invitation to become familiar with access and egress of the Site. Ensure the CFA are aware of the contents of the emergency information containers and why this is important to review prior to accessing the Site.

26. Solar Energy Facility management to engage with CFA to encourage residents to prepare Bushfire Survival Plans as per CFA standard practice and prepare themselves for bushfire.

27. Solar Energy Facility management share information with adjoining landowners to help ensure they are aware of pre-summer fire prevention and preparedness activities.

28. Monitoring of the local area to be undertaken during elevated fire danger conditions to detect bushfires early.

29. On days of elevated fire danger, ensure staff and contractors are aware of the importance of early notification to emergency services of a bushfire in the local area.

30. Where possible, the use of technology solutions to support remote operation to reduce the number of employees on site during 'extreme' and 'code red' fire risk days will be implemented.

31. The products classified as a Dangerous Good will be listed within the Site's Dangerous Goods register and the site operators will be aware of the locations and quantities of Dangerous Goods.

32. Maintenance programs will be enacted to ensure all infrastructure that contains Dangerous Goods will be maintained in accordance with the manufacturer's specifications and the relevant Australian Standards.

33. The Emergency Management Plan will include details of the hazards associated with dangerous goods and appropriate procedures in response to the RMP, including leak management and other response arrangements to Dangerous Goods related emergencies.

9.4 Fire Management Plan

The risk assessment identified that the ongoing management of fire risk is critical. The Fire Management Plan is the plan that outlines the specific activities required to be completed to mitigate the risk of fire. It would be expected for this plan to be incorporated into the Site's management plans. The introduction of a Solar Energy Facility and BESS requires the ongoing management of risk, and the Fire Management Plan provides the process to achieve this. The Plan is provided in Appendix A.

One of the key focus areas of the Fire Management Plan is the management of vegetation on the Site. The management of vegetation will limit the ability for a fire to enter or leave the Site or escalate within it.

The Plan also outlines the method of managing the Vegetation Screen that is proposed to be created along the boundary with other private land and in some locations along the roadside.

9.5 Emergency Management Plan

The Bookaar Solar Energy Facility and BESS Emergency Management Plan outlines the roles of staff (and contractors) and how to respond to an emergency at the Site. The aim of this plan is to document preparedness and response requirements for the Bookaar Solar Energy Facility and BESS in order to minimise the impact of fires in, or threatening the area, so reducing the fire threat to life, property and the environment.

The Plan outlines the background, context and general management arrangements for responding to emergencies on site, ranging from a single incident to more complex, major emergencies. It provides a general understanding of the resources and access challenges for responding to emergencies and details general arrangements that can be utilised to support existing processes and procedures for response.

The Emergency Management Plan is being developed and will be provided in the future.

10 Conclusion

The Bookaar Solar Energy Facility and BESS will be constructed approximately 10 kilometres north of Camperdown in south west Victoria. The area is dominated by farming activities, and whilst it has not been impacted by major fires, similar areas in south west Victoria have been impacted by bushfires.

Due to the potential for fires to impact on this area, and to meet the requirements of Clause 13.02-1S – Bushfire Planning, the Site and surrounding landscape has been assessed through a desktop assessment and Site visit. The assessment considered a number of key documents to ensure that the assessment and mitigation requirements would meet the standards of the CFA's Renewable Energy Guidelines and would address issues raised in a VCAT decision for a Previous Application at the Site.

Clause 13.02-1S and CFA's Guidelines were the key documents to ensure the location of the Solar Energy Facility was appropriate and the design considered CFA's requirements. To support these assessments, landscape bushfire scenarios were identified, ignition sources on the Site were determined, and a level of risk was ascertained. Mitigation treatments were then recommended for each stage of the Proposal's life, and adopted as part of the Solar Energy Facility and BESS design.

The outcome of this fire risk assessment is that there is no increase in fire risk associated with the development of the Proposal. Whilst the risk of ignitions is greater due to the introduction of electrically charged equipment, the implementation of mitigation recommendations including vegetation management and perimeter fire breaks will reduce the potential for a fire to escalate on the Site. These treatments will also limit the ability for a bushfire to enter or exit the Site.

In conclusion, the assessment demonstrates how the Proposal has responded to this fire risk assessment, and that the Proposal will not increase the bushfire risk in the surrounding area.

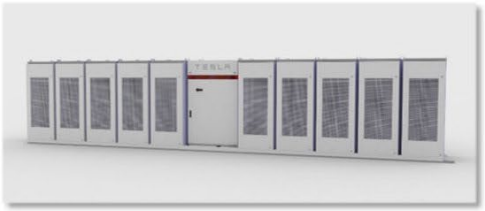
Appendix A – Fire Management Plan

Attached separately.

Appendix B – Lithium-Ion Battery Emergency Response Guide

POWERWALL

MEGAPACK



POWERPACK

Lithium-Ion Battery Emergency Response Guide

For Tesla Energy Products Powerwall, Powerpack, and Megapack

PRODUCT SPECIFICATIONS

All specifications and descriptions contained in this document are verified to be accurate at the time of printing. However, because continuous improvement is a goal at Tesla, we reserve the right to make product or documentation modifications at any time, with or without notice.

The images provided in this document are for demonstration purposes only. Depending on product version and market region, details may appear slightly different.

This document does not create contractual obligations for Tesla or its affiliates, except to the extent expressly agreed in a contract.

LATEST REVISIONS

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ERRORS OR OMISSIONS

To communicate inaccuracies or omissions in this document, reach out to your Tesla representative.

1 Introduction and Scope

This guide serves as a resource for emergency responders and Authorities Having Jurisdiction (AHJs) with regards to safety surrounding Tesla Energy Products. This guide should also be reviewed by customers, site managers, and operators to ensure a clear understanding of the hazards and procedures to follow in case of emergencies.

Tesla Energy Products are defined as rechargeable lithium-ion battery energy storage products designed, manufactured, and sold by Tesla, and include products such as Megapack, Powerpack, and Powerwall. The information and recommendations set forth are made in good faith and believed to be accurate as of the date of preparation. TESLA, INC. makes no warranty, expressed or implied, with respect to this information.

This guide is available in various languages as indicated below. Information in this guide is periodically updated and translations are periodically added. Check the Tesla First Responders Information page at *https://www.tesla.com/firstresponders* for the latest revision of this guide and any additional translations.

English	Deutsch	Español	Français
עברית	Italiano	日本語	한국어
Nederlands	简体中文	繁體中文	Português
Slovenščina			

2 Company, Contact, & Product Info

2.1 Identification of Company and Contact Information

Table 1. Company and Contact Information

Products	Tesla Energy Products, designed for residential, commercial, and industrial/utility energy applications, and modules and sub-assemblies that can be installed in such products. Descriptions and specific part numbers are listed in *Product Descriptions* on page 7.	
Locations	Headquarters (USA)	13101 Tesla Road Austin, TX 78725 USA Tel. No. +1 512-516-8177 (do not use for emergencies; see below)
	Europe and Africa	Burgemeester Stramanweg 122 1101EN Amsterdam, The Netherlands Tel. No. +31 20 258 3916 (do not use for emergencies; see below)
	Australia and Asia	Level-14, 15 Blue Street North Sydney NSW, 2060, Australia Tel. No. 1800 686 705 (do not use for emergencies; see below)
	Manufacturer (USA)	13101 Tesla Road Austin, TX 78725 USA Tel. No. +1 512-516-8177 (do not use for emergencies; see below)
Emergency Contacts	CHEMTREC	For Hazardous Materials (or Dangerous Goods) Incidents: Spill, Leak, Fire, Exposure, or Accident Call CHEMTREC Day or Night Within USA and Canada: 1-800-424-9300 Contract Number: CCN204273 Outside USA and Canada: (international prefix) +1 703-741-5970 (collect calls accepted)
	Tesla Energy Technical Support Contacts	Powerpack & Megapack: • Hotline numbers:

		◦ North America (24x7): +1 650-681-6060 ◦ Asia/Australia/New Zealand (24x7): +61 2 432 802 81 ◦ Europe/Middle East/Africa (24x7): +31 2 08 88 53 32 ◦ Japan: +0120 312-441 ◦ France: +33 173218702 ◦ The Netherlands: +31 208885332 ◦ Slovenia: +38 617778699 ◦ South Africa: +27 213004878 ◦ Switzerland: +41 445155607 ◦ United Kingdom: +44 1628450645 • Email support: *IndustrialStorageSupport@tesla.com* Powerwall: • Hotline numbers: ◦ North America (24x7): +1 877-961-7652 ◦ Asia/Australia/New Zealand (24x7): +61 2 432 802 81 ◦ Germany: +49 8955 0520235 ◦ Italy: +39 028 731 7132 ◦ South Africa: +27 87 550 3480 ◦ Switzerland: +41 618 553028 ◦ United Kingdom: +44 162 845 0630 • Email support: ◦ North America: *PowerwallSupportNA@tesla.com* ◦ Australia/New Zealand: *PowerwallSupportNA@tesla.com* ◦ Japan: *EnergyCustomerSupportJP@tesla.com* ◦ Europe/Middle East/Africa: *EnergySupportEmea@tesla.com*

2.2 SDS Information

Safety Data Sheets (SDS) are a sub-requirement of the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard, 29 CFR Subpart 1910.1200. This Hazard Communication Standard does not apply to various subcategories including anything defined by OSHA as an "article." OSHA has defined "article" as a manufactured item other than a fluid or particle; (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities (e.g., minute or trace amounts) of a hazardous chemical, and does not pose a physical hazard or health risk to employees.

Tesla Energy Products referenced herein meet the OSHA definition of "article." Thus, they are exempt from the requirements of the Hazard Communication Standard and do not require an SDS per OSHA.

NOTE: For projects in Australia or New Zealand, contact your Tesla representative for the product's safety data sheet.

Tesla Energy Products contain sealed lithium-ion battery cells (cells) that are similar to rechargeable batteries in many consumer electronic products.

Cells each contain lithium-ion electrodes, which can be composed of:

- Lithium Nickel Cobalt Aluminum Oxide (NCA material), LiNixCoyAlzO2;
- Lithium Nickel, Manganese, Cobalt Oxide (NMC material) LiNixMnyCozO2;
- Lithium Iron Phosphate (LFP material) LiFePO4;
- Lithium Nickel, Manganese Oxide (NMO material), LiNixMnyO2
- Lithium Cobalt Oxide, LiCoO2;
- or a mixture of these compounds

THE CELLS AND BATTERIES DO NOT CONTAIN METALLIC LITHIUM. Individual cells have nominal voltages of up to approximately 3.6 V.

Tesla Energy Products also include sealed thermal management systems containing coolants and/or refrigerants. Safety Data Sheets (SDS) are available for these liquid materials. Scan the QR code below or go directly to *MSDSonline* and enter the Product Name or CAS# to find the appropriate datasheet.

Figure 1. MSDSonline - SDS Search

Table 2. Thermal Contents

Non-Cell Materials with SDS found in Tesla Energy Products	Approximate Quantity
Ethylene glycol 50/50 mixture with water	Powerwall 1: 1.6 L of 50/50 mixture Powerwall 2: 2.3 L of 50/50 mixture Powerpack 1: 22 L of 50/50 mixture Powerpack 2: 26 L of 50/50 mixture Powerwall+: 2.3 L of 50/50 mixture Powerpack Inverter: 11 L of 50/50 mixture Powerpack Pod module: None Megapack: 540 L of 50/50 mixture Megapack battery module: 20 L of 50/50 mixture

Non-Cell Materials with SDS found in Tesla Energy Products	Approximate Quantity
	Megapack 2: 360 L of 50/50 mixture Megapack 2 battery module: 20 L of 50/50 mixture Megapack 2 XL: Up to 400 L of 50/50 mixture Megapack 2 XL battery module: 20 L of 50/50 mixture
R-134a: 1,1,1,2-Tetrafluoroethane refrigerant	Powerwall 1, 2: None Powerwall+: None Powerpack 1, 2: 400 g Powerpack Pod module: None Megapack: 7.6 kg Megapack battery module: None Megapack 2: 7.6 kg Megapack 2 battery module: None Megapack 2 XL: Up to 3.0 kg Megapack 2 XL battery module: None

2.3 Product Descriptions

Individual lithium-ion cells are connected to form modules. Modules are battery sub-assemblies. These modules are installed in Tesla Energy Products. Approximate specifications of Tesla Energy Products are listed below.

2.3.1 Powerwall and Powerwall+

Powerwall is Tesla's battery system for residential and light commercial use. Powerwall+ is an integrated solar battery system that includes a Powerwall 2 for storage. Wherever "Powerwall" is mentioned, it applies to both Powerwall and Powerwall+ units unless otherwise noted.

NOTE: Images below are indicative representations designed to assist with product identification. Existing product models may vary.

Figure 2. Powerwall (Left) and Powerwall+ (Right)

Figure 3. Example of a Powerwall Installed on a House

Table 3. Approximate Powerwall Specifications

Part Number (Reman Number if available)	Description	Module Voltage – as shipped (V)	Max System DC Voltage	Max System AC Voltage	Weight	Height	Width	Depth
Powerwall 1 Versions								
1050100-x*y*-z*	POWERWALL, 2KW, 7KWH	<40 (DC)	450 (DC)	-	95 kg (210 lb)	130 cm (51 in)	86 cm (34 in)	18 cm (7 in)
1067000- x*y*-z*	POWERWALL, 3.3KW, 7KWH	<40 (DC)	450 (DC)	-	95 kg (210 lb)	130 cm (51 in)	86 cm (34 in)	18 cm (7 in)
1068000-x*y*-z*	POWERWALL, 6.6KW, 10KWH	<40 (DC)	450 (DC)	-	101 kg (223 lb)	130 cm (51 in)	86 cm (34 in)	18 cm (7 in)
** The 8th or 9th digit could be any number or letter and the 10th digit could be any letter.*								
Powerwall 2 Versions								
1092170-x*y*-z*	AC POWERWALL	<40 (DC)	450 (DC)	300 (AC)	114 kg (251.3 lb)	115 cm (45.3 in)	75 cm (29.6 in)	14 cm (5.75 in)
1112170-x*y*-z*	DC POWERWALL	<40 (DC)	450 (DC)	-	115 kg (254 lb)	112 cm (44 in)	74 cm (29 in)	14 cm (5.5 in)
2012170-x*-y*-z*	AC POWERWALL	<40 (DC)	450 (DC)	300 (AC)	114 kg (251.3 lb)	115 cm (45.3 in)	75 cm (29.6 in)	14 cm (5.75 in)

Part Number (Reman Number if available)	Description	Module Voltage – as shipped (V)	Max System DC Voltage	Max System AC Voltage	Weight	Height	Width	Depth
3012170-x*-y*-z*	AC POWERWALL	<40 (DC)	450 (DC)	300 (AC)	114 kg (251.3 lb)	115 cm (45.3 in)	75 cm (29.6 in)	14 cm (5.75 in)
** The 8th or 9th digit could be any number or letter and the 10th digit could be any letter.*								
Powerwall+ Versions								
2012170-x*-y*-z*	POWERWALL+	<40 (DC)	450 (DC)	300 (AC)	140 kg (310 lb)	159.6 cm (62.8 in)	75.5 cm (29.7 in)	16 cm (6.3 in)
3012170-x*-y*-z*	POWERWALL+	<40 (DC)	450 (DC)	300 (AC)	140 kg (310 lb)	159.6 cm (62.8 in)	75.5 cm (29.7 in)	16 cm (6.3 in)
** The 8th or 9th digit could be any number or letter and the 10th digit could be any letter.*								

2.3.2 Powerpack

Powerpack is Tesla's energy storage system for commercial and industrial use.

NOTE: Images below are indicative representations designed to assist with product identification. Existing product models may vary.

Figure 4. Powerpack: Units and Inverter

1. Powerpack Units (include lithium-ion cells)
2. Powerpack Inverter

Figure 5. Example of a Powerpack Site

Table 4. Approximate Powerpack Specifications

Part Number (Reman Number if available)	Description	Module Voltage – as shipped (V)	Max System DC Voltage	Max System AC Voltage	Weight	Height	Width	Depth
Powerpack 1 Versions								
1047404-x*y*-z*	POWERPACK (2hr continuous net discharge)	<30 (DC)	450 (DC)	480 (AC)	1680 kg (3700 lb)	219 cm (86 in)	97 cm (38 in)	132 cm (52 in)
1060119-x*y*-z*	POWERPACK (4hr continuous net discharge)	<30 (DC)	450 (DC)	480 (AC)	1665 kg (3670 lb)	219 cm (86 in)	97 cm (38 in)	132 cm (52 in)
1121229-x*y*-z*	POWERPACK (4hr continuous net discharge)	<30 (DC)	450 (DC)	480 (AC)	2160 kg (4765 lb)	219 cm (86 in)	97 cm (38 in)	132 cm (52 in)
** The 8th or 9th digit could be any number or letter and the 10th digit could be any letter.*								
Powerpack 1.5 Version								
1089288-x*y*-z*	POWERPACK 1.5 C/2 SYSTEM	<30 (DC)	960 (DC)	480 (AC)	1622 kg (3575 lb)	219 cm (86 in)	131 cm (51.5 in)	82 cm (32.5 in)
** The 8th or 9th digit could be any number or letter and the 10th digit could be any letter.*								
Powerpack 2 / 2.5 Versions								
1083931-x*y*-z* (1130518-x*y*-z*)	POWERPACK 2,C/4 SYSTEM	<30 (DC)	960 (DC)	480 (AC)	2160 kg (4765 lb)	219 cm (86 in)	131 cm (51.5 in)	82 cm (32.5 in)

Part Number (Reman Number if available)	Description	Module Voltage – as shipped (V)	Max System DC Voltage	Max System AC Voltage	Weight	Height	Width	Depth
1083932-x*y*-z*	POWERPACK 2,C/2 SYSTEM	<30 (DC)	960 (DC)	480 (AC)	2160 kg (4765 lb)	219 cm (86 in)	131 cm (51.5 in)	82 cm (32.5 in)
1490025-x*y*-z*	POWERPACK 2.5,C/4 SYSTEM	<30 (DC)	960 (DC)	480 (AC)	2160 kg (4765 lb)	219 cm (86 in)	131 cm (51.5 in)	82 cm (32.5 in)
1490026-x*y*-z*	POWERPACK 2.5,C/2 SYSTEM	<30 (DC)	960 (DC)	480 (AC)	2160 kg (4765 lb)	219 cm (86 in)	131 cm (51.5 in)	82 cm (32.5 in)
1490027-x*y*-z*	POWERPACK 2.5,C/2 SYSTEM	<30 (DC)	960 (DC)	480 (AC)	2160 kg (4765 lb)	219 cm (86 in)	131 cm (51.5 in)	82 cm (32.5 in)
** The 8th or 9th digit could be any number or letter and the 10th digit could be any letter.*								
Spare Parts								
N/A	POWERPACK POD MODULE	<30 (DC)	960 (DC)	N/A	98 kg (215 lb)	12 cm (5 in)	100 cm (39 ½ in)	75 cm (29 ½ in)

2.3.3 Megapack

Megapack is Tesla's all-in-one utility-scale energy storage system.

NOTE: Images below are indicative representations designed to assist with product identification. Existing product models may vary.

Figure 6. Megapack

Figure 7. Example of a Megapack Site

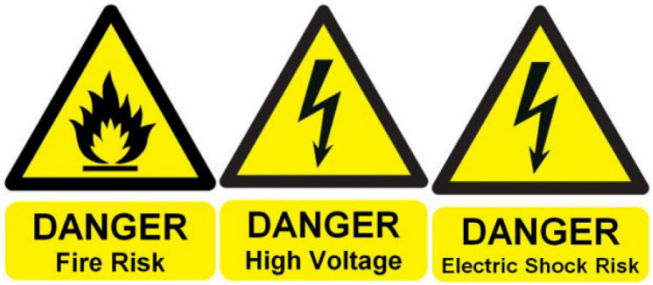
Table 5. Approximate Megapack Specifications

Part Number (Reman Number if available)	Description	Module Voltage – as shipped (V)	Max System DC Voltage	Max System AC Voltage	Weight	Height	Width	Depth
Megapack (all versions - dimensions as measured for enclosure envelope for 1462965-x*y*-z*)								
1462965-x*y*-z*	MEGAPACK	<450 (DC)	960 (DC)	518 (AC)	25,400 kg (56,000 lb) (max)	252.2 cm (99 ¼ in)	716.8 cm (282 ¼ in) (length)	165.9 cm (65 ¼ in)
1748844-x*y*-z*	MEGAPACK 2	480 (AC)	<1230 (DC)	480 (AC)	30,500 kg (67,250 lb) (max)	250.6 cm (98 ¾ in)	725.0 cm (285 ½ in) (length)	163.7 cm (64 ½ in)
1848844-x*y*-z*	MEGAPACK 2 XL	480 (AC)	<1230 (DC)	480 (AC)	38,100 kg (84,000 lb)	278.5 cm (110 in)	880 cm (346 ½ in)	165 cm (65 in)
** The 8th or 9th digit could be any number or letter and the 10th digit could be any letter.*								
Spare Parts								
N/A	MEGAPACK BATTERY MODULE	<450 (DC)	960 (DC)	N/A	1,085 kg (2,400 lb)	66 cm (26 in)	81 cm (32 in)	149 cm (59 ½ in)
N/A	MEGAPACK 2 BATTERY MODULE	480 (AC)	<1230 (DC)	480 (AC)	1,250 kg (2,760 lb)	67 cm (26 ½ in)	81 cm (32 in)	149 cm (59 ½ in)

Part Number (Reman Number if available)	Description	Module Voltage – as shipped (V)	Max System DC Voltage	Max System AC Voltage	Weight	Height	Width	Depth
N/A	MEGAPACK 2 XL BATTERY MODULE	480 (AC)	<1230 (DC)	480 (AC)	1,250 kg (2,760 lb)	67 cm (26 ½ in)	81 cm (32 in)	149 cm (59 ½ in)

3 Handling, Use, & Hazard Precautions

3.1 General Precautions



The products described by this document are dangerous if mishandled. Injury to property or person, including loss of life is possible if mishandled.

Tesla Energy Products contain lithium-ion batteries. A battery is a source of energy. Do not short circuit, puncture, incinerate, crush, immerse, force discharge or expose to temperatures above the declared operating temperature range of the product. An internal or external short circuit can cause significant overheating and provide an ignition source resulting in fire, including surrounding materials or materials within the cell or battery. Under normal conditions of use, the electrode materials and electrolyte they contain are not exposed, provided the battery integrity is maintained and seals remain intact. Risk of exposure may occur only in cases of abuse (mechanical, thermal, electrical).

3.2 High-Voltage Hazards

Under normal conditions of use, provided that a Tesla Energy Product enclosure remains closed, handling the product does not pose an electrical hazard. Numerous safeguards have been designed into Tesla Energy Products to help ensure that the high voltage battery is kept safe and secure as a result of a number of expected abuse conditions. All of the constituent component battery cells are sealed within the product as sub-groups within enclosures (Pods for Powerpack or battery modules for Megapack).

In Powerpack and Megapack, the exterior of each Pod/battery module is isolated from internal components and connectors are touch-safe. Pods are then installed in a rigid metal enclosure, which is isolated from high voltage. Megapack battery modules are similarly sealed and cannot be accessed from the exterior. In the Powerwall, the module is contained within the unit and not accessible to non-Tesla personnel. Access to these components is limited to Tesla-authorized personnel only.

A Tesla Energy Product may pose a significant high voltage and electrocution risk if the outer enclosure, Pod / battery module enclosures and/or safety circuits have been compromised or have been significantly damaged. A battery pack, even in a normally discharged condition, is likely to contain substantial electrical charge and can cause injury or death if mishandled. If a Tesla Energy Product has been significantly visibly damaged or its enclosure compromised, practice appropriate high-voltage preventative measures until the danger has been assessed (and dissipated if necessary).

WARNING: NEVER CUT INTO A SEALED TESLA ENERGY PRODUCT ENCLOSURE due to the high voltage and electrocution risks.

For proper installation / removal instructions please contact the Tesla Service Support team (*Identification of Company and Contact Information* on page 4).

3.3 Hazards Associated with Mechanical Damage

Mechanical damage to Tesla Energy Products can result in a number of hazardous conditions (discussed below) including:

- Leaked battery pack coolant (see *Hazards Associated with Leaked Coolant* on page 18)
- Leaked refrigerant (Powerpack System and Megapack only, see *Hazards Associated with Leaked Refrigerant (Powerpack and Megapack Only)* on page 18)
- Leaked cell electrolyte (see *Hazards Associated with Leaked Electrolyte* on page 19)
- Rapid heating of individual cells due to exothermic reaction of constituent materials (cell thermal runaway), venting of cells, and propagation of self-heating and thermal runaway reactions to neighboring cells.
- Fire

To prevent mechanical damage to Tesla Energy Products, these items should be stored in their original packaging when not in use or prior to being installed (see *Storage Precautions* on page 29).

3.4 Hazards Associated with Elevated Temperature Exposure

Tesla Energy Products are designed to withstand operating ambient temperatures up to 50°C (122°F), with up to 100% operating humidity (condensing), and storage temperatures up to 60°C (140°F) and <95% relative humidity (non-condensing) for up to 24 hours without affecting the health of the unit.

Prolonged exposure of Tesla Energy Products to temperatures beyond that can drive battery cells into thermal runaway and result in a fire. Exposure of battery packs to localized heat sources such as flames could result in cell thermal runaway reactions and should be avoided.

3.5 Hazards Associated with Leaked Coolant

Thermal management of Tesla Energy Products is achieved via liquid cooling using a 50/50 mixture of ethylene glycol and water. A typical Powerpack battery unit includes about 26 L of coolant (Powerpack 2/2.5) or about 22 L of coolant (Powerpack 1). A typical Powerwall unit includes about 1.6 L of coolant (Powerwall 1) or about 2.3 L of coolant (Powerwall 2). The Powerpack Inverter (fully populated) includes about 11 L of coolant. A typical Megapack includes about 540 L of coolant. A typical Megapack 2 includes about 360 L of coolant. Mechanical damage of a Tesla Energy Product that has been installed could result in leakage of the coolant. The fluid may be blue, green, or orange in color and does not emit a strong odor.

For information regarding the toxicological hazards associated with ethylene glycol, as well as ecological effects and disposal considerations, refer to the specific Safety Data Sheet (SDS) for battery coolant.

Extended exposure of a Tesla Energy Product to leaked coolant could cause additional damage to the product such as corrosion and compromise of protection electronics.

3.6 Hazards Associated with Leaked Refrigerant (Powerpack and Megapack Only)

The Powerpack and Megapack thermal management system includes 400 g and 7.6 kg respectively of R-134a: 1,1,1,2-Tetrafluoroethane refrigerant in a sealed system. Mechanical damage of a Powerpack or Megapack could result in a release of the refrigerant. Such a release would appear similar to the emission of smoke.

For information regarding the toxicological hazards associated with R-134a, as well as ecological effects and disposal considerations, refer to the specific Safety Data Sheet (SDS) for R-134a.

3.7 Hazards Associated with Leaked Electrolyte

The electrolyte within constituent cells includes a volatile hydrocarbon-based liquid and a dissolved lithium salt (which is a source of lithium ions) such as lithium hexafluorophosphate. The electrolyte in Tesla Energy Products' cells is largely absorbed in electrodes within individual sealed cells. The electrolyte reacts with those materials and is consumed during normal operation of the batteries. As such, the absence of free liquid electrolyte makes it impractical to report the volume of electrolyte within Tesla Energy Products.

The possibility of a spill of electrolyte from Tesla Energy Products is very remote. Electrolyte can be extracted from a single cell using a centrifuge, or under some extreme abuse conditions such as a severe crush. However, it is very difficult to mechanically damage cells in such a way as to cause leakage of electrolyte. Even if a single cell were damaged in a manner that could cause electrolyte leakage, it is extremely difficult to cause a leak from more than a few cells due to any incident. Furthermore, cells are connected into modules which are placed within a sealed steel compartmentalized enclosure. Each compartment has the capacity to contain liquid from a large number of individual cells. For the electrolyte liquid to come into contact with a user of a Tesla Energy Product, the external enclosure, the Pod/battery module enclosure, and the cell would have to be severely mechanically damaged. As such, Tesla Energy Products are deemed not to pose a liquid electrolyte release hazard.

Any released electrolyte liquid is likely to evaporate rapidly, leaving a white salt residue. Evaporated electrolyte is flammable and will contain alkyl-carbonate compounds. Leaked electrolyte is colorless and characterized by a sweet odor. If an odor is obvious, evacuate or clear the surrounding area and ventilate the area.

WARNING: AVOID CONTACT WITH ELECTROLYTE.

Leaked electrolyte solution is flammable and corrosive / irritating to the eyes and skin. If a liquid is observed that is suspected electrolyte, ventilate the area and avoid contact with the liquid until a positive identification can be made and sufficient protective equipment can be obtained (eye, skin, and respiratory protection). Chemical classifier strips can be used to identify the spilled liquid (electrolyte will contain petroleum/organic solvent and fluoride compounds).

In case of an electrolyte leak, the following protective equipment is recommended: an air purifying respirator with organic vapor/acid gas cartridges (e.g. P100 masks), safety goggles or a full-face respirator, and safety gloves (Butyl rubber or laminated film (e.g., Silver Shield)). Protective clothing should be worn. Use a dry absorbent material to clean up a spill.

NOTE: An acceptable exposure concentration of electrolyte has not been identified by the American Council of Governmental Industrial Hygienists (ACGIH). In case of electrolyte leakage from the battery, the oral (rat) LD50 is greater than 2 g/kg (estimated).

3.8 Hazards Associated with Vented Electrolyte

Lithium-ion cells are sealed units, and thus under normal usage conditions, venting of electrolyte should not occur. If subjected to abnormal heating or other abuse conditions, electrolyte and electrolyte decomposition products can vaporize and be vented from cells. Accumulation of liquid electrolyte is unlikely in the case of abnormal heating. Vented gases are a common early indicator of a thermal runaway reaction – an abnormal and hazardous condition.

If a suspicious odor is detected near a Tesla Energy Product, or, more generally, gases or smoke are observed escaping from a Tesla Energy Product, evacuate the area and notify a first responder team and/or the local fire department. Gases or smoke exiting a lithium-ion battery pack are likely flammable and could ignite unexpectedly as the condition that led to cell venting may also cause ignition of the vent gases. A venting Tesla Energy Product should only be approached with extreme caution by trained first responders equipped with appropriate personal protective equipment (PPE), as discussed in *Firefighter PPE* on page 24.

Cell vent gas composition will depend upon a number of factors, including cell composition, cell state of charge, and the cause of cell venting. Vent gases may include volatile organic compounds (VOCs) such as alkyl-carbonates, methane, ethylene, and ethane; hydrogen gas; carbon dioxide; carbon monoxide; soot; and particulates containing oxides of nickel, aluminum, lithium, copper, and cobalt. Additionally, phosphorus pentafluoride, POF3, and HF vapors may form.

WARNING: AVOID CONTACT WITH VENTED GASES.

Vented gases may irritate the eyes, skin, and throat. Cell vent gases are typically hot; upon exit from a cell, vent gas temperatures can exceed 600°C (1,110°F). Contact with hot gases can cause thermal burns. Vented electrolyte is flammable and may ignite on contact with a competent ignition source such as an open flame, spark, or a sufficiently heated surface. Vented electrolyte may also ignite on contact with cells undergoing a thermal runaway reaction.

4 In Case of Emergency

WARNING: In case of emergency, severe physical impact, or transportation accident, do not approach the product or open any of its doors.

WARNING: In case of severe physical impact or transportation accident, it may take time before any visible indication of an abnormal and hazardous condition (e.g. smoke or fire) can be observed. Contact Tesla Energy Technical Support for guidance (*Identification of Company and Contact Information* on page 4).

CAUTION: Response should only be performed by trained professionals.

4.1 During Storage or Operation

During storage or operation, cases of emergency include but are not limited to:

- Suspicious odor observed near a Tesla Energy Product
- Smoke or fire emanating from a Tesla Energy Product
- Severe physical impact on a Tesla Energy Product

In case of emergency, the following should be performed:

1. If possible, shut off the unit/system (see *Shutting Down in an Emergency* on page 25).
2. Evacuate the area.
3. If not already present, notify appropriately trained first responders, the local fire department, and any appointed subject matter expert (SME) if available.
4. Contact Tesla Energy Technical Support for guidance (*Identification of Company and Contact Information* on page 4).

4.2 During Transportation

During transportation, cases of emergency include but are not limited to:

- Suspicious odor observed near a Tesla Energy Product
- Smoke or fire emanating from a Tesla Energy Product
- Transportation accident causing a severe physical impact on a Tesla Energy Product
- Transportation accident leading to tipping over of a Tesla Energy Product

In case of emergency, the following should be performed:

1. If possible, move the unit/system to an open area and away from exposures (e.g. buildings, flammable material, or people).
2. Evacuate the area.
3. If signs of suspicious odor, smoke, or fire are detected, notify appropriately trained first responders, the local fire department, and any appointed subject matter expert (SME) if available.
4. Contact Tesla Energy Technical Support for guidance (*Identification of Company and Contact Information* on page 4).

5 Firefighting Measures

WARNING: Response should only be performed by trained professionals. In the event of a response to a Tesla product fire or hazardous event, contact Tesla Energy Technical Support for guidance (*Identification of Company and Contact Information* on page 4).

5.1 Responding to a Venting Tesla Energy Product

Smoke or suspicious odor emanating from a Tesla Energy Product can be an indication of an abnormal and hazardous condition. Battery thermal runaway fires are preceded by a period of smoke. The smoke is likely flammable and may ignite at any time. If fire, smoke, or suspicious odor is observed emanating from a Tesla Energy Product at any time, the following should be performed:

1. If possible, **shut off the unit/system** (see *Shutting Down in an Emergency* on page 25).
2. **Evacuate the area.**

   WARNING: When responding to a fire event with the **Powerpack System**, do not approach the Powerpack units from the front (door-side) or the rear. Perform all incident response from the sides of the units. Do not attempt to open the enclosure doors or come in contact with the units.

   WARNING: When responding to a fire event with **Megapack**, do not approach the unit and attempt to open any doors. The doors are designed to remain shut, and built-in deflagration vents in the roof of the unit will vent any smoke and flame out of the top of the unit and front thermal system intake louvers.
3. If not already done, **contact Tesla Energy Technical Support** for assistance (*Identification of Company and Contact Information* on page 4).
4. **Maintain a safe distance from the unit and monitor** (*Defensive Firefighting* on page 24) for evidence of continued smoke venting or fire.

   WARNING: There may be periods of up to three hours at a time during which the thermal runaway propagates from battery modules to battery modules. During such time, the battery may not generate visible signs of thermal event although the event can still be active and the battery can flare up.

   a. **If a fire has not developed** and only smoke is visible, take a defensive stance toward the system and be prepared to apply water spray **to neighboring exposures and neighboring battery enclosures.**
   b. **If a fire develops:**
      - **Continue to take a defensive stance toward the burning unit.** Applying water to the burning unit will only slow its eventual combustion (see *Defensive Firefighting* on page 24).
      - **If advised by Tesla, apply water to neighboring battery enclosures.** If communication cannot be established with Tesla, apply water at the discretion of first responders.
      - **At the discretion of first responders, apply water to other neighboring exposures.**
5. **Allow the battery pack to cool down** for a minimum of 12 hours after all fire and smoke has visibly subsided.

6. **Monitor the temperature** of the battery pack using a thermal imaging camera to determine if it is safe to interact with the unit.
7. Contact Tesla Energy Technical Support for next steps (*Identification of Company and Contact Information* on page 4).

5.2 Defensive Firefighting

Tesla's recommendation is to fight a Tesla Energy Product fire defensively. The fire crew should maintain a safe distance in any direction of at least:

- 5 m from Powerwall
- 10 m from Powerpack
- 20 m from Megapack

WARNING: Depending on the conditions of the event (such as location of the burning battery, wind speed and direction) a safe distance may be higher than those prescribed above.

As outlined in the procedure above, **the fire crew should allow the battery to burn itself out.** To further mitigate the spread of the hazards, Tesla may recommend the application of water spray to neighboring battery enclosures, and first responders may apply water spray to neighboring exposures. **Applying water directly to the affected enclosure will not stop the thermal runaway event, as the fire will be located behind several layers of steel material, and direct application of water has shown to only delay the eventual combustion of the entire unit.**

WARNING: In confined spaces, if water is used directly on the enclosure that is burning, electrolysis of water (splitting of water into hydrogen and oxygen) may contribute to the flammable gas mixture formed by venting cells, burning plastic, and burning of other combustibles.

Water spray has been deemed safe as an agent for use on exposed Tesla Energy Products. Water is considered the preferred agent for managing lithium-ion battery fires. Gaseous agents such as CO2, Halon, or dry chemical suppressants may temporarily suppress flaming of lithium-ion battery packs, but they will not cool lithium-ion batteries and will not limit the propagation of cell thermal runaway reactions. Metal fire suppressants such as LITH-X, graphite powder, or copper powder are not appropriate agents for suppressing fires involving lithium-ion battery packs as they are unlikely to be effective.

A battery fire may continue for several hours and it may take 24 hours or longer for the battery pack to cool after it has been fully consumed by a thermal runaway event. After all fire and smoke has visibly subsided for at least 12 hours, a thermal imaging camera can be used to actively measure the temperature of the unit and determine if it is safe to interact with.

5.3 Firefighter PPE

Firefighters should wear self-contained breathing apparatus (SCBA) and fire-protective turnout gear. Regulatory testing has shown that the products of combustion of Tesla Energy Products can include flammable and nonflammable gases. Based on those regulatory tests, the flammable gases were found to be below their lower flammable limit (LFL) and would not pose a deflagration or explosion risk to first responders or the general public. The nonflammable gases were found to be comparable to the smoke encountered in a typical Class A structure fire and do not contain any unique, or atypical, gases beyond what you would find in the combustion of modern combustible materials.

6 Shutting Down in an Emergency

WARNING: Shutting off power to a Tesla Energy Product does not de-energize the battery, and a shock hazard may still be present.

WARNING: If smoke or fire is visible, do not approach the product or open any of its doors.

WARNING: In case of flooding, stay out of the water if any part of the Tesla Energy Product or wiring is submerged.

To shut off the Powerpack System, Megapack, or Powerwall in an emergency, perform the appropriate steps and then contact Tesla (*Identification of Company and Contact Information* on page 4):

6.1 Powerpack System

1. If an external emergency stop (E-Stop) button or remote shutdown contact to the Powerpack is present, engage it.
2. If the Powerpack is serviced upstream by an external AC breaker or disconnect, open the breaker or disconnect.

6.2 Megapack

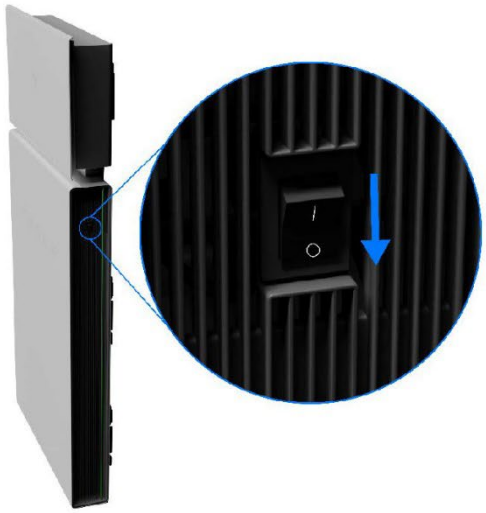
1. If an external E-Stop button or remote shutdown contact to the Megapack is present, engage it.
2. If the Megapack is serviced upstream by an external AC breaker or disconnect, open the breaker or disconnect.

6.3 Powerwall

If Safe to Access Switches and Breakers

1. If there is solar generation on-site, turn off the AC breaker for each inverter.
2. If an E-Stop button or external shutdown switch is present, engage it.
3. If it is safe to access the Powerwall(s), turn off each Powerwall using its on/off switch.

Figure 8. Powerwall+ On/Off Switch



4. Turn off the AC breaker for each Powerwall.
5. If there is a Backup Gateway installed, turn off the Backup Gateway breaker.

Figure 9. Powerwall+ and Backup Gateway 2

6. If the emergency affects the rest of the site, turn off the entire site by opening the main service disconnect(s).

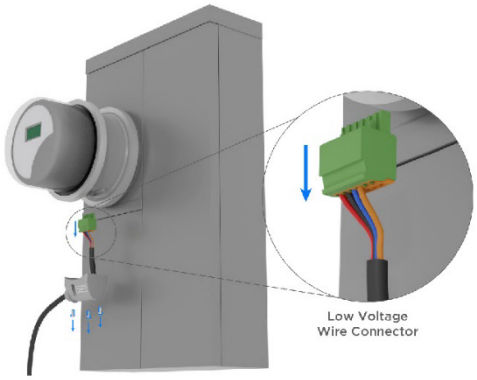
If Unable to Access Switches and Breakers

WARNING: Pulling the utility meter or Backup Switch from the meter socket is NOT a means of shutting down the Powerwall system. Do not pull the utility meter unless authorized to do so by the utility that owns it. Do not pull the Backup Switch unless authorized by Tesla.

To shut down the system in the event that Powerwall switches and/or breakers are not safely accessible:

1. If safe to do so, loosen the three (3) captive screws on the Backup Switch conduit hub and remove the conduit hub.
2. Pull the green low-voltage (<50 V) wiring connector to unplug OR cut the low voltage communication cable directly (cutting all four wires within the cable jacket) to force Powerwalls to cease charge/ discharge.

Figure 10. Low-Voltage Wire Connector



7 First Aid Measures

7.1 Electric Shock / Electrocution

Seek immediate medical assistance if an electrical shock or electrocution has occurred (or is suspected).

7.2 Contact with Leaked Electrolyte

The constituent battery cells are sealed. Contents of an open (broken) constituent battery cell can cause skin irritation and/or chemical burns. If materials from a ruptured or otherwise damaged cell or battery contact skin, flush immediately with water and wash affected area with soap and water. If a chemical burn occurs or if irritation persists, seek medical assistance.

For eye contact, flush with significant amounts of water for 15 minutes without rubbing and see a physician at once.

7.3 Inhalation of Electrolyte Vapors

If inhalation of electrolyte vapors occurs, move person into fresh air. If not breathing give artificial respiration and seek immediate medical assistance.

7.4 Vent Gas Inhalation

The constituent battery cells are sealed and venting of cells should not occur during normal use. If inhalation of vent gases occurs, move person into fresh air. If not breathing give artificial respiration. Seek immediate medical assistance.

8 Storage Precautions

Powerpack systems, Powerwalls, and sub-assemblies should be stored in approved packaging prior to installation. Megapack does not include packaging and can be stored as-shipped with a tarp.

Do not store Tesla Energy Products in a manner that allows terminals to short circuit (do not allow the formation of an electrically-conductive path).

Elevated temperatures can result in reduced battery service life. Tesla Energy Products can withstand ambient temperatures of -40°C to 60°C for up to 24 hours. However, Tesla Energy Products stored for longer than one month should be stored at ambient temperatures between -20°C and 30°C (-4°F and 86°F), at humidity <95%, and protected from condensation. Storing at temperatures outside the recommended range can result in degradation of product lifetime. Do not store Tesla Energy Products near heating equipment.

Ideally, a Tesla Energy Product should be stored at 50% state of charge (SOC) or less. Tesla Energy Products should not be stored for extended periods either at a full SOC or completely discharged since both conditions adversely impact battery life.

The storage area should be protected from flooding.

Long-term storage areas should be compliant with the appropriate local fire code requirements.

Acceptable storage density of battery packs and storage height of battery packs will be defined by the local authority having jurisdiction (AHJ). Requirements and limits will be based upon a number of factors including the structural and fire protection characteristics of the storage area and recommendations for fire protection promulgated by the National Fire Protection Association (NFPA) and similar organizations. At the time of this writing, no standard Commodity Classification has been defined for lithium-ion cells or battery packs (see 2016 NFPA 13: Standard for the Installation of Sprinkler Systems). Tesla products only have a 30-40 % state of charge (SOC) while in storage which reduces the energy impact on fire occurrences. As an example of the reduced energy, the 30% level has been determined to be acceptable for air flight shipping based upon extensive testing and analysis in conjunction with the FAA. Tesla recommends treating lithium-ion cells and batteries in packaging as equivalent to a Group A Plastic Commodity.

9 Damaged Product Handling

This section describes the handling, storage, and transportation of damaged Tesla Energy Products

If the event of damage to a Tesla Energy Product, contact Tesla immediately (*Identification of Company and Contact Information* on page 4**).**

If a Tesla Energy Product has been damaged (battery enclosure has been dented or compromised), it is possible that heating is occurring that may eventually lead to a fire. Damaged or opened cells/batteries can result in rapid heating (due to exothermic reaction of constituent materials), the release of flammable vapors, and propagation of self-heating and thermal runaway reactions to neighboring cells.

Before handling or transporting a damaged Tesla Energy Product, wait at least 24 hours. Smoke may be an indication that a thermal reaction is in progress. If no smoke, flame, sign of coolant leakage, or signs of heat has been observed for 24 hours, the Tesla Energy Product may be disconnected and moved to a safe location. To obtain specific instructions for evaluating, disconnecting, and preparing a damaged Tesla Energy Product for transport, please contact the Tesla Energy Technical Support (*Identification of Company and Contact Information* on page 4).

A damaged Tesla Energy Product should be monitored during storage for evidence of smoke, flame, sign of coolant leakage, or signs of heat. If full-time monitoring of the Product is not possible (for example during extended storage), the Product should be moved to a safe storage location.

A safe storage location for a damaged battery will be free of flammable materials, accessible only by trained professionals, and 50 feet (15m) downwind of occupied structures. For example, a fenced, open yard may be an appropriate safe location. DO NOT STORE DAMAGED TESLA ENERGY PRODUCTS ADJACENT TO UNDAMAGED TESLA ENERGY PRODUCTS. It is possible that a damaged battery may sustain further damage during transportation and may lead to a fire. To further reduce this risk, handle the damaged battery with extreme caution.

10 Disposal Procedures

Tesla Energy lithium-ion batteries do not contain heavy metals such as lead, cadmium, or mercury.

The procedures below apply to Tesla Energy Products at the end of their life (EOL). For disposal after a fire or thermal event, please contact Tesla for guidance (*Identification of Company and Contact Information* on page 4).

Tesla Energy Products should be disposed of or recycled in accordance with local, state, and federal regulations. Note that regulations regarding disposal of batteries vary by jurisdiction. In the United States, batteries are classified as Universal Waste, and in addition, many individual states have specific regulations regarding disposal of battery packs. For example, in California, all batteries must be taken to a Universal Waste handler or authorized recycling facility.

Tesla Energy Products contain recyclable materials. Tesla strongly encourages recycling. At this time, when a Tesla product must be decommissioned, we request that it be returned to a Tesla facility for disassembly and further processing.

If disposing without return to Tesla, please consult with local, state and/or federal authorities on the appropriate methods for disposal and recycling. Tesla has confirmed that at least two recycling processors are capable of recycling Tesla battery products in North America and three in the Europe, the Middle East and Africa (EMEA) region.

11 Maintenance or Repair

Tesla requests all maintenance, service, and repairs of Tesla Energy Products be performed by Tesla-approved service personnel or Tesla authorized repair facilities. This includes all proactive and corrective maintenance over the lifetime of a Tesla Energy Product. Improper service or repair by personnel not approved nor authorized by Tesla could void the product's Limited Warranty, lead to failure of the Tesla Energy product, and potentially result in development of an unsafe condition and unexpected electrical events.

12 Transportation

Lithium-ion batteries are regulated as Class 9 Miscellaneous dangerous goods (also known as "hazardous materials") pursuant to the International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by Air, International Air Transport Association (IATA) Dangerous Goods Regulations, the International Maritime Dangerous Goods (IMDG) Code, European Agreements concerning the International Carriage of Dangerous Goods by Rail (RID) and Road (ADR), and applicable national regulations such as the USA's hazardous materials regulations (see 49 CFR 173.185). These regulations contain very specific packaging, labeling, marking, and documentation requirements. The regulations also require that individuals involved in the preparation of dangerous goods for transport be trained on how to properly package, label, mark and prepare shipping documents.

NOTE: Transportation regulations vary by region. To ensure compliant transportation, always refer to local regulations as applicable.

UN Number	3480
Proper Shipping Name	Lithium-Ion Batteries
Hazard Classification	Class 9 Miscellaneous
Packing Group	N/A

NOTE: The information and recommendations set forth are made in good faith and believed to be accurate as of the date of preparation. TESLA, INC. makes no warranty, expressed or implied, with respect to this information.

Revision History

Revision #	Date	Description
01	14-July-2015	ERG for Tesla Powerpack systems, Powerwalls, and Sub-assemblies
02	3-Sept-2015	Added part numbers, updated weights, voltages, and temperatures, clarified hazards associated with spilled electrolyte, updated storage requirements, updated warning label icons, updated packing group.
03	3-Oct-2016	Added part numbers, minor edits
04	30-June-2017	Added fire ground operations response for Powerpack 2, including approach; exhaust gases; and safety. Updated general product information and contacts, as well as part numbers and reman numbers
05	22-Oct 2018	Reformatted for ease of use and translation; removed Confidential status; corrected phone number for CHEMTREC
06	27-Feb-2019	Updated storage conditions and firefighting measures section to provide further context on response tactics to Tesla Energy Product fires. Adjusted formatting, included graphics for warnings and notices.
07	17-Dec-2019	Updates to contact information (Tesla contact), product specs section, leaked electrolyte section, and inclusion of Megapack throughout the document.
1.8	March 11, 2020	Fixed footer; fixed styles.
2.0	July 8, 2020	• Updated formatting • Updated product specs • Updated contact info • Corrected elevated temperature topic to include Megapack • Corrected name of Tesla Inverter to Powerpack Inverter • Separated information on shutting down into its own topic for visibility • Reorganized the Firefighting section for clarity • Updated language on re-ignition risks
2.1	August 28, 2020	Added spare parts specifications: • Megapack battery module • Powerpack Pod module
2.2	June 23, 2021	• Updated contact information in *Identification of Company and Contact Information* on page 4 • Updated specs according to updated products in *SDS Information* on page 5 • Added Powerwall part numbers to *SDS Information* on page 5 • Enhanced firefighting guidance: *Firefighting Measures* on page 23 • Added guidance in case of emergency: *In Case of Emergency* on page 21

Revision #	Date	Description
		• Added additional early signs of thermal runaway: *Hazards Associated with Vented Electrolyte* on page 19 • Updated Powerwall instructions in *Shutting Down in an Emergency* on page 25
2.3	July 28, 2021	• Added coolant volume for separately shipped Megapack battery modules (*SDS Information* on page 5) • Clarified firefighting guidance (*Firefighting Measures* on page 23) • Enhanced product identification information (*Product Descriptions* on page 7) • Simplified emergency shut-down procedures for Megapack and Powerpack (*Shutting Down in an Emergency* on page 25)
2.4	February 16, 2022	• Enhanced firefighting guidance regarding neighboring battery enclosures (*Firefighting Measures* on page 23) • Clarified products of combustion (*Firefighter PPE* on page 24) • Added Powerwall+ and Megapack 2 information. • Enhanced emergency shut-down procedures for Powerwall, especially in the event switches and breakers are unavailable (*Powerwall* on page 26) • Provided reference to safety data sheet specific to Australia/New Zealand (*SDS Information* on page 5) • Amended that coolant color can be blue, green, or orange (*Hazards Associated with Leaked Coolant* on page 18) • Added links and QR codes to download this guide in additional languages (*Introduction and Scope* on page 2) • Updated contact information (*Identification of Company and Contact Information* on page 4), including: Tesla headquarters, Powerwall North America hotline, Megapack and Powerpack Japan technical support
2.5	May 23, 2022	• Added Megapack 2 XL (*SDS Information* on page 5, *Product Descriptions* on page 7)

Appendix C – Compliance with the CFA Guidelines

The table below demonstrates how the Model Requirements within the CFA Guideline have been achieved through the design response and ongoing mitigation treatments for the Proposal.

Model requirement	Compliance	Comments
Section 3 – consulting with CFA		
Early consultation, prior to the development of the planning permit application, ensures that CFA can effectively consider emergency response implications.	✓	CFA has been consulted on the Proposal and ongoing consultation will continue to occur in particular through the development of this Risk Management Plan, the Fire Management Plan and Emergency Management Plan.
Section 4 – Planning Applications		
Planning applications must address all relevant aspects of fire safety, including landscape and bushfire hazards, and hazards to and from the proposed technologies.	✓	This RMP forms part of the Planning Permit processs and includes all fire related considerations relating to a Solar Energy Facility and BESS.
Section 6- Facility Location and Design		
Section 6.1 – Facility Location		
Planning applications for all renewable energy facilities proposed in high-risk environments must address the following, in addition to providing an assessment against policy at Clause 13.02-1S (Bushfire Planning):	✓	This RMP includes an assessment against Clause 13.02 within Section 8.2.
a) The impact of any ignitions arising from the infrastructure (solar panels, wind turbines, battery energy storage systems, electrical infrastructure) on nearby communities, infrastructure and assets.	✓	This report considers the impact and the likelihood of fires that leave the property. The Clause 13.02 assessment has considered this and has also been addressed within the risk assessment in Section 5.
b) The impact of bushfire on the infrastructure (eg. ember attack, radiant heat impact, flame contact).	✓	This report considers the impact of bushfire on the infrastructure. The Clause 13.02 assessment considered this and has also been addressed within Section 8.2.
c) Assessment of whether the proposal will lead to an increase in	✓	The Clause 13.02 assessment has considered this and determined that the project will likely reduce

risk to adjacent land and how the proposal will reduce risks at the Site to an acceptable level.		the risk in the landscape from bushfire. The requirements including managing vegetation on the property during the fire danger period and the perimeter fire break supports the reduction of risk.
Section 6.2 – Facility Design		
Section 6.2.1 – Emergency vehicle access		
All facilities		
a) Construction of a four (4) metre perimeter road within the perimeter fire break.	✓	A four metre wide perimeter road is being provided within the perimeter fire break.
b) Roads must be of all-weather construction and capable of accommodating a vehicle of fifteen (15) tonnes.	✓	This has been included within the design.
c) 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.	✓	This has been included within the design.
d) The average grade should be no more than 1 in 7 (14.4% or 8.1°) with a maximum of no more than 1 in 5 (20% or 11.3°) for no more than fifty (50) metres.	✓	The Site is mainly flat with only small slopes present. There are no roads that will require assessment of the grade.
e) Dips in the road should have no more than a 1 in 8 (12.5% or 7.1°) entry and exit angle.	✓	The Site is mainly flat with only small slopes present. There are no roads that will require assessment of dips.
f) Roads must incorporate passing bays at least every 600 metres, which must be at least twenty (20) metres long and have a minimum trafficable width of six (6) metres. Where roads are less than 600 metres long, at least one passing bay must be incorporated.	✓	This has been included within the design.
g) Road networks must enable responding emergency services to access all areas of the facility, including fire service infrastructure, buildings, and battery energy storage systems and related infrastructure.	✓	The BESS and substation are located within a short distance of the main entrances to the Site and are adjacent to an Emergency Access point. Other alternative access locations will also provide access to the BESS area if required. Driveway access is provided to these areas and across the development.
h) The provision of at least two (2) but preferably more access points to	✓	The property is provided within a main entrance with additional access points available around the

the facility, to ensure safe and efficient access to and egress from areas that may be impacted or involved in fire. The number of access points must be informed through a risk management process.		Site. With the surrounding road network and the perimeter access road being included, there is effective all year round access to the entire Site.
Section 6.2.2 Firefighting Water Supply		
All Facilities		
a) Water access points must be clearly identifiable and unobstructed to ensure efficient access.	✓	Static water supplies will be located at property entrance locations with a static water supply of 10,000 litres as a minimum. The static water supplies are indicated on the map provided in Figure 1.
b) Static water storage tank installations must comply with AS 2419.1-2005: Fire hydrant installations – System design, installation and commissioning.	✓	This has been included within the design.
c) The static water storage tank(s) must be an above-ground water tank constructed of concrete or steel.	✓	This has been included within the design.
d) The static water storage tank(s) must be capable of being completely refilled automatically or manually within 24 hours.	✓	Site management will have an arrangement with a local water carrier to ensure static water supplies are refilled within 24 hours.
e) The static water storage tanks must be located at vehicle access points to the facility and must be positioned at least ten (10) metres from any infrastructure (solar panels, wind turbines, battery energy storage systems, etc.).	✓	This has been included within the design.
f) The hard-suction point must be provided, with a 150mm full bore isolation valve (Figure 1) equipped with a Storz connection, sized to comply with the required suction hydraulic performance. Adapters that may be required to match the connection are: 125mm, 100mm, 90mm, 75mm, 65mm Storz tree adapters (Figure 2) with a matching blank end cap to be provided.	✓	This has been included within the design.
g) The hard-suction point must be positioned within four (4) metres to	✓	This has been included within the design.

a hardstand area and provide a clear access for emergency services personnel.		
h) An all-weather road access and hardstand must be provided to the hard-suction point. The hardstand must be maintained to a minimum of 15 tonne GVM, eight (8) metres long and six (6) metres wide or to the satisfaction of the CFA.	✓	This has been included within the design.
i) The road access and hardstand must be kept clear at all times.	✓	This has been included within the design.
j) The hard-suction point must be protected from mechanical damage (eg. bollards) where necessary.	✓	This will be included within the design.
k) Where the access road has one entrance, a ten (10) metre radius turning circle must be provided at the tank.	✓	This has been included within the design.
l) An external water level indicator must be provided to the tank and be visible from the hardstand area.	✓	This has been included within the design.
m) Signage (Figure 3) indicating 'FIRE WATER' and the tank capacity must be fixed to each tank.	✓	This has been included within the design.
n) Signage (Figure 4) must be provided at the front entrance to the facility, indicating the direction to the static water tank.	✓	This has been included within the design.
Solar Energy Facilities		
a) The fire protection system for solar energy facilities must incorporate at least one (1) x 45,000L static water tank for every 100ha. For example, a 500ha Site requires a minimum of five (5) x 45,000L static water tanks.	✓	The development will provide 800,000 litres of fire water supply that is well in excess of the CFA requirements.
b) A fire water tank must be located at the primary vehicle access point to the facility, and elsewhere in consultation with CFA.	✓	This has been included within the design and discussed with the CFA.
c) Fire water must be provided to cover buildings, control rooms,	✓	This has been included within the design.

substations and grid connections, in consultation with CFA.		
d) Additional fire protection systems or equipment required under any Australian Standards for dangerous goods must be provided as prescribed.	✓	The dangerous goods quantities have been collated and there are no additional fire protection systems required beyond what is being proposed as part of the RMP.
Battery Energy Storage Systems		
1) For facilities with battery energy storage systems, the fire protection system must include as a minimum:		
b) Where no reticulated water is available, a fire water supply in static storage tanks, where:		
i. The fire water supply must be of a quantity no less than 288,000L or as per the provisions for Open Yard Protection of AS 2419.1-2005 flowing for a period of no less than four hours at 20L/s, whichever is the greater.	✓	The BESS area will be provided with 452,000 litres of static water supply in three separate tanks located to the east, west and north of the BESS area. This is in addition to the fire water provided near the property entrances.
ii. The quantity of static fire water storage is to be calculated from the number of hydrants required to flow from AS 2419.1-2005, Table 3.3. *(E.g., For battery installations with an aggregate area of over 27,000m2, 4 hydrant outlets are required to operate at 10L/s for four hours, which equates to a minimum static water supply of 576kL.)*	✓	The total water supply required to protect the BESS is 432,000 litres. This is based on 30l/s required to be flowed for at least 4 hours. The total water supplied for the BESS is 450,000 litres.
iii. Fire hydrants must be provided and located so that every part of the battery energy storage system is within reach of a 10m hose stream issuing from a nozzle at the end of a 60m length of hose connected to a fire hydrant outlet.	✓	The location of the static water supplies will allow for all areas of the BESS to be within 60 metres of the firefighting appliance connected to the static water supply.
iv. The fire water supply must be located at vehicle entrances to the facility, at least 10m from any infrastructure (electrical substations, Inverters, battery energy storage systems, buildings).	✓	Following discussions with CFA, the static water supply for the BESS will be split into three separate tanks at the east, west and north points of the BESS area.
v. The fire water supply must be reasonably adjacent to the battery energy storage system and shall be accessible without undue danger in an emergency. (Eg., Fire water tanks	✓	The fire water supply is at least 20 metres from the Megapacks which complies with the recommended distances outlined within the Tesla Guide.

are to be located closer to the Site entrance that the battery energy storage system).		
vi. The fire water supply must comply with AS 2419.1-2005: Fire hydrant installations - Section 5: Water storage.	✓	This will be included within the design to the satisfaction of CFA.
Substations		
Fire water must be available to substations.	✓	The substation is located adjacent to the BESS and near the property entrance where a 100,000 litre static water supply is located. There are sufficient water supplies in the area to support firefighting activities as discussed with the CFA during consultation before the finalisation of this report.
Section 6.2.4 – Fire Breaks		
A fire break must be established and maintained around:		
a) The perimeter of the facility, commencing from the boundary of the facility or from the vegetation screening inside the property boundary.	✓	The solar panels are set back from all perimeter boundaries. Within this space will be a fire break and access road.
b) The perimeter of control rooms, electricity compounds, substations and all other buildings on site. The width of fire breaks must be a minimum of 10m, and at least the distance where radiant heat flux (output) from the vegetation does not create the potential for ignition of on-Site infrastructure.	✓	All infrastructure is protected by the provision of a 10 wide fire break.
Battery Energy Storage Systems		
A fire break must be established and maintained around battery energy storage systems and related infrastructure.	✓	A fire break of 10 metres has been included in the design. The surrounding areas include works area, substation and solar panels and will also be managed.
Section 6.2.5 – Design Specific to Facility Type		
Solar Energy Facilities		
Solar energy facilities are to have a minimum six (6) metre separation between solar panel banks.	✓	This has been included within the design.
Battery Energy Storage Systems		

1) The design of the facility must incorporate:		
a) A separation distance that prevents fire spread between battery containers/enclosures and: • Other battery containers/enclosures. • On-Site buildings. • Substations. • The Site boundary. • Any other Site buildings. • Vegetation. *Separation must be at least the distance where the radiant heat flux (output) from a battery energy storage system container/enclosure fully involved in fire does not create the potential for ignition of these Site elements.*	✓	The design of the BESS area provides appropriate separation between pairs of battery units, the adjacent 33kV Transformers, the solar panels, substation and other infrastructure. Firefighters are able to stand at least 20 metres from all Megapacks and operate safely. This complies with the advice provided by manufacturer.
b) A fire break around the battery energy storage system and related infrastructure, of a width of no less than 10m, or greater where determined in the Risk Management Plan. Fire breaks must be non-combustible, constructed of concrete, mineral earth or non-combustible mulch such as crushed rock. *The width must be calculated based on the ignition source being radiant heat of surrounding vegetation, including landscaping.*	✓	A fire break of 10 metres is being provided around the entire perimeter of the battery facility This is supported by the groundcover vegetation management requirements in and around the Solar Energy Facility along with the perimeter road. Fire breaks will be non-combustible, constructed of concrete, mineral earth or non-combustible mulch such as crushed rock.
c) A layout of Site infrastructure that: i. Considers the safety of emergency responders. ii. Minimises the potential for grassfire and/or bushfire to impact the battery energy storage system. iii. iii. Minimises the potential for fires in battery containers/enclosures to impact on-Site and offSite infrastructure.	✓	The design of the entire development and the large open space areas between the Solar Energy Facility and the BESS will ensure there is sufficient space available for firefighters to stage and assess the emergency prior to entering the area. The vegetation management arrangements for the entire Site will reduce the potential for fires to either leave or enter the Site.
2) Battery energy storage systems must be:		

a) Located so as to be reasonably adjacent to a Site vehicle entrance (suitable for emergency vehicles).	✓	This has been included within the design.
b) Located so that the Site entrance and any fire water tanks are not aligned to the prevailing wind direction (therefore least likely to be impacted by smoke in the event of fire at the battery energy storage system.)	✓	There are a number of emergency entrance points that could be utilised during an emergency event that are of sufficient distance from the BESS to enable access to the Site without being impacted by smoke. Once on the Site, there are several different access tracks that can provide access to the BESS as well as different staging locations that will ensure firefighters will not need to enter the smoke plume.
c) Provided with in-built detection and suppression systems. Where these systems are not provided, measures to effectively detect and/or suppress fires within containers must be detailed within the Risk Management Plan.	✓	The BESS will be provided with IR heat and flame systems that will be monitored locally and connected through the SCADA system. The Megapack technology is not designed to have in built suppression systems as these will interrupt the Megapack design and how it responds to a fire event.
d) Provided with suitable ember protection to prevent embers from penetrating battery containers/enclosures.	✓	The Megapack design allows for the prevention of dust and insects to enter the enclosure. This is achieved using seals on doors and other openings. This protection also reduces the potential for embers to penetrate the enclosure.
e) Provided with suitable access roads for emergency services vehicles, to and within the Site, including to battery energy storage system(s) and fire service infrastructure.	✓	Driveway access will be provided within and around the BESS area.
f) Installed on a non-combustible surface such as concrete.	✓	The battery area and the supporting infrastructure are being stored on a non-combustible surface which will be maintained.
g) Provided with adequate ventilation.	✓	The batteries are stored with sufficient ventilation around and between the pack of containers.
h) Provided with impact protection to at least the equivalent of a W guardrail-type barrier, to prevent mechanical damage to battery containers/enclosures.	✓	There will be various protection systems installed including bollards to ensure the battery enclosures and other infrastructure are protected from damage from vehicles and other equipment.
i) Provided with enclosed wiring and buried cabling, except where required to be above-ground for grid connection.	✓	This has been included within the design.

j) Provided with spill containment that includes provision for management of fire water runoff.	✓	The detailed Site design includes fire water runoff considerations including an impervious concreted area around the battery units contained by a 150mm rollover that will allow for fire water runoff to be initially contained within the BESS area without coming into contact with electrically charged equipment. A sump pit will allow for hard suction hose to pump the fire water from the BESS area into a 150,000 litre water tank. The Emergency Management Plan will clearly outline the process to manage fire water runoff during a fire.
Section 7 – Facility Construction and Commissioning		
Section 7.1.4 – Emergency Management		
An Emergency Management Plan must be developed for the construction and commissioning phase of the facility.	✓	An Emergency Management Plan will be developed for both the construction and operations phase.
Section 8 – Facility Operation		
Section 8.1 – Vegetation and Fuel Management		
Facility operators must undertake the following measures during the Fire Danger Period:		
a) Grass must be maintained at or below 100mm in height during the declared Fire Danger Period.	✓	This requirement will be included within the Fire Management Plan.
b) Long grass and/or deep leaf litter must not be present in areas where heavy equipment will be working, during construction or operation.	✓	This requirement will be included within the Fire Management Plan.
c) Restrictions and guidance must be adhered to during the Fire Danger Period, days of high (and above) fire danger and Total Fire Ban days (refer to www.cfa.vic.gov.au).	✓	This requirement will be included within the Fire Management Plan.
d) All vehicles and heavy equipment must carry at least a nine (9)-litre water stored-pressure fire extinguisher with a minimum rating of 3A, or firefighting equipment as a minimum when on-Site during the Fire Danger Period.	✓	This requirement will be included within the Fire Management Plan.
Section 8.2 – Maintenance		
All Facilities		

Inspection, maintenance and any required repair activities must be conducted for all infrastructure, equipment and vehicles at the facility. Maintenance must be in line with any relevant Australian Standards and the manufacturer's requirements.	✓	This requirement will be included within the Fire Management Plan.
Section 8.4 Facility and System Monitoring		
All Facilities		
Appropriate monitoring for facility infrastructure must be provided, to ensure that any shorts, faults or equipment failures with the potential to ignite or propagate fire are rapidly identified and controlled, and any fire is notified to 000 immediately.	✓	The Site will be provided with a SCADA system that will monitor the day to day operations of the batteries and associated infrastructure. The system includes a range of sensors that are preprogramed to send alert messages and includes: • Over temperature • Under temperature • Under voltage warning • Power off fault • Voltage and current changes. These alerts are automatically transmitted to a monitoring centre. There are appropriate levels of back up communication systems installed in the event of power failures or other events that may interrupt the communications connections. The BESS will include multi-spectrum IR heat or flame detectors will be installed externally to the Megapacks and monitored locally through a Fire Indicator Panel.
Section 9 – Fire Management Planning		
All Facilities		
A Fire Management Plan must be developed for the facility, in conjunction with CFA, before commissioning of the facility.	✓	A Fire Management Plan has been developed that outlines the mitigation treatments and provides a description of these initiatives.
Section 10 – Emergency Management Planning		
All Facilities		
An Emergency Management Plan must be developed specific to the	✓	An Emergency Management Plan will be developed prior to the commissioning of the

facility, in conjunction with CFA, prior to commissioning of the facility.		facility. This Plan will be provided to CFA for their consideration and feedback.
Section 10.2.1 – Developing an Emergency Information Book		
All Facilities		
An Emergency Information Book must be developed and available to emergency responders. Emergency Information Books must be located in Emergency Information Containers, provided at each vehicle entrance the facility.	✓	An Emergency Information Book will be provided at the Site entrances in a container that is protected from weather.

Appendix D – Vegetation Screen planting and maintenance requirements

The following information is provided to guide the ongoing management of the Vegetation Screen that is being provided around the entire Site. It also applies to the existing shelterbelts and windbreaks along the western edge of the Site. As outlined within this Report, the management of the Vegetation Screens will ensure these areas of vegetation do not increase the bushfire risk to the Site and the local area.

Utilising plant species that are not highly flammable

There are a variety of factors that are to be considered when selecting the most appropriate species to ensure there is no increase in bushfire risk. Ramsay and Rudolph (2003) states that an assessment of vegetation bushfire risk should include the type of bark, moisture content, foliage density, leaf fineness and height of the lowest foliage above the ground. All of these factors will determine the suitability of the vegetation and how it performs during a bushfire.

The most critical factor is the selection of vegetation that has limited bark hazard. Vegetation that has bark that is fibrous or stringy will support the generation of fire spotting embers. Smooth barked vegetation will generally reduce the number of short distance embers that are generated during a bushfire.

The initial identification of species for the vegetation Screen will be influenced by the Ecological Vegetation Class (EVC) for the local area. Trees that have limited bark and smooth surfaces should be used.

CFA have produced a Plant Selection Key[42] to support the assessment of vegetation to determine its flammability level. Once the preferred vegetation has been identified, the Plant Selection Key would be utilised to inform the flammability level of a particular species. Final species selection should be aimed at achieving at least low to moderate flammability.

Removal of Dead vegetation in the screen before the declared Fire Danger Period

Any branches and other vegetation that has fallen from the screen can accumulate on the ground and increase bushfire risk. This material can increase bushfires intensity and allow for the generation of increased radiant heat along with allowing the fire to burn for longer periods. Prior to the annual declared Fire Danger Period, this dead material must be removed.

Maintain grass to 100mm or less in the planting areas during the Fire Danger Period

CFA guidance material clearly outlines the importance of maintaining grass to 100mm or less during the Fire Danger Period. This will reduce the likelihood of a bushfire burning on the ground under the Screen vegetation developing significantly and will restrict the amount of heat being produced in a bushfire event.

Removal of branches within 2m of the ground.

The removal of branches from within two metres of the ground will limit a fire's ability to move vertically from the ground to the canopy. If the fire is of an intensity high enough to directly burn the canopy, this could generate additional embers that may land in and around the Site. This requirement,

[42] Plant Selection Key – CFA, https://www.cfa.vic.gov.au/plan-prepare/plant-selection-key/.

along with the requirement to maintain grass within the vegetation screen at or below 100mm will reduce the ability for fires to establish, develop significantly and enter the canopy.

Appendix E – Peat Assessment

Attached separately.

Appendix F – Consideration of the VCAT decision

Finding No.	VCAT concern	How this concern has been addressed
10	The bushfire assessment is also inadequate. The applicant's expert evidence cites some factors relevant to mitigate bushfire risk, but does not comprise a substantive risk and hazard assessment.	A full bushfire risk assessment (Bookaar Solar Energy Facility Bushfire Risk Assessment & Mitigation Plan 2020) has been conducted. This includes risks to Site staff, contractors and surrounding neighbours from bushfire. A Fire Management Plan has been developed in accordance with the CFA Guideline. An Emergency Management Plan will be developed prior to the construction phase commencing.
	• There is no draft fire or emergency plan.	A Fire Management Plan has been developed for the Proposal. This plan contains a Description of the control measures to prevent fire occurring and limit the consequences of fire at the facility, including the requirement for an Emergency Management Plan for the Site. A preliminary Bushfire Response Plan was prepared to support the Planning Permit application. Based on the decision to comply with the recently released CFA Guideline, this will now be expanded to an Emergency Management Plan. This Plan will be provided to CFA for their endorsement and will be in place for the construction and operational phase.
	• There is reference to general CFA guidelines that require, for example, a static water supply of not less than 45,000 litres capacity, but all parties (including the CFA and the applicant) concede that this would be inadequate for a large Solar Energy Facility covering almost 6 km².	A significant water supply to support firefighting operations on site is provided in the Plan. Static water supply now incorporated into the design at 8 strategic locations adjacent to vehicle entrances. Each tank holds 100, 000 litres with fire appliance access in accordance with the CFA Guideline. Furthermore, at the location of the BESS, static water supplies (3 x 150,000 lt tank) have been supplied in consultation with the CFA and in accordance with the CFA Guideline.
	• There is no clear assessment of what other fire suppressants may be needed to deal with a fire affecting particular electrical installations.	CFA provides guidance to its firefighters on how to combat fires involving Solar Panels. This includes information on: • Power isolation • Control Strategies The primary strategy for fires involving electrical installations is to isolate the power before using water. As mentioned in this report, the key challenge with Solar energy facilities is the vegetation under and surrounding the panels.
	• There is no clear assessment of: the impact	The Proposal is serviced by an all-weather road network that gives access to all areas of the Site including a perimeter road. Eight access points have been included within the design with,

Finding No.	VCAT concern	How this concern has been addressed
	of fencing and limited access.	4 of these available at all times and the remaining for emergency vehicle access only. Due to the number of access points now provided for emergency vehicle access, the provision of fencing will not limit access and egress.
	• There is no clear assessment of the 20 metre landscape buffer surrounding almost the entire Site.	Vegetation Screen planting guidance has been included within this report at Appendix D. Further information to reduce bushfire risk annually has been included as part of the Bushfire Mitigation Operational Schedule.
	• There is no clear assessment of the likely location of all-weather internal access roads.	Refer to detailed design drawing. All roads, emergency access points, asset protection zones and static water locations are provided on the Site Plan.
	• There is an acknowledgement that the Site may contain peat soils, but the applicant is unable to indicate whether they add significantly to the risk.	A detailed assessment peat at the Site has been carried been undertaken. No Peat was discovered as part of the assessment which concludes that the likelihood of Pete at Site is low.
	• There is no assessment of the capacity of the local brigade to deal with bushfire in or around the proposed facility.	CFA firefighting capability and capacity has been addressed in the Plan. In summary, CFA's dispatch system will respond the most appropriate appliances to the Site depending on the nature of the emergency. The Solar Energy Facility operators will also have a first attack capability on site which has been specified within the Fire Management Plan.
248	Application needs to address 2 scenarios: • Fire within the facility • Fire in the area travelling towards the facility	Fires originating from within the Site and external to the Site have been addressed in this report. This includes a landscape risk assessment from within 1 km and 20 km of the Site. Possible Ignition sources have also been identified and recommendations to reduce the likelihood of ignitions have been included.

Finding No.	VCAT concern	How this concern has been addressed
249	Priority to be given to the protection of human life above all other policy considerations	The Risk Management Plan, Fire Management Plan and the Emergency Management Plan (once developed) ensure that the primacy of life is prioritised above all other activities associated with the construction, commissioning and operational phases of the Proposal. This is in accordance with Victorian State Government direction and response doctrine adopted by the Fire Agencies. This report also addresses the requirements of Clause 13.02-1S of the Corangamite Planning Scheme that requires the primacy of life be considered.
250	There is a need for: • Risk and hazard assessment • Emergency management plan	This report analyses the risk associated with a bushfire both within or external to the Site as well as specific risks and hazards associated with the Solar Energy Facility and the BESS The Proponent will have in place an Emergency Management Plan that outlines the response arrangements to respond to these types of events.
251 a)	Are there any guidelines published by the CFA that specifically relate to bushfire management in the context of solar energy facilities?	The CFA Guidelines for Renewable Energy Installations 2019 provide clear guidance on the management of fire risk within solar energy facilities. This report outlines in detail how the design meets these guidelines. DELWP have published Solar Energy Facilities – Design & Development Guidelines August 2019 that refers to the CFA guidelines.
251 b)	Has there been any study which has looked at incident of fire at solar energy facilities?	A detailed assessment of previous fires in solar energy facilities has been undertaken as part of this report. The primary outcome is the importance of managing vegetation under and surrounding the Solar Panels.
251 c)	Does the infrastructure associated with a solar energy facility create wind conditions that might accentuate any fire risk?	Following a literature search including the CFA Renewable Energy Guideline, there is no evidence available to support this scenario.
251 d)	Is there any concern with the proposed planting of up to 7 rows of trees with the 20m landscape buffer of the species outlined in the letter included in your brief?	The proposed makeup of the vegetation screens is 4 rows of trees within a 20m wide buffer. The Vegetation Screen plantings will be undertaken in accordance with design guidelines outlined within this report (see Appendix D). Complying with these guidelines will ensure the plantings meet the exclusion provisions outlined within clause 2.2.3.2 of AS3959:2018. Further information to reduce bushfire risk annually has been included in the Plan as part of the Bushfire Mitigation Operational Schedule.

Finding No.	VCAT concern	How this concern has been addressed
251 e)	What assumptions have been made in keeping fuel levels with the Site array at acceptable levels?	The CFA Guidelines for Renewable Energy Installations 2022 provide clear guidance on the management of fuel within solar energy facilities. Grassland within the Site will be managed in accordance with the Guideline.
253	Detail regarding how a fire coming into the Solar Energy Facility, or a fire within the Solar Energy Facility, will be able to be managed, given 45,000 litres is known to be insufficient.	Analysis of a potential bushfire impacting on the Proposal is included at Sections 8.1.4 and 8.2. The staic water supply proposed for the development has been developed in consultation with the CFA and exceeds CFA requirements for the overall Size of the facility. This includes the provision of 8 x 100,000 lt water tanks at each access point across the Site and a further 3 x 150,000 litre water tanks adjacent to the BESS.
255	The potential for peat and subsequent fire impact.	A detailed assessment of possible peat locations on site has been undertaken. No peat was discovered as part of this assessment and the potential for Peat to be found within the Site was assessed to be low.
256	Information relating to the effect of solar panel toxicity on firefighters.	There is limited information available on the effects of solar panel toxicity on firefighters. It is understood that plastics will be present on cables, enclosures and other parts of the system. Fires involving plastics is a concern for firefighters and is why they are provided with safety equipment including breathing apparatus. Plastics are present in a wide variety of fires that firefighters respond to including car and building fires. CFA provide guidance to their firefighters and how to minimise exposure to any toxic environment through the use of breathing apparatus or by remaining away from the smoke. Multiple access points and access routes within the Site will allow help emergency responders to avoid smoke when approaching fires.
258	The ability for any bushfire on site to be adequately managed is foremost, and not assumed.	The Risk Management Plan and Fire Management Plan have articulated how the Site will have the ability to both prevent and suppress bushfires on the Site. The Site will also develop an Emergency Management Plan that complies with the CFA Guideline and AS3745 prior to the commissioning phase commencing.

Appendix G – Dangerous Goods and Non Dangerous Goods products

The client has provided the following list of products and their Safety Data Sheets (SDSs) that will be used within the Solar Energy Facility and BESS. An assessment occurred of the SDSs to identify if the individual products were classified by the manufacturer as a Dangerous Good.

The outcome of this assessment has identified the three products that have been listed as a Dangerous Good. Those products identified as a Dangerous Good in the below table have their relevant Dangerous Good Class provided.

Battery area	Item	Contains	Dangerous Goods Class
	33kV Transformers	Mineral oil	N/A
	Battery modules	Lithium ion	Class 9
	Megapack	Coolant (50-50 ethy6lene glycol-water)	N/A
	Megapack	Refrigerant (R-134a (1,1,1,2-Tetrafluoroethane)	Class 2.2
Substation	100MVA Transformer	Mineral oil	N/A
	Static VAR Generator	Power electronics	N/A
	Capacitor bank	Dielectric/insulating liquid	N/A
	33kV Switch room	Insulating gas (worst case)	Class 2.2

Appendix H – Authors background and experience

Graeme Taylor

Managing Director

Graeme has extensive strategic and operational management experience with a strong focus on leadership and critical decision making in an emergency management environment. He has extensive experience in State fire policy, planning, incident management and operational services for large fire events. Graeme has first-hand experience in leadership roles for major incidents including The Longford gas explosion, 2009 Black Saturday fires, and multiple Gippsland fire and flood events. He has also been called upon on numerous occasions to manage fires interstate.

Graeme provides support to agencies, local government and industry before, during and after emergencies. He has led the development of risk reduction and fire protection planning, including fuel modification and management across a range of projects in Australia. Current clients include the Country Fire Authority of Victoria, ESSO, Department of Defence, Forest Fire Management and numerous large asset managers and developers across Australia.

Graeme has excellent knowledge of State and local government emergency management and fire planning arrangements and provisions, including State legislation around bushfire risk in renewable energy projects.

Mark Potter

Risk and Emergency Planning Lead

Mark Potter is a proven executive with experience providing leadership across complex and diverse roles. He has a strong background in developing internal and external relationships, operating in complex and technical environments, leading teams through significant change and steering strategy into action.

Within the emergency management sector, Mark has extensive experience in leading the development, assessment and testing of all aspects of emergency management plans. This experience includes Major Hazards Facilities, Latrobe Valley Coal Mines, Gippsland Regional Strategic Fire Management Plan, the Bushfire Management Overlay and the Gippsland Emergency Management Plan. Mark has performed in roles including Chair – Gippsland Regional Strategic Fire Management Planning Committee, Project Manager – Latrobe Valley Coal Mines Emergency Management Project, member of the Gippsland Emergency Management Planning Committee and the State Fire Management Planning Committee.

His experience extends across the ability to undertake, participate or develop risk management plans that identify the relevant risks for treatment plans to be developed.