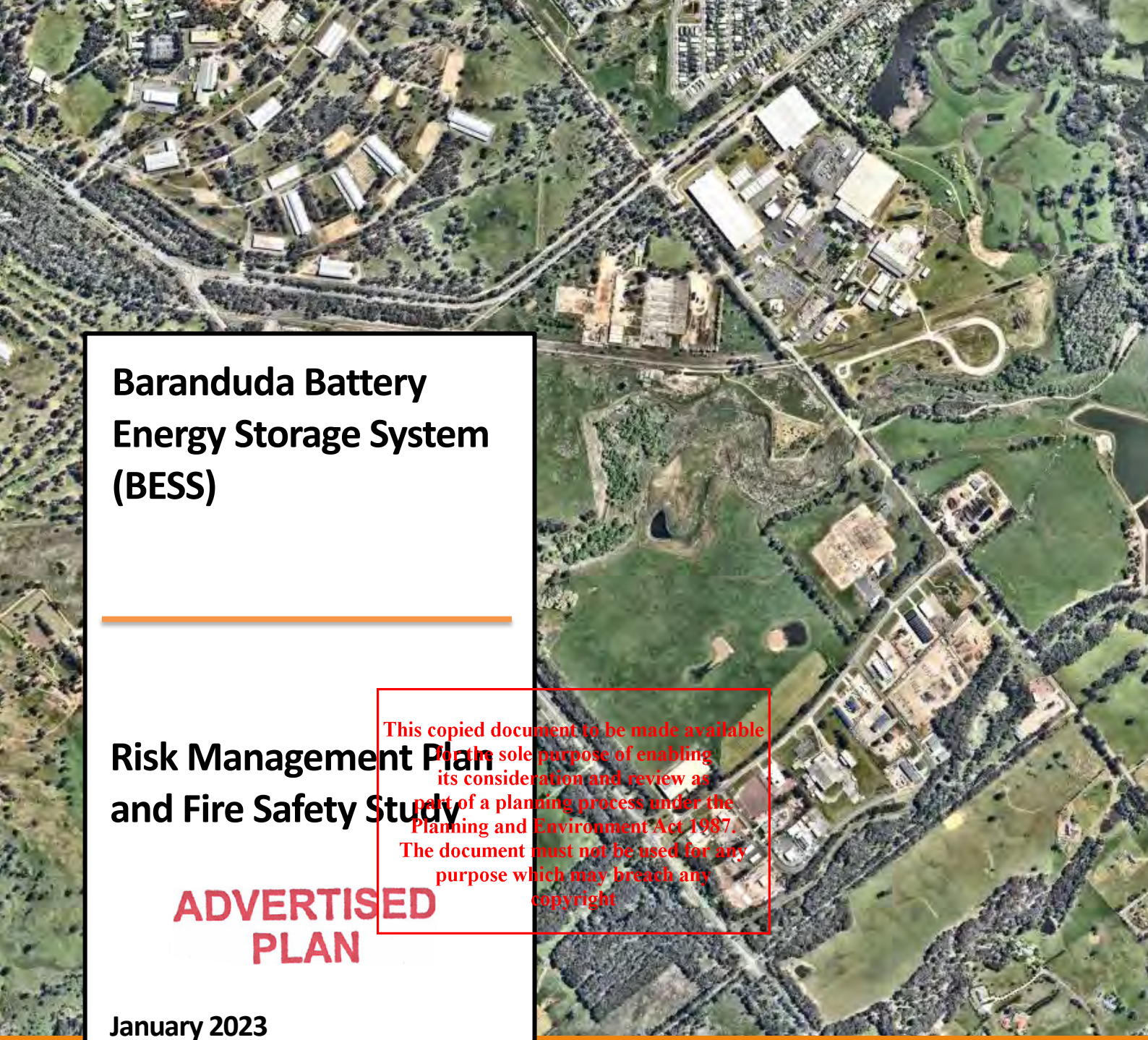

Baranduda Battery Energy Storage System (BESS)

Risk Management Plan and Fire Safety Study

January 2023

FIRE RISK Consultants

Front cover – Aerial photo of the Baranduda Bess site and surrounding area (sourced by FRC from Nearmap)

Document history and date

Revision	Date	Description	By	Review	Approved
V1 - DRAFT	8/1/2024	Initial draft following assessment of available information.	M Potter & FRC Project Team	FRC Review Team	G Taylor Managing Director
V2	5/2/2024	Updated following client feedback.	M Potter & FRC Project Team	FRC Review Team	G Taylor Managing Director

Fire Risk Consultants
PO Box 12, Glengarry VIC 3854
0487 790 287
www.fireriskconsultants.com.au

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Any fire safety work, including but not limited to planned burning, back burning and/or fire suppression, on any property or building is specifically excluded from this report.

*Where the term **"Bushfire prevention and mitigation related activities"** (or words to that effect) are used, this is to be defined as the clearance of vegetation in accordance with the Victorian State Government guidelines, including clearing and maintenance of existing fire breaks and/or fire access for fire fighters under electricity pylons and properties that have been constructed to Australian Standard AS3959 and/or the National Construction Code.*

Contents

1 Introduction

Fire Risk Consultants has been engaged by Birdwood Energy (the Client) to develop a Risk Management Plan (RMP) for the Baranduda Battery Energy Storage System (BESS) (the Project). The Project is to the north of the Baranduda township and to the south east of Wodonga. The BESS is adjacent to existing farming properties the existing Wodonga Terminal Station and to the north of the Baranduda industrial estate. The site is accessed from Baranduda Drive which is accessible from Whytes Road or Kiewa Valley Highway.

This RMP has been prepared in accordance with the *Design Guidelines and Model Requirements: Renewable Energy Facilities 2023* (CFA Guidelines). In addition to the RMP, a Fire Management Plan (FMP) and Emergency Management Plan (EMP) will be prepared once the Planning Permit has been issued.

Following the assessment against the CFA Guidelines, the following areas have been identified where the design solution proposed does not conform with the recommendations contained within the Guideline. It is acknowledged that where a variation to the recommended position is considered, an analysis against NSW Planning's *Hazardous Industry Planning Advisory Paper 2: Fire Safety Study Guidelines (2011)* is required. The areas where the design does not comply with the CFA Guideline recommended position is:

1. The site will not be provided a perimeter road along part of the eastern boundary adjacent to the substation. It is believed that the intent of the model requirements is for the perimeter road to be provided to the BESS area of the site. The Substation area will comply with Ausnet requirements and have a non combustible surface. Whilst this area is not formally declared a perimeter road, it would be trafficable when the power has been isolated if required.
2. The site is provided with a main access/egress point to the south that connects to Baranduda Drive. In the north western corner of the site, an emergency vehicle access/egress gate is provided that will enable firefighters to exit if required during an emergency. It is likely for this access/egress point to support firefighting vehicles during drier periods of the year.
3. The fire water supply is located within the site and not adjacent to the main entrance. This is due to the limited siting options at the main entrance. The location does provide firefighters with the ability to access the water supply and associated infrastructure before entering the BESS area.

This report has been prepared following an assessment of the site, analysis of supplied information from the Client and a meeting with technical experts in relation to the design, commissioning and operation of a BESS.

As per the CFA Guidelines, 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 project. Where the CFA Guideline provides specific requirements relating to matters that are outlined within the Fire Safety Study Guidelines, the CFA Guideline information has been utilised. In summary, the following sections of the Fire Safety Study Guidelines have been covered within this report.

Table 1 - Response to NSW Fire Safety Study Guideline

Section 2 summary	Response
Identification of fire hazards and the consequences of possible fire incidents	The CFA Guideline provides an outline of the types of fire hazards associated with renewable energy developments. This report also analyses previous fire history (Section 5.3) and includes the assessment of risk resulting from these fire events and other information that is supplied by the developer. As the development is at the Planning Permit stage, the selection of a BESS supplier has not been undertaken. The CFA Guidelines outline requirements that will be utilised in the selection of a BESS supplier. Within Victoria, it is the normal process for the Planning Permit to specify the development of an RMP which will involve updating this version with the manufacturer details and specifications once they have been engaged. In support of the planning approval processes, a bushfire assessment has been completed by Terramatrix. This RMP relies on the Terramatrix bushfire risk assessment and is provided in Appendix A.
Fire prevention strategies and measures	The outcome of the assessment of risk and the assessment of the design against the CFA Guideline has resulted in a range of fire prevention strategies and measures. These strategies and measures will be included within the Fire Management Plan (FMP) and will specify their design and maintenance standards. The FMP will likely be a condition of the Planning Permit and is a requirement of the CFA Guideline. The proposed design due to site constraints will provide an alternative design solution to meet the objectives of the CFA Guidelines.
Analysis of the requirements for fire detection and protection and identification of the specific measures to be implemented	The CFA Guideline provides specific fire detection and protection requirements including the installation of firefighting water supplies, detection and suppression systems and bushfire protection measures. The specific installation measures are outlined in Section 4.1.
Calculation of firefighting water supply and demand	The CFA Guideline provides clear requirements to design and install the fire hydrant system to AS2419 – open yard protection requirements. This includes the development of a firefighting water supply and demand requirement.
Containment of contaminated firefighting water	The CFA Guideline provides the requirement to contain firefighting water to enable testing to occur before it is allowed

	to either enter the stormwater drainage system or needs to be disposed at an EPA approved location.
First aid fire protection requirements.	The CFA Guideline imposes certain requirements along with the obligation on the operator to meet the occupational health and safety requirements imposed by various legislation. This includes the provision of fire extinguishers, warning signs, road access minimum requirements, staff training, induction programs and emergency management planning.

2 Project Overview

2.1 Site development

The Project will install, commission and connect a BESS on a property to the south east of Wodonga. The BESS site is located within an existing farming property and adjacent to the Wodonga Terminal Station.

The Project generally includes the following:

- A series of battery units, inverters, cooling systems, MV transformers, protection devices, ring main units and connecting infrastructure.
- Transmission connection infrastructure including HV transformers, protection devices, earthing systems and connecting infrastructure.
- Control room, switch room and maintenance buildings.
- Utility connections.
- Sealed access at the entrance to the BESS facility.
- Fire protection equipment including a fire hydrant system, water tanks and tank connections.
- Civil and foundation works including laying of crushed rock and fencing.
- Construction of roads and access point.
- Civil and drainage infrastructure within the site including provision for a detention pond.
- Combination of trenched and open swale type stormwater drainage.
- Installation of perimeter security fencing.
- Installation of lighting poles.

The indicative site layout is shown in Figure 1.

2.2 Battery Energy Storage System

The development has not selected the battery supplier, and this will occur post the Planning Permit being issued. However, there are numerous consistencies in the design, construction and installation of the Battery Units. This is mainly driven by the requirement to comply with various codes and standards. In relation to managing fire risk, the following standards and codes will be complied with:

- UL9540A Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems
- UL9540 Energy Storage Systems and Equipment
- NFPA 855 Standard for the Installation of Stationary Energy Storage Systems.

The Battery will be prefabricated at the factory and arrive with a small charge and largely a plug-in type of arrangement. The product is fitted with a range of systems that manage the battery and receives and responds to various alerts. The Battery Management System (BMS) is able to be regularly updated as new technologies or learnings are introduced into the software.

The Battery will be supplied with a range of Manuals that address installation, maintenance and safety. The Manuals will outline the outcomes of the various tests including UL9540A that demonstrates that the design of the system meets the requirements of UL9540.

The Units will be fitted with a range of sensors that connect through to a central monitoring centre. The sensors will detect various activities that may allow a cell to commence the process to go into thermal runaway if no intervention occurs. Due to the remote monitoring capability, the monitoring centre can remotely commence shut down procedures if required. The Units are likely also fitted with gas detection devices and an E-stop system that allows for the Unit to be shut down externally.

Table 4 outlines the typical fire safety systems that are likely to be installed within the Battery Units:

Table 2 - Overview of fire safety systems

Fire Safety System	Description
Battery Management System (BMS)	The BMS constantly monitors cell and pack level voltage, temperature, State of Charge (SOC), and other parameters to ensure early detection of pre fault conditions, and immediate detection of fault events. Should any parameter exceed a permissible value, the BMS will disconnect the effected Units and send an alarm to the Monitoring Centre.
Emergency Stop (Estop)	Each Battery Unit will contain Estop buttons. When pushed, the Unit will immediately commence shut down, and the BMS will isolate the battery strings from the main system bus.
Fire detection and alarms	The Units will be equipped with smoke and heat detectors calibrated to detect early signs of fire. The Units will contain both an audible fire alarm and visual fire strobe located on the outside of the Unit. If the smoke and heat detectors are triggered, both alarms will activate, and corresponding alarms will be sent to the Monitoring Centre.
Emergency system shutdown	In the event of an emergency on site, the Units can be shut down locally, or remotely. A system shutdown will result in electrical isolation of the battery strings and cessation of battery charging or discharging.
IP Rating	The IP (Ingress Protection) rating varies for each manufacturer, but it will likely be elevated in that it will prevent ember ingress into the Units. The IP

	rating is defined by the international standard EN 60529 (British Standard BS EN 60529:1992). The first digit relates to the ability for solids to enter the enclosure and the second digit indicates the ability for liquids to enter the enclosure. Most Battery Units are a minimum of IP55 rating, and this is classified as: • Ingress of dust is not entirely prevented, but it must not enter in sufficient quantity to interfere with the safe operation of the equipment. • Water projected by a nozzle (6.3 mm) against enclosure from any direction shall have no harmful effects. In the unlikely event of a bushfire in the surrounding vegetation that develops embers, the IP rating will likely reduce the ability for embers to enter the Unit.

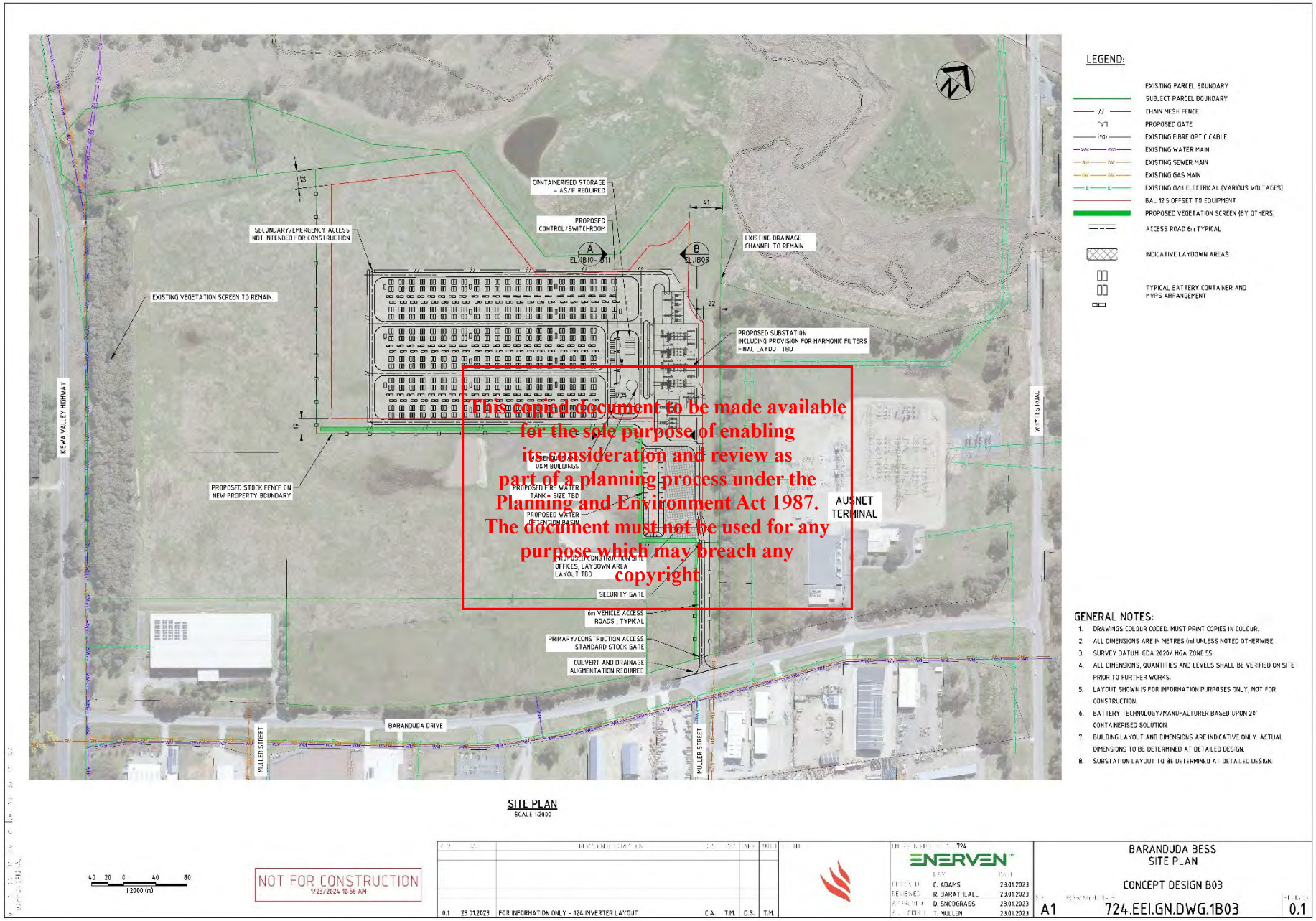

Figure 1 – Baranduda BESS - indicative layout plan (sourced from Birdwood Energy)

3 Existing conditions assessment

3.1 Site description and location

The Project will be located to the west of the existing Wodonga Terminal Station on a property that is currently utilised for farming activities. The site is cleared and is part of a larger property that is being excised to enable the development of the BESS. The site is accessed from Baranduda Drive which connects to Whytes Road to the north and Kiewa Valley Highway to the south. The adjoining properties include Middle Creek to the north, farming properties to the west and the Baranduda industrial estate to the south of Baranduda Drive.

The site is flat and has limited to no vegetation apart from grasses within paddocks. Further description of the surrounding landscape is contained within Appendix A.

The location of the site in relation to the surrounding landscape is shown in Figure 2.

3.2 Risk indicators

In support of the risk assessment required by the CFA Guideline, the following information has been obtained and provides relevant information that informs the analysis of risk. This information supports the assessment contained within Section 5. As mentioned previously, the assessment of bushfire risk is contained within Appendix A and should be read in conjunction with this report.

3.3 Fire brigade intervention

The site is located within the country area of Victoria and is therefore covered by the Country Fire Authority. Fire Rescue Victoria is also present and is located at Wodonga. As the site is located close to the border it would be expected for support to also be provided by New South Wales Fire and Rescue Service located at Albury.

The closest fire stations and the driving distance (sourced from Google maps) is:

- CFA Baranduda Fire Station – 4 kilometres
- FRV Fire Station 76 – 6.4 kilometres
- CFA Wodonga Fire Station – 6.4 kilometres
- CFA Bonegilla Fire Station – 8 kilometres
- CFA Wodonga West Fire Station – 12 kilometres

It can be assumed that a fire at the site or in the surrounding landscape would have a firefighting vehicle at the scene within a short period of time.

Figure 2 - The Project site and the surrounding landscape

3.3.1 Unit design fire

As outlined in Section 2.2, the BESS Units have not been selected yet and this will occur post the Planning Permit approval. However, the selection process will utilise the information contained within this RMP to guide the selection.

The minimum requirements include:

- The system has been tested in accordance with the UL9540A test method.
- The BESS supplier has undertaken a large scale fire test to demonstrate that the separation between the Units is sufficient.

The detailed analysis to support the secondary consent process will ensure that the design fire that is considered involves a single Unit fully involved in fire. The available data will provide the radiant heat impact on adjoining Units from a fully involved Unit fire.

4 Risk assessment process

To effectively assess the fire risk associated with the proposal, this report is structured to assess risk using the following frameworks:

- Assessment against the requirements of the CFA Guidelines *Design Guidelines and Model Requirements: Renewable Energy Facilities 2023* including the Fire Safety Study requirements outlined within the NSW Planning Guidelines.
- Risk assessment that meets Section 3 of the CFA Guidelines.

The risk assessment is based on the information outlined in this report along with industry best practice and our professional expertise.

4.1 Analysis against CFA Guidelines

CFA have developed Guidelines that outline their requirements to address fire risk within renewable energy installations. These guidelines are aligned to the Planning approval conditions. In addition, further analysis occurs (Section 3) that is aimed at addressing the risk assessment requirements.

Table 4 outlines the model requirements from the CFA Guidelines and details how this influences the design.

Table 3 - Response to CFA Guidelines

Model requirement	Compliance	Comments
Section 2 – Consulting with CFA		
a) Where located within a Bushfire Prone Area, bushfire risk is addressed according to the Victoria Planning Provisions, Clause 13.02-1S (Bushfire Planning), through bushfire hazard identification and assessment (including a bushfire hazard site and landscape assessment). This assessment must include risks to the proposed technologies from the landscape (bushfire/grassfire).	✓	A bushfire assessment was completed by Terramatrix in support of the planning approval process. This is provided in Appendix 1. The bushfire assessment has identified the presence of the surrounding grassland and woodland that could support bushfire activity. The BESS and the associated infrastructure have been located to not expose the development to more than 12.5 kW/m². The design solution has considered this impact and provided solutions to eliminate the risk of grassfires entering the site or a fire that starts within the site leaving the property.

Model requirement	Compliance	Comments
b) Address risks from proposed technologies through a comprehensive risk management process, documented in a Risk Management Plan.	✓	Section 5 of this RMP includes an analysis of risk to demonstrate the mitigation solutions are sufficient to manage the fire risk.
c) Indicate where the exact specifications of elements within the renewable energy facility will be determined during the detailed design phase, such as solar panel and wind turbine model/ manufacturer and battery chemistry.	✓	This RMP considers the site layout and provides design solutions to manage the fire risk. The RMP will be updated following the Planning Permit approval being obtained. This will also include the development of a Fire Management Plan and Emergency Management Plan.
d) Explicitly state that the following documentation will be prepared in accordance with this guideline, in consultation with CFA, before development starts: • Risk Management Plan • Fire Management Plan • Emergency Management Plan	✓	This document is the Risk Management Plan. The outcomes of this assessment will inform the Fire Management Plan and Emergency Management Plan.
Section 3 – Risk Management Plan		
A Risk Management Plan must be developed for all renewable energy facilities. The Risk Management Plan must:		
a) Describe the infrastructure (natural and built), landscape, nature of operations and occupancy of the facility.	✓	Refer to Section 2 and 3.
b) Describe the risks and hazards at the facility to and from the renewable energy infrastructure (including battery energy storage systems).	✓	Refer to Section 5.
c) Specify and justify, in accordance with Section 4.2 of this guideline:		

Model requirement	Compliance	Comments
• The location of the facility in the landscape, and the proposed infrastructure on-site.	✓	Refer to Section 4.3 of this Table.
• Emergency vehicle access to and within the facility that: o Includes site access points of a number suitable to the size and hazard of the facility (a minimum of two). o Provides access to renewable energy infrastructure, substations and fire service infrastructure.	✓	Refer to Section 4.3 of this Table.
• Firefighting water supply for the facility.	✓	Refer to Section 4.3 of this Table.
• A fire break width of 10m or greater, based on radiant heat flux (output) as an ignition source: o Around the perimeter of the facility. o Between any landscape buffer/vegetation screening and infrastructure.	✓	Refer to Section 4.3 of this Table.
• The separation distance, based on radiant heat flux (output) as an ignition source, between: • Adjacent renewable energy infrastructure (e.g., between adjacent battery containers/enclosures). • Battery containers/enclosures and related battery infrastructure, buildings/structures, and vegetation.	✓	Refer to Section 4.3 of this Table.

Model requirement	Compliance	Comments
• All other controls for the management of on and off-site hazards and risks at the facility (including all proposed battery energy storage system safety and protective systems).	✓	Refer to Section 4.3 of this Table.
d) Provide an evidence-based determination of the effectiveness of the risk controls against the identified hazards, including justification for the omission of any battery safety and protective system/s.	✓	Refer to Section 5.
e) Form the basis for the design of the facility.	✓	The outcomes of this assessment have been incorporated within the design of the facility, the Fire Management Plan and the Emergency Management Plan.
Section 4- Facility Location and Design		
Section 4.1 – Facility Location		
Planning applications for all renewable energy facilities proposed in high-risk environments must address the following:		
a) An assessment against policy at Clause 13.02-1S (Bushfire Planning) where the facility is located in a Bushfire Prone Area (BPA).	✓	This has been completed by Terramatrix and is contained within Appendix A.
b) 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.	✓	The design for this facility has considered the surrounding landscape and has ensured a 20 metre setback is included within the design. This will ensure the radiant heat exposure onto the infrastructure will not exceed 12.5 kW/m² when assessed against AS3959 – *Building in Bushfire Prone Areas*. The setback will also support the inability for a fire event on the property to spread into the neighbouring landscape.

Model requirement	Compliance	Comments
c) The impact of bushfire on the infrastructure (e.g. ember attack, radiant heat impact, flame contact).	✓	The site layout has ensured that there is a minimum 20 metre setback that will ensure a maximum radiant heat exposure of 12.5 kW/m² when assessed against AS3959 – *Building in Bushfire Prone Areas*. The Terramatrix report has identified the low risk landscape. Whilst the surrounding landscape would support bushfire activity, due to the fragmented landscape, the risk is considered reduced.
d) Assessment of whether the proposal will lead to an increase in risk to adjacent land and how the proposal will reduce risks at the site to an acceptable level.	✓	The design has included appropriate setbacks, non combustible fencing, CCTV system and a perimeter access road to ensure there is no increase in risk to adjoining properties.
Section 4.2 – Facility Design		
Section 4.2 – Facility Design		
Section 4.2.1 – Emergency vehicle (Fire Truck) access		
a) Construction of a four (4) metre perimeter road within the perimeter fire break.	✓	A minimum four metre wide perimeter road is being provided. The access road is located within the setback area around the BESS area of the site. A perimeter road is not provided along the eastern boundary adjacent to the substation area. However, this area will be provided with a non combustible surface.
b) Roads must be of all-weather construction and capable of accommodating a vehicle of fifteen (15) tonnes (e.g. no compacted earth).	✓	All areas where a vehicle can park or travel across including the formed access roads will be designed and constructed to accommodate a vehicle of 15 tonnes will be 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. Ensure any fencing along access	✓	This will be included within the design. The road widths will be a minimum of four metres wide. The main access road from Baranduda Drive to the commencement of the development will be 6 metres wide.

Model requirement	Compliance	Comments
routes allows for width of fire vehicles.		
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 flat, and no consideration is required.
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 flat. 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. At least one passing bay must be incorporated where roads are less than 600 metres long.	✓	Due to the size of the site, the length of roads does not exceed 600 metres. However, there are several intersections within the development that provides overtaking or passing capability.
g) Road networks must enable responding emergency services to access all areas of the facility, including fire service infrastructure, buildings, battery energy storage systems and related infrastructure, substations and grid connection areas.	✓	The perimeter road provides effective access to all parts of the property.
h) Provision of at least two (2) but preferably more access points to each part of the facility. The number of access points must be informed through a risk management process, in consultation with CFA.	✓	The development is providing a single main access/egress point with an emergency access/egress point at the north western corner of the development. This emergency access/egress point will provide personnel access all year round and vehicle access during drier months. The availability of access is considered within Section 5.
Section 4.2.2 Firefighting Water Supply		

Model requirement	Compliance	Comments
a) Water access points must be clearly identifiable and unobstructed to ensure efficient access.	✓	The water access point will be clearly marked and identifiable to enable efficient access for firefighters.
b) Static water storage tank installations must comply with *AS 2419.1-2021: Fire hydrant installations – System design, installation and commissioning.*	✓	Static water storage will be provided near the eastern side of the development. It is located to enable firefighters to access the water supply, pumps and booster assembly before entering the BESS area.
c) The static water storage tank(s) must be an above-ground water tank constructed of concrete or steel.	✓	The static water tanks will be above ground and constructed of steel or concrete.
d) The static water storage tank(s) must be capable of being completely refilled automatically or manually within 24 hours.	✓	The Emergency Management Plan will outline the process to ensure the tanks are refilled within 24 hours of them being used.
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.).	✓	The static water tanks are located adjacent to the main entrance and are at least 10 metres from any infrastructure. They are approximately 20 metres from the nearest BESS Unit.
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.*	✓	The hard suction points will be provided, and fitting requirements will be confirmed with CFA prior to the finalisation of the fire hydrant system design.
g) The hard-suction point must be positioned within four (4) metres to a hardstand area and provide a clear	✓	The hard stand is located within four meters of the hard suction point.

Model requirement	Compliance	Comments
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.	✓	A hardstand area is located adjacent to the water tanks and will ensure the firefighting appliance that is boosting the fire hydrant system is not impeding access to the site.
i) The road access and hardstand must be kept clear at all times.	✓	The site is provided with access roads. Due to the low number of staff and contractors likely to be on the site, the potential for road access and hard stand areas to be blocked is highly unlikely. The Site Emergency Management Plan will include a requirement that where safe to do so after a fire has started requiring fire brigade to respond, all vehicles will be removed from the site.
j) The hard-suction point must be protected from mechanical damage (e.g. bollards) where necessary.	✓	This will be incorporated within the design.
k) Where the access road has one entrance, a ten (10) metre radius turning circle must be provided at the tank.	✓	Suitable turning provisions are provided within the design.
l) An external water level indicator must be provided to the tank and be visible from the hardstand area.	✓	This will be incorporated within the design.
m) Signage indicating 'FIRE WATER' and the tank capacity must be fixed to each tank.	✓	This will be incorporated within the design.
n) Signage must be provided at the front entrance to the facility, indicating the direction to the static water tank.	✓	This will be incorporated within the design.
Battery Energy Storage Systems		

Model requirement	Compliance	Comments
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:	✓	Firefighting water supplies will be provided within a static water supply.
i. The fire water supply must be of a quantity no less than 288,000L or as per the provisions of *AS2419.1-2021: Fire hydrant installations*, Table2.2.5(D) for open yards flowing for a period of no less than four hours at 20L/s, whichever is the greater.	✓	The design is providing a minimum of 576,000 litres of firefighting water supply contained within tanks that comply with AS2419.1. The system will also incorporate pumps and a booster assembly as required by the Australian Standard.
ii. The quantity of static fire water storage is to be calculated from the number of hydrants required to flow from *AS 2419.1-2021: Fire hydrant installations*, Table 2.2.5(D). *(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.)*	✓	As above, 576,000 litres of firefighting water supply will be supplied.
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.	✓	Fire hydrants will be provided throughout the site and connected to a booster assembly, pumps and 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).	✓	The fire water supply is located within the site at a location that allows firefighters to access the water supply before they enter the BESS area.
v. The fire water supply must be reasonably adjacent to the battery	✓	The fire water supply is located in a position that provides a balance between

Model requirement	Compliance	Comments
energy storage system and shall be accessible without undue danger in an emergency. (E.g., Fire water tanks are to be located closer to the site entrance that the battery energy storage system).		being accessible and providing effective coverage of the site.
vi. The fire water supply must comply with AS2419.1-2021: Fire hydrant installations, Section 5:Water storage tanks.	✓	The fire hydrant system will comply with the specified requirements.
Section 4.2.3 Fire Detection and Suppression Equipment		
Suitable fire detection and suppression equipment must be provided:		
a) For on-site buildings and structures, according to the requirements of the National Construction Code.	✓	The buildings will comply with the National Construction Code where required.
b) For storages of dangerous goods, according to the requirements of any Australian Standards for storing and handling of dangerous goods.	✓	The storage of dangerous goods will comply with the relevant legislation.
c) For electrical installations, a minimum of two (2) suitable fire extinguishers must be provided within 3m-20m of each PCU.	✓	Fire extinguishers will be provided across the site and included within the Fire Management Plan.
d) In all vehicles and heavy equipment, each vehicle must carry at least a nine (9)-litre water stored-pressure fire extinguisher with a minimum rating of 3A, or other firefighting equipment as a minimum when on-site during the Fire Danger Period.	✓	This requirement will be specified within the Fire Management Plan.
Section 4.2.5 – 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	✓	The entire BESS development inside the boundary fences will be treated as per the fire break requirements. The entire surface

Model requirement	Compliance	Comments
screening inside the property boundary.		will be covered with crushed rock, concrete or other non-combustible surface products.
b) The perimeter of control rooms, electricity compounds, substations and all other buildings onsite. *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 minimum 10 wide fire break from the external surface.
Battery Energy Storage Systems		
A fire break must be established and maintained around battery energy storage systems and related infrastructure.	✓	This has been included within the design.
Section 4.2.6 – Design Specific to Facility Type		
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 battery system as per the CFA Guideline is required to be provided with appropriate separation between the batteries and supporting infrastructure. The CFA Guideline also requires the battery unit to comply with UL9540 and be certified against UL9540A by an independent testing authority. The results of the UL9540A test guides the required separation distance between the various battery units and other infrastructure to reduce the likelihood of fire spread occurring. The layout of the battery units will conform with the manufacturer specifications that directly relate to the outcomes of the UL9540A test. The UL9540A standards requires the test methodology to:

Model requirement	Compliance	Comments
		Determine the capability of a battery technology to undergo thermal runaway and then evaluate the fire and explosion hazard characteristics of those battery energy storage systems that have demonstrated a capacity to undergo thermal runaway. The spacing requirements are also influenced by NFPA 855 which requires the BESS manufacturer to determine the spacing requirements through appropriate testing including the use of UL9540A.
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.*	✓	As outlined previously, the separation being provided around the BESS and associated infrastructure is greater than 10 metres.
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. Minimises the potential for fires in battery containers/enclosures to impact on-site and offsite infrastructure.	✓	The site layout has been developed to provide emergency responders options to travel through the site once they have entered the property through the main access point. The layout is considerate of the potential for fires and how they may spread through a BESS site.
2) Battery energy storage systems must be:		

Model requirement	Compliance	Comments
a) Located so as to be reasonably adjacent to a site vehicle entrance (suitable for emergency vehicles).	✓	The development is easily accessed from Baranduda Drive.
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.)	✓	An analysis of available Bureau of Meteorology data (Albury) for the period 1983 to 2007 identifies the dominant wind direction at 3pm is from the west, north west or south west (approx. 40%). Approximately 20% is from the east, south east and north east. The 9am data indicates low wind strengths have existed. The dominant wind direction is from the south east (10%). The data does not indicate any dominant wind direction for this location. The 'wind rose' issued by the Bureau of Meteorology for 9am and 3pm is provided in Appendix B.
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 chosen BESS system will be provided with a fire safety system following consultation with CFA. This is likely to include a detection and suppression system. This is outlined in Section 2.2.
d) Provided with explosion prevention via sensing and venting, or explosion mitigation through deflagration panels.	✓	The Units are provided with explosion prevention and venting systems.
e) Provided with suitable ember protection to prevent embers from penetrating battery containers/enclosures.	✓	The enclosures are designed to eliminate the ingress of dust, spiders and other insects. This will also prevent any embers from fires in adjoining buildings or vacant properties to enter the BESS container. The chosen BESS Unit will have an IP rating, and this will be included within the updated RMP.
f) Provided with suitable access roads for emergency services	✓	Driveway access is provided that allows access and parking inside the main

Model requirement	Compliance	Comments
vehicles, to and within the site, including to battery energy storage system(s) and fire service infrastructure.		entrance along with perimeter access around the battery storage area.
g) Installed on a non-combustible surface such as concrete.	✓	The battery area and the supporting infrastructure are being stored on a non-combustible surface.
h) Provided with adequate ventilation.	✓	The batteries are stored with sufficient ventilation around and between the pack of containers and conform with the manufacturer's specifications.
i) Provided with impact protection to at least the equivalent of a W guardrail-type barrier, to prevent mechanical damage to battery containers/enclosures.	✓	There are various protection systems installed including bollards to ensure the battery enclosures and other infrastructure are protected from damage from vehicles and other equipment. The final decision for the provision of a system to prevent mechanical damage will be based on a final assessment during detailed design. The site will also introduce a policy that only permits vehicles to access the site when approved by site management. Unnecessary vehicle movements on the property will be always avoided.
j) Provided with enclosed wiring and buried cabling, except where required to be above-ground for grid connection.	✓	This has been included within the design.
k) Provided with spill containment that includes provision for management of fire water runoff.	✓	The development will be provided with a stormwater retention area that will also be used to capture any fire water runoff that may occur during firefighting operations. The stormwater retention area will be able to capture a minimum of 576,000 litres. Procedures will be included within the Emergency Management Plan to inform onsite staff and firefighters on the procedure to utilise the fire water retention area.

Model requirement	Compliance	Comments
Section 5 – Facility Construction and Commissioning		
Section 5.1.4 – Emergency Management		
An Emergency Plan must be developed for the construction and commissioning phase, before development starts.	✓	An Emergency Management Plan will be developed for both the construction and operations phase.
Section 6 – Facility Operation		
Section 6.1 –Fire Management Plan		
A Fire Management Plan must be developed for the facility, in consultation with CFA, before development starts.	✓	A Fire Management Plan will be developed for both the construction and operations phase.
Section 6.2 1 –Fire Hazards and Risk Controls		
If your facility is at-risk of bushfire, prevention and preparedness activities must be detailed in the Fire Management Plan.	✓	Appropriate procedures will be incorporated within the Fire Management Plan / Emergency Management Plan that addresses the bushfire risk.
Section 6.2 2–Vegetation 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 and Emergency Management Plan.
Section 6.2 4–Facility and System Monitoring		

Model requirement	Compliance	Comments
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. Any fire must be notified to 000 immediately.	✓	The site will be monitored by a SCADA system that is remotely monitored. All alerts will be received at the Monitoring Centre and a procedure will be in place to determine the most effective response that may include the following: • Activation of the Estop systems. • Deploy a technician to the site. • Call 000 and request emergency service assistance.
6.2.5 – Maintenance		
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 will be outlined within the Fire Management Plan.
Section 7 –Emergency Planning		
An Emergency Plan must be developed specific to the facility, in conjunction with CFA, before development starts.	✓	An Emergency Management Plan will be developed prior to construction commencing.
Section 8 – Provision of emergency information		
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 main entrance and the emergency entrance in a container that is protected from weather.

4.2 Treatment summary

Following the assessment against the CFA Guidelines the following treatments will be provided to manage the risk of fires. The Fire Management Plan will outline the detailed requirements for the

provision and maintenance of fire management treatments. The below list is a summary of the requirements:

1. Access to the site to include full perimeter access including appropriate widths and load limits from a main access point and an emergency access point.
2. Perimeter fire break that is a minimum of 10 metres.
3. Fire hydrant system that complies within AS2419.1 and will be designed to achieve 30l/s flow.
4. Fire water retention of at least 576,000 litres.
5. Fire Management Plan
6. Emergency Management Plan
7. Emergency Information Book and Emergency Information Containers.

5 Risk Assessment

This risk assessment has been developed to meet the requirements of Section 5 of the CFA Guidelines. Section 3 of the CFA Guidelines is outlined within Section 4.2 of this report.

5.1 Introduction

The risk assessment process involves identifying, analysing, evaluating and treating 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.

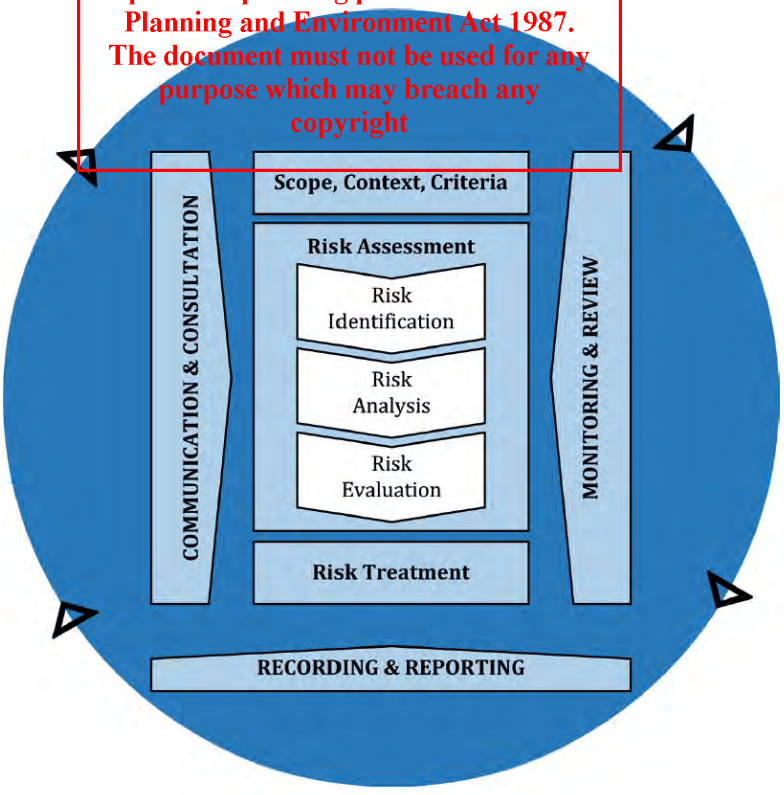

Figure 3 - Overview of AS/NZS ISO 31000-2018 risk management process

This report seeks to follow the steps outlined within the risk management guideline 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.

5.2 Context

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

5.3 Analysis of fire risk

BESS infrastructure is largely acknowledged as having limited potential to cause fires. Fires have occurred previously and where possible these have been considered during the assessment of risk outlined this report. The occurrence of fires in large scale battery packs is not common. Fires have occurred and these are usually contained to a single battery pack. The range of sensors that are fitted to the systems will in most cases enable the early shut down that will prevent thermal runaway from occurring.

It is important the assessment of risk considers the key stages of the Project being the construction and operations phase.

5.3.1 Assessment of fire risk during construction

The construction phase includes various stages including site works, undergoing infrastructure, construction of footings and the installation of the battery units. This stage also includes the commissioning of the battery units and other systems including fire protection systems. This stage also ensures the relevant connectivity is installed to ensure that all alerts and system messages are transmitted to an appropriate monitoring location.

A recent fire that occurred at the Victorian Big Battery[1] installation on the outskirts of Geelong has been assessed and reports are available that outlines what occurred and how system manufacturers and installers should consider this information. This fire occurred during the commissioning phase of the particular unit. In summary, the isolation of the unit whilst it contained a charge was considered an incorrect process[2].

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

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

On 28 September 2021, Energy Safe Victoria released their Statement of Findings – Fire at the Victorian Big Battery. They outlined that the root cause was most likely:

> *a leak within the Megapack cooling system that caused a short circuit that led to a fire in an electronic component. This resulted in heating that led to a thermal runaway and fire in an adjacent battery compartment within one Megapack, which spread to an adjacent second Megapack.*

The report outlines the contributory factors and the lessons learned to prevent a reoccurrence. Energy Safe Victoria provided approval to recommence commissioning at the Victorian Big Battery providing the measures outlined are in place. The report states that the affected Megapacks failed safely despite total loss.

The report states that Tesla is investigating why the second Megapack was lost and what they will do to prevent this from occurring in the future. Tesla has altered the design of their Megapack to limit the potential for fire spread to occur.

5.3.2 Assessment of fire risk during operations

The operations phase follows the commissioning stage of the Project, and 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 development is critical to ensure the ongoing management of fire risk.

All the system components are to be considered as critical as they all are contributing to the ongoing safe operations. The system components including monitoring connectivity, fire protection systems, vegetation management, site access controls, battery safety systems and other safety systems.

5.4 Risk identification

Through discussions with the client, review of various documentation and the consideration of previous fire history that involved BESS infrastructure, the following hazards have been identified:

Table 4 - Hazard identification and description

Hazard	Description
Electrical hazards causing a fire	Electrical faults and/or hazards can be a key cause of fire in BESS infrastructure. Hazards including battery faults, overcharging, rapid discharge, loss of remote monitoring systems, internal short circuits and overheating.
Fire causing spread to adjoining infrastructure on the property	A fire that has started in a single battery unit may spread to adjoining batteries, facilities or other infrastructure. Rapid escalation of the fire size and complexity can create issues for onsite staff and contractors, firefighters and the community.

Fire causing offsite impacts	Any fire on the property that is able to 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.
Offsite 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.
Fire water runoff	In the event of a fire, firefighters will respond and use water to either extinguish or cool the surrounding area until the infrastructure is deemed safe.
Dangerous Goods exposure	The dangerous goods that are stored within the BESS and associated infrastructure may leak and either ignite or require clean up by either on site staff, contractors or firefighters.
Staff and firefighters accessing the site.	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 will allow the assessment of most hazards that may be encountered in a development of this type.

5.5 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 risk matrix has been developed that enables the effective consideration of risk and to enable a comparison between the outcome of each hazard assessment.

5.5.1 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 a number of 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 5 - Likelihood table

Likelihood scale frequency	Description
Almost certain	The event Is expected to occur in most circumstances. (75%-99%). Has occurred frequently at the location.
Likely	The event will probably occur in most circumstance (50% - 75%). Has occurred frequently in the company.
Possible	The event should occur at some time. Likely to occur sometime (25% - 50%). Has occurred many times in the industry, but not in the company.
Unlikely	The event could occur at some time. Unlikely but possible (10% - 25%). Has occurred once or twice in the industry.
Rare	The event may occur only in exceptional circumstances. Assumed it may not be experienced (0% - 10%). Unheard of in the industry.

5.5.2 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 6 - Risk assessment consequence table

Consequence scale	Description		
	People	**Environment**	**Plant/Equipment**
Catastrophic	Multiple fatalities	Permanent widespread ecological damage. Toxic release off-site with detrimental effect. Likely EPA prosecution	Massive widespread equipment damage (i.e. plant/equipment write-off) ($1M +).
Major	Single fatality or permanent disability	Heavy ecological damage with costly restoration. Off-site release contained with outside assistance and little detrimental impact.	Multiple equipment replacements ($200 000 - $1M).

Moderate	Major injuries - Incapacitations or requiring time off work	Major but recoverable ecological damage. On-site release contained with outside assistance.	Equipment level replacement /repair ($50 000 - $200 000).
Minor	Significant injuries - Medical treatment, non-permanent injury	Limited but medium term damage. On-site release immediately contained	Component level replacement /repair ($10 000 - $50 000).
Insignificant	Slight injuries- First Aid Treatments (cuts/ bruises)	Short term damage. Low financial loss, negligible environmental impact	Slight Damage (< $10 000).

The risk rating table (Table 8) 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 development. Actions can be prioritised using this method to determine where risk mitigation works will occur.

Table 7 - Risk matrix

				Impact Score				
				1	2	3	4	5
				Insignificant	Minor	Moderate	Major	Catastrophic
Fire Risk Consultants Risk Assessment Matrix			People	Slight Injuries- First Aid Treatments (cuts/bruises)	Significant Injuries - Medical Treatment, non-permanent injury	Major Injuries - Incapacitations or requiring time off work	Single Fatality or Permanent Disability	Multiple Fatalities
			Environment	Short term damage / Low financial loss, negligible environmental impact	Limited but medium term damage / On-site release immediately contained	Major but recoverable ecological damage / On-site release contained with outside assistance	Heavy ecological damage with costly restoration / Off-site release contained with outside assistance and little detrimental impact	Permanent widespread ecological damage / Toxic release off-site with detrimental effect / Likely EPA prosecution
			Plant / Equipment	Slight Damage (< $10 000)	Component level replacement /repair ($10 000 - $50 000)	Equipment level replacement /repair ($50 000 - $200 000)	Multiple equipment replacements ($200 000 - $1M)	Massive widespread equipment damage (ie plant/equipment write-off) ($1M +)
Likelihood	A	Almost Certain	The event Is expected to occur in most circumstances / 75%-99% / Has occurred frequently at the location	Low (5)	Moderate (10)	Very High (18)	Extreme (23)	Extreme (25)
	B	Likely	The event will probably occur in most circumstance / 50% - 75% / Has occurred frequently in the company	Low (4)	Moderate (9)	Very High (17)	Very High (20)	Extreme (24)
	C	Possible	The event should occur at some time. Likely to occur some time / 25% - 50% / Has occurred many time in the industry, but not in the company	Low (3)	Moderate (8)	High (13)	Very High (19)	Very High (22)
	D	Unlikely	The event could occur at some time. Unlikely but possible / 10% - 25% / Has occurred once or twice in the industry	Low (2)	Low (7)	High (12)	High (15)	Very High (21)
	E	Rare	The event may occur only in exceptional circumstances. Assumed it may not be experienced / 0% - 10% / Unheard of in the industry	Low (1)	Low (6)	Moderate (11)	High (14)	High (16)

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.

5.5.3 Risk analysis worksheets

The following worksheets have assessed the hazards identified in Section 5.4 and results in a risk classification along with strategies to lower risk if it is deemed required. The initial assessment of risk is based on the information that has been supplied to date. The development of additional strategies to lower risk are made as either there was no information provided that identified the treatment or further clarity is required to considered.

Table 8 - Risk assessment - Electrical hazards causing a fire.

RISK	Electrical hazards causing a fire
CAUSE	Electrical faults and/or hazards can be a key cause of fire in BESS infrastructure. Hazards including battery faults, overcharging, rapid discharge, loss of remote monitoring systems, internal short circuits and overheating. These events may cause off gassing or thermal runaway.
LIKELIHOOD	Possible
JUSTIFICATION	The occurrence of electrical faults and/or hazards has occurred in the past and are likely to occur again in the future. The likelihood of an electrical fault escalating into an emergency such as a fire is unlikely due to the multiple layers of controls in place including sensors, 24/7 system monitoring and maintenance programs. There are examples of fires within BESS technology that indicates that when faults occur, they can escalate into challenging events including thermal runaway. 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: • Cooling systems that maintain the temperature of the batteries packs during day-to-day operations. • Safety system communicates to the monitoring centre if a sensor is activated. • Smoke and gas detection systems. • Internal barriers within the battery enclosures designed to reduce the possibility of thermal runaway events from spreading to adjoining battery units. • Separation distances between individual battery units and rows of batteries 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 and including compliance with *UL9540 – Energy Storage System Requirements* and *NFPA 855 - Standard for the Installation of Stationary Energy Storage Systems.* • The design and layout of the battery units are guided by the outcomes of the testing completed in accordance with UL9540A.
CONSEQUENCE	Moderate
JUSTIFICATION	The early detection of a fault that if not addressed can lead to a fire. The identification of a fault by the system monitoring process will result in early intervention. Intervention includes shut down, responding a technician or calling the fire brigade. The CFA Guideline requires a range of controls to be implemented and maintained including: • Non-combustible surface that won't support fire spread through vegetation accumulation.

	• SCADA monitoring system that will monitor the system performance including over charging, elevated temperatures and a range of other faults and send alerts to the monitoring centre • Compliance with UL9540 and subsequently UL9540A • Appropriate separation between battery containers and other infrastructure If the fire escalates and the implementation of shut down procedures does not stop the battery entering the off gassing phase and the thermal runaway phase, it is unlikely for the fire to spread beyond the Unit. The outcomes of the UL9540A tests indicate that the potential for a fire to occur and to then spread throughout the Unit is highly unlikely. The implementation of the controls outlined above will support the prevention of faults from escalating into fires and if a fire does occur, limit the ability for the fire to spread into an adjoining battery enclosure. The provision of a communications system between the SCADA system and the monitoring centre with built in redundancies will ensure the site is monitored 24/7 thereby ensuring early notification and receipt of alerts. The site is in an area that provides access options depending on the location of the fire and the prevailing wind conditions. This ensures that under any wind direction, firefighters can gain access to the incident/fire site safely.
RISK RATING	High (13)
STRATEGY TO LOWER RISK	The requirements outlined within the response to the CFA Guidelines will be sufficient to ensure the risk is managed at an acceptable level. Other strategies outlined within the response to the CFA Guidelines that will also assist with managing the risk includes: • Development of an Emergency Management Plan that includes in addition to that required by CFA: o A system to communicate effectively between the monitoring centre and the onsite 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. • Developing a procedure that requires a technician to be deployed to the site when the site monitoring communications are down, or a fault has been detected that may lead to an off gassing or thermal runaway event. • The SCADA system will be zoned to enable quick identification of the area of the facility that has caused an alarm. • Fire hydrant systems enabling firefighters to access firefighting water immediately.
RESIDUAL RISK	Moderate (8) (Possible/Minor)

Table 9 - Risk assessment - Fire causing spread to adjoining infrastructure on the property.

RISK	Fire causing spread to adjoining infrastructure on the property.
CAUSE	A fire that has started in a battery unit may spread to adjoining batteries, facilities or other infrastructure. Rapid escalation of the fire size and complexity can create issues for onsite staff and contractors, firefighters and the community.
LIKELIHOOD	Unlikely
JUSTIFICATION	The installed monitoring systems will send alerts to the monitoring station. These include sensors that are monitoring for over charging, elevated temperatures, and other faults. The day-to-day monitoring system will trigger an immediate response if alerted. The BESS system can be remotely operated, and this includes the commencement of shutdown procedures. The battery system is provided with a detailed operating manual that outlines the likely cause of an alert and how the operators are to respond. The site procedures will include a provision that ensures all alerts are addressed within two hours of activation. This will also include an immediate response to any fault that has been detected by the SCADA system. Operators within the monitoring centre will be able to access CCTV footage to enable them to gather additional information on the status of the faults at the site. Upon the system sensing a fault, the monitoring centre will determine an appropriate response that may include: • Notify the on-call technician to attend the site. • Call 000 and report the activation to the fire brigade in addition to notifying the on call technician to attend. The battery system enclosure is non-combustible and will provide a level of protection if a fire does occur inside the enclosure. If a fire occurs in an adjoining area of the site, the same enclosures will provide a level of protection. Most of the infrastructure that supports the BESS is non-combustible or has low quantities of combustible materials. There are a small number of fire events within BESS technology where a fire has spread to an adjoining battery. The layout design incorporates spaces that will reduce the risk of fire spread occurring.
CONSEQUENCE	Major
JUSTIFICATION	If a fire does spread to another battery enclosure or other infrastructure it may cause additional issues including smoke management, dangerous goods leaks, fire water runoff management and exposure to electrical hazards. The ability for fire spread to occur is limited due to the many safety systems that are installed and maintained including sensors that generates alerts and 24/7 monitoring resulting in early detection and response. The firefighting water supply will enable firefighters to protect exposures for the duration of the fire event if this is deemed required. It is noted that the BESS manufacturers response guide advises fire agencies to not attempt to extinguish a fire and to allow it to burn out. The layout design will be in accordance with the manufacturers specifications which will ensure there is suitable separation being provided between the battery enclosures and to other infrastructure. The separation distance requirements have been determined through fire engineering analysis and small to large scale fire testing.

RISK RATING	High (15)

STRATEGY TO LOWER RISK	The provision of additional controls as required by the CFA Guidelines and the outcome of this assessment will reduce the risk of a fire spreading to other infrastructure.
	
	The requirements outlined within the response to the CFA Guidelines and complying with the manufacturer specifications will be sufficient to ensure the risk is managed at an acceptable level. Other strategies outlined within the response to the CFA Guidelines that will also assist with managing the risk includes:
	
	• Development of Emergency Management Plan that includes in addition to that required by CFA:
	  o A system to communicate effectively between the monitoring centre and the onsite 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.
	• Developing a procedure that requires a technician to be deployed to the site when the site monitoring communications are down.
	• The SCADA system will be zoned to enable quick identification of the area of the facility that has caused an alarm.

RESIDUAL RISK	High (12) (Unlikely/Moderate)

Table 10 - Risk assessment - Fire causing offsite impacts.

RISK	Fire causing offsite impacts.
CAUSE	Any fire on the property can spread to adjoining properties. This would most likely be through vegetation connectivity. If this occurs on an elevated fire danger day, the fire could spread into adjoining properties.
LIKELIHOOD	Possible
JUSTIFICATION	The likelihood of a fire occurring within the BESS Area is outlined within Table 8 and 9. In addition to this, the compliance with CFA Guidelines also requires mitigation strategies implemented including: • Non-combustible surface under the battery containers and other infrastructure. • Provision of a fire break and additional managed areas between the fire break and the boundary fence. • The battery systems are contained within the metal cabinets and any fire activity will likely stay within the cabinets. • The requirement for a Fire Management Plan and Emergency Management Plan that will include prevention and preparedness activities that must occur annually prior to the fire danger period. • The Fire Management Plan will also provide clear direction on the maintenance of the various controls required to manage the fire risk.

	In addition to the CFA Guideline, the provision of non combustible fencing around the site will limit the ability for a fire to leave the property.
CONSEQUENCE	Minor
JUSTIFICATION	The surrounding landscape consists of a grassland environment. With the provisions of a fire break, setbacks from the boundary and the non combustible fencing the risk of fires leaving the site is reduced significantly. In the event of a fire and smoke is being generated, the Emergency Management Plan will require the site operators to immediately engage with their neighbours to inform them of the fire and the suggested actions they should take. The fire agency also has access to a system that can warn or alert the surrounding area of the fire and provide advice as to actions they can take.
RISK RATING	Moderate (8)
STRATEGY TO LOWER RISK	Any vegetation growth on the property will be managed and removed and this will be outlined within the Fire Management Plan. During the fire danger period, additional inspections will occur to ensure that all weeds and other vegetation is removed from the fire break and other areas. The site operators will enact standard OH & S policies and procedures including Hot Works, use of naked flames on the property, smoking management, induction of new staff and contractors and contractor management. The induction procedure will include a requirement to ensure people are aware of their obligations of not creating fire risks during their day to day activities.
RESIDUAL RISK	Low (7) (Unlikely/Minor)

Table 11 - Risk assessment - Offsite fire impacting on the site.

RISK	Offsite fire impacting on the site.
CAUSE	A fire burning in the surrounding landscape can enter the property and threaten the infrastructure by potentially starting new fires through ember attack or flame contact.
LIKELIHOOD	Unlikely
JUSTIFICATION	There is a risk of bushfires impacting on the property or the surrounding area. The surrounding grassed areas will likely support bushfire activity under elevated fire danger conditions. The site includes fire breaks and managed areas that will limit the ability for a fire to burn on the property. The Fire Management Plan will outline the management arrangements and the maintenance requirements. The ongoing removal of vegetation and other combustible materials in and around the BESS area will be specified within the Fire Management Plan. The design of the battery enclosures will prevent fires from entering the Units. The enclosures are designed to prevent dust, insects and birds from entering. The enclosures are also fitted with internal climate control systems that will result in fires likely to self-extinguish due to the cool temperatures.

CONSEQUENCE	Minor
JUSTIFICATION	The ability for a vegetation fire to generate sufficient radiant heat in the surrounding landscape is unlikely to impact on the non combustible fencing. The requirements to maintain and manage the onsite vegetation will ensure that fire spread onto the property will be limited. It is highly unlikely for flame contact or radiant heat to impact on the BESS from a fire in the surrounding area.
RISK RATING	Low (7)
STRATEGY TO LOWER RISK	Within the Emergency Management Plan ensure the following is included: • When elevated fire danger conditions are forecast, ensure all vegetation maintenance activities have occurred. • If a fire has occurred in the surrounding landscape, engage with CFA to ascertain any actions that should be undertaken to protect the BESS infrastructure.
RESIDUAL RISK	Low (6) (Rare/Minor)

Table 12 - 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. There is the potential for a Dangerous Goods leak to occur that may cause a threat to people, the environment or be involved in a fire.
LIKELIHOOD	Unlikely
JUSTIFICATION	Dangerous goods are located within the battery enclosures and the transformers. 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. 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 BESS Site. 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 and other infrastructure 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 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.

	Due to the manufacturing and installation procedures, the potential for a Dangerous Good incident to occur is unlikely.
CONSEQUENCE	Moderate
JUSTIFICATION	The assessment of the dangerous goods quantities at the BESS identified the following infrastructure with quantities of dangerous goods that will likely exceed the Schedule 2 requirements as outlined within the Victoria Dangerous Goods legislation. The largest quantity of Dangerous Goods will be the Lithium Ion (Class 9). Other Dangerous Goods may include refrigerant and oils. These will be assessed when the final design has been endorsed. The Dangerous Goods referred above, are stored in separate components within the battery enclosures, or in separate infrastructure (Transformers, Inverters, etc). It is therefore unlikely for the total quantities of Dangerous Goods on the site to be involved in an incident at the Site at the same time. There are other goods that may be utilised and stored on the site, but it would be expected that these would be in small quantities.
RISK RATING	High (12)
STRATEGY TO LOWER RISK	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. The fire brigade will be aware of the presence of Dangerous Goods in relation to the Proposal. Further consultation with CFA 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 actions to Dangerous Goods related emergencies.
RESIDUAL RISK	Moderate (11) (Rare/Moderate)

Table 13 - Risk assessment - Fire water runoff

RISK	Fire water runoff
CAUSE	In the event of a fire, firefighters will respond and use water to either extinguish or cool the surrounding area until the infrastructure is deemed safe.
LIKELIHOOD	Unlikely
JUSTIFICATION	As outlined in previous assessments, the risk of a large fire is very low and unlikely. This is due to the separation between various areas of the BESS and the extensive use of non-combustible materials. The sensors within the infrastructure are monitored 24/7 and will alert technicians and if required, the fire brigade to the site early. If a fire occurs, it will likely be contained to a single battery unit. Firefighting water can be used to cool the adjoining areas and will be considered largely clean as it has not been exposed to fire or smoke. The site is mainly flat and will not support fire water to leave the property easily. The provided landscaping will support the containment of fire water runoff.

CONSEQUENCE	Minor
JUSTIFICATION	The site will be provided with a facility to capture fire water runoff. This water will be contained until testing can occur and then in conjunction with EPA determine the most effective disposal method. The Emergency Management Plan will include procedures to capture fire water and then if required, disposal arrangements.
RISK RATING	Low (7)
STRATEGY TO LOWER RISK	Onsite staff will be trained in the fire water runoff management procedures. They will then be available to assist firefighters with managing fire water runoff. The requirement to regularly check the fire water runoff retention basin will be contained within the Fire Management Plan.
RESIDUAL RISK	Low (6) (Rare/Minor)

Table 14 - 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	Possible
JUSTIFICATION	There is the potential for firefighters and/or staff and contractors to be present during an emergency event and not being familiar with the site. The CFA Guidelines 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 potential for a fire to occur whilst a low risk, if it does occur, there is the potential for a firefighter to arrive who is unfamiliar with property and the technology installed.
CONSEQUENCE	Moderate
JUSTIFICATION	The provision of an Emergency Information Container that will include the Emergency Management Plan, site plans and contact details for technical specialists will ensure responding firefighters seek information prior to entering the property. The layout of the site will ensure that firefighters will only access the site through the main entrance which is where the Emergency Information Container is located.
RISK RATING	High (13)

STRATEGY TO LOWER RISK	The arrangements for monitoring the SCADA system through the monitoring centre will ensure that an informed decision can be made following an assessment of the alerts being received. In all cases a technician will be dispatched to the site to review the alert at the BESS. The Emergency Management Plan will include a requirement to engage with the responding firefighters early to ensure they are aware that a technician is on their way and that entry to the site can wait until they arrive unless there is a life protection emergency. The Emergency Information Container that is required by the CFA Guidelines will provide detailed contact information for responding firefighters to seek specialist advice prior to accessing the property.
RESIDUAL RISK	Moderate (8) (Possible/Minor)

6 Conclusion

The assessment of fire risk for the Baranduda BESS has resulted in an assessment of low to medium risk.

The low risk is driven by compliance with the CFA Guidelines during the design phase of the Project. The risk assessment along with the assessment against the CFA Guideline has identified that the project achieves compliance. The two areas that have varied the model requirements and have been considered as part of this RMP are:

- The site will not be provided a perimeter road along part of the eastern boundary adjacent to the substation. It is believed that the intent of the model requirements is for the perimeter road to be provided to the BESS area of the site. The Substation area will comply with Ausnet requirements and have a non combustible surface. Whilst this area is not formally declared a perimeter road, it would be trafficable when the power has been isolated if required.

- The site is provided with a main access/egress point to the south that connects to Baranduda Drive. In the north western corner of the site, an emergency vehicle access/egress gate and turning provisions is provided that will enable firefighters to exit if required during an emergency or to safely turn around. It is likely for this access/egress point to support firefighting vehicles during drier periods of the year.

- The fire water supply is located within the site and not adjacent to the main entrance. This is due to the limited siting options at the main entrance. The location does provide firefighters with the ability to access the water supply and associated infrastructure before entering the BESS area.

The systems and procedures that are being implemented during design, construction, commissioning and operation will ensure that any risk is managed to an acceptable level.

Historically, fire events involving these types of facilities are due to inappropriate procedures that include having not considered the risk of fire effectively. This RMP has considered these examples in the development of risk mitigation treatments for the Baranduda BESS.

BESS facilities can present fire risks if not designed, constructed, commissioned and operated effectively. The importance of following design requirements and committing to the ongoing maintenance of the system is critical to reduce fire risk.

Appendix A – Bushfire Risk Assessment

Terramatrix project code: BirdwoodEnergyReservePtyLtd-2023-01 Cl1302_BPA-Baranduda
Cover image: Looking over the site.

Accountability

Stage	Date completed	Name	Title
Site assessment	2023-02-24	Amalie Tibbits	Manager, Bushfire Analysis and Research
Analysis & report preparation	2023-12-18	Angus Barbary	Analyst
Peer review	2023-12-19	Jon Boura	Managing Director

Version Control

Version	Date issued	Comments	Issued by
1.0	2023-12-19	Bushfire Development Report (BDR) to client	Angus Barbary
1.1	2024-01-31	Updated BDR	Angus Barbary

Terramatrix Pty. Ltd.
ACN 129 163 373
ABN 44 129 163 373
PO Box 1391
Collingwood VIC 3066
P: 03 9417 2626
www.terramatrix.com.au

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GIS disclaimer
Spatial data was supplied by the State Government of Victoria. Care was taken with the creation of maps used in this report, however the accuracy cannot be guaranteed. Users of the maps should make appropriate enquiries to ascertain the useability of this information.

TABLE OF CONTENTS

1. Executive summary

- This Bushfire Development Report (BDR), in support of the Baranduda Battery Energy Storage System (hereafter referred to as 'Baranduda BESS') planning permit application, demonstrates how it can respond to the applicable bushfire regulations.
- This report's structure and content responds to the *Design Guidelines and Model Requirements for Renewable Energy Facilities v4*; (hereafter referred to as the 'Guidelines') and *Clause 13.02-1S Bushfire Planning* of the Wodonga Planning Scheme.
- A bushfire hazard assessment was conducted at the site on 24/02/2023, and an assessment of landscape hazard was conducted by desktop analysis (see Section 5).
- The site and wider Baranduda area are in a landscape of moderate bushfire hazard. The site is in a designated Bushfire Prone Area (BPA), but not covered by the Bushfire Management Overlay (BMO).
- The Baranduda BESS is exposed to classified vegetation within 100 m of the site, comprising Grassland in surrounding paddocks outside the lease area (site) and Woodland along the creek line to the north.
- The applicable slope classes are 'Downslope >0°-5°' to the north and 'All upslopes and flat land in other directions.
- The bushfire risk to the Baranduda BESS can be mitigated to an acceptable level and the facility meet the objectives of the Guidelines by implementing the applicable 'model requirements' (see Sections 6-10).
- Distinct elements of the Guidelines are:
  - Risk Management Plan (see Section 6).
  - Fire Safety Study (not included in this BDR but referenced in Section 6.6).
  - Fire Management Plan (not included in this BDR but referenced in Section 9).
  - Emergency Management Plan (not included in this BDR but referenced in Section 10).
  - A response to Clause 13.02-1S (see Section 4.1.2 and Section 11).
- The elements of Clause 13.02-1S addressed in this report are:
  - Bushfire hazard assessment at various scales (see Section 5).
  - Setbacks from classified vegetation to achieve a radiant heat flux less than 12.5 kW/m².
- Design elements of the Baranduda BESS that pertain to bushfire protection (see Section 7.2) are:
  - Minimum low threat or non-vegetated setback distances for BESS infrastructure to achieve a radiant heat flux less than 12.5 kW/m² are:
    - 41 m from Woodland to the north
    - 22 m from Grassland to the north
    - 19 m from Grassland to the south.
  - Two points of access/egress and a road encircling the facility that is at least 6 m wide.
  - A XXX L static water supply on site with a compliant tank and hydrant system.

- Fire detection and suppression systems (see Section 7.2.7)
- A 12 m wide fire break around BESS infrastructure in the central facility area that is clear of any vegetation (including screening).
- A minimum BAL-12.5 construction standard for any buildings on the site.

2. Introduction

This Bushfire Development Report has been prepared for Birdwood Energy Reserve Pty Ltd, to assess how the proposed development of a Battery Energy Storage System (BESS) at 157 Kiewa Valley Highway, Baranduda VIC 3691 can respond to the bushfire risk and the applicable Victorian planning and building controls that relate to bushfire, in particular the objective and applicable strategies of the Planning Policy Framework (PPF) at Clause 13.02-1S *Bushfire Planning* in the Victoria Planning Provisions (Clause 13.02-1S Wodonga Planning Scheme).

The proposal aims to meet the objectives of Clause 13.02-1S and responds to the Model and Additional Requirements outlined in the *Design Guidelines and Model Requirements: Renewable Energy Facilities v4* (CFA, 2023). The Guidelines require the Baranduda BESS to address bushfire risk according to the Victoria Planning Provisions, through the bushfire hazard assessment methodology in Clause 13.02-1S. Theses assessments are shown in this report at Section 5.

The development site comprises a lease area ('the site') within a larger property. The site is in a designated Bushfire Prone Area (BPA). BPAs are those areas subject to or likely to be subject to bushfires, as determined by the Minister for Planning. Higher hazard land within a BPA, that may be subject to extreme bushfire behaviour, is covered by the Bushfire Management Overlay (BMO). The western corner of the property is covered by the BMO, however the buildings and works associated with the BESS are outside this area and the development is not required to respond to the BMO.

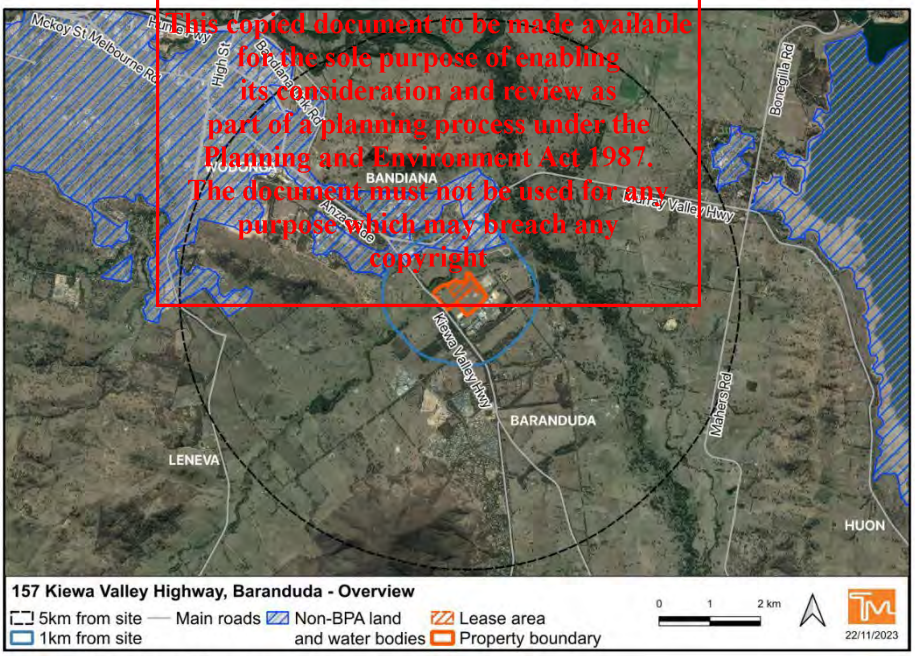
The primary function of the Baranduda BESS is to capture and store energy from the grid during off-peak energy use times and feed it back into the grid during times of peak energy use. The anticipated operational lifespan of the facility is 30 years.

This report assesses the bushfire hazard and identifies how the proposed development of the BESS can appropriately mitigate the bushfire risk and comply with the applicable bushfire planning and building controls. It has been prepared in accordance with guidance for the assessment of, and response to, bushfire risk, provided in:

- Clause 13.02-1S *Bushfire Planning* (Clause 13.02-1S Wodonga Planning Scheme).
- AS 3959-2018 *Construction of buildings in bushfire prone areas* (Standards Australia, 2020).
- *Bushfire State Planning Policy Amendment VC140*, Planning Advisory Note 68 (DELWP, 2018).
- *Design Guidelines and Model Requirements: Renewable Energy Facilities v4* (CFA, 2023).

3. Site and proposal overview

Address:	157 Kiewa Valley Highway, Baranduda VIC 3629
Property size:	45.6 ha (BESS lease area: 16.4 ha)
Local Government Area:	City of Wodonga
Zone/s	Industrial Zone and Schedule 1 (IN1Z)
Overlay/s	Bushfire Management Overlay (BMO) (partial coverage, does not affect lease area) Floodway Overlay and Schedule (FO) (partial coverage, does not affect lease area) Vegetation Protection Overlay and Schedule 4 (VPO4) (partial coverage, does not affect lease area)
Directory reference	VicRoads 35 H4
Site assessment date	24-02-2023
Assessed by	Amalie Tibbits



Map 1 – Overview of the site.

The Baranduda BESS will include a battery array, a substation that connects the facility to the wider power grid, electrical equipment and supporting infrastructure. The battery array will comprise up to a 500-skid (unit) lithium-ion battery array and 120 inverter stations with adjacent medium voltage (MV) transformer stations rated at 4.5 MVA. The substation will comprise four main transformers, each rated to a maximum capacity of 150 MVA. The supporting infrastructure will comprise high and low voltage (overhead) configurations, laydown and storage areas, fencing, roads, drainage, earthing, and supporting buildings including storage containers and switchgear, control, operations, and maintenance buildings.

The net weight of the lithium-ion battery cells throughout the facility (not including their containers) will be approximately 12 kilotons.

During the operations there will be 5-10 staff on-site during business hours, with callouts to the site outside business hours as required. During the construction phase, there will typically be 25-50 workers on-site, with a maximum of 150 people during the peak construction stage.

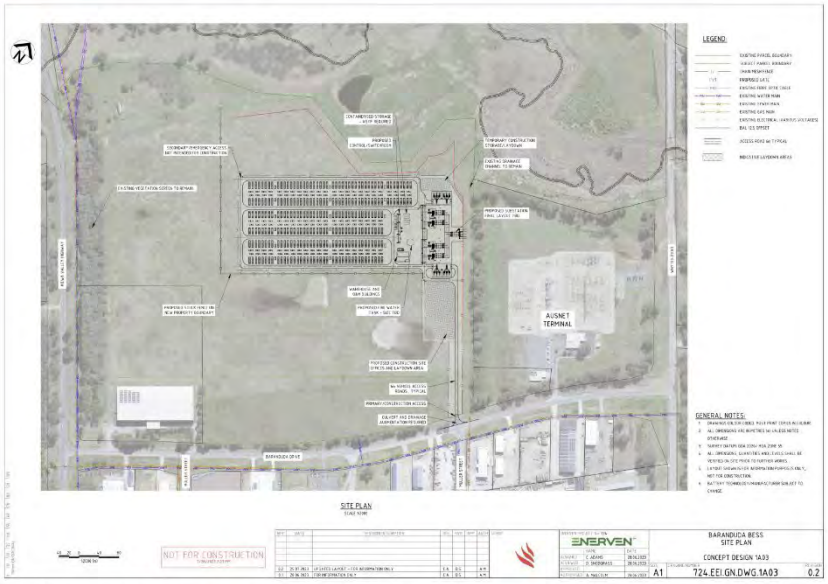


Figure 1 – Site plan for the Baranduda BESS (Enerven, 2023).

Figure 2 – Landscape maintenance plan for the Baranduda BESS (Chris Smith & Associates, 2023).

4. Bushfire planning and building controls

This section identifies the applicable planning and building controls that relate to bushfire.

4.1 Clause 13 Environmental risks and amenity

This clause in the Planning Policy Framework (PPF) has two key provisions pertinent to bushfire.

4.1.1 Clause 13.01-1S Natural hazards and climate change

The objective of this Clause is to minimise the impacts of natural hazards and adapt to the impacts of climate change through risk-based planning. Specified strategies to achieve the objective are:

- *'Consider the risks associated with climate change in planning and management decision making processes.*
- *Identify at risk areas using the best available data and climate change science.*
- *Integrate strategic land use planning with emergency management decision making.*
- *Direct population growth and development to low risk locations.*
- *Develop adaptation response strategies for existing settlements in risk areas to accommodate change over time.*
- *Ensure planning controls allow for risk mitigation or risk adaptation strategies to be implemented.*
- *Site and design development to minimise risk to life, property, the natural environment and community infrastructure from natural hazards'* (Clause 13.01-1S Wodonga Planning Scheme).

Especially in southern and eastern Australia, since the 1950's there has been an increase in the length of the fire weather season and an increase in extreme fire weather (CSIRO/BOM, 2020a). The trend of a longer fire season and increased number of dangerous fire weather days is projected to continue. Climate change is contributing to these changes in fire weather including by affecting temperature, relative humidity and associated changes to the fuel moisture content (CSIRO/BOM, 2020a) (see Section 5.3). The National Council for Fire and Emergency Services (formerly AFAC) identify that a failure of building codes and land use planning to adequately adapt to climate change is a significant risk (AFAC, 2018).

Climate change trends associated with the risk of bushfire, support the adoption of a precautionary and conservative approach in identifying and responding to the risk. Climate change in relation to fire weather is discussed further in the hazard assessment in Section 5.3 of this report.

4.1.2 Clause 13.02-1S Bushfire planning

Clause 13.02-1S has the objective *'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

Wodonga Planning Scheme). The policy must be applied to all planning and decision making under the Planning and Environment Act 1987, relating to land which is:

- Within a designated BPA;
- Subject to a BMO; or
- Proposed to be used or developed in a way that may create a bushfire hazard.

Development should not be approved where '*...a landowner or proponent has not satisfactorily demonstrated that the relevant policies have been addressed, performance measures satisfied or bushfire protection measures can be adequately implemented*'.

The CFA Guidelines require the Clause 13.02-1S bushfire hazard identification and assessment strategies to be applied (see Sections 1 and 5).

The Baranduda BESS can appropriately prioritise the protection of human life and meet the objectives of Clause 13.02-1S, by developing and implementing a Bushfire Management Plan, maintaining low threat vegetation within the site and other site management practices informed by the Guidelines, as detailed in this report.

4.2 Clause 71.02-3 Integrated Decision Making

Clause 71.02-3 states that planning and responsible authorities should endeavour to integrate policies and balance conflicting objectives in favour of net community benefit and sustainable development. However, in bushfire affected areas, the protection of human life must be prioritised over all other policy considerations (Clause 71.02-3 Wodonga Planning Scheme).

4.3 Bushfire Prone Area (BPA)

The entire site is within the BPA. BPAs are those areas subject to or likely to be subject to bushfire, as determined by the Minister for Planning.

In a BPA, the Building Act 1993 and associated Building Regulations 2018, through application of the National Construction Code 2022 (NCC), require specific design and construction standards for Class 1, 2 and 3[1] buildings, certain Class 9 and 4 buildings[2], and Class 10A buildings[3] or decks adjacent to, or connected with, these classes of buildings.

[1] Class 1, 2 and 3 buildings are defined in the NCC and are generally those used for residential accommodation, including houses and other dwellings, apartments, hotels and other buildings with a similar function or use.
[2] Applicable Class 9 buildings are Class 9a health-care buildings, Class 9b early childhood centres, primary and secondary schools, Class 9c residential care buildings, and any Class 4 parts of a building associated with these Class 9 buildings.
[3] Class 10a buildings are defined in the NCC as non-habitable buildings including sheds, carports, and private garages.

For Class 1 buildings (dwellings) and associated Class 10A buildings or decks, the applicable performance requirement in the NCC is:

'A Class 1 building or a Class 10a building or deck associated with a Class 1 building that is constructed in a designated bushfire prone area must be designed and constructed to—

(a) reduce the risk of ignition from a design bushfire with an annual exceedance probability not more than 1:50 years; and

(b) take account of the assessed duration and intensity of the fire actions of the design bushfire; and

(c) be designed to prevent internal ignition of the building and its contents; and

(d) maintain the structural integrity of the building for the duration of the design bushfire (ABCB, 2022).

The performance requirement for Class 1, 2 and 3 buildings and associated Class 10a buildings and decks, is deemed to be satisfied by design and construction in accordance with AS 3959-2018 *Construction of buildings in bushfire prone areas* and, for Class 1 buildings and associated decks, the NASH Standard – *Steel Framed Construction in Bushfire Areas* (NASH, 2021).

The buildings proposed for the site are not in a class that requires construction to a BAL under the NCC. However, we consider it advisable that a BAL-12.5 construction standard be applied to the buildings where possible, to reduce vulnerability to ember attack. This ties in with the Clause 13.02-1S requirement to provide setbacks from classified vegetation to reduce radiant heat flux to less than 12.5 kW/m², which corresponds to a BAL-12.5 construction standard.

The buildings at the Baranduda BESS that should be constructed to BAL-12.5 and provided with the commensurate low threat or non-vegetated setbacks are:

- The control/switch room
- The Warehouse and O&M and storage
- Any buildings associated with the substation.

4.4 Design guidelines renewable energy facilities

The *Design Guidelines and Model Requirements Renewable Energy Facilities* (CFA, 2023) call for consultation with CFA and provide guidance on designing, constructing, and operating new renewable energy facilities, including a BESS. The Guidelines include standard measures and processes in relation to fire safety, risk and emergency management. Measures include those to be applied in the development of all renewable energy installations, shown in this report as red tables:

Model Requirements – all facilities

and others specific to battery installations, shown in this report as orange tables:

Model or Additional Requirements – BESS specific

Of relevance to the proposed Baranduda BESS are:

- Consideration of applicable Australian standards.
- Meeting the requirements of the planning approvals process.
- Risk management planning.
- Facility location and design.
- Construction, commissioning, and operational procedures.
- Emergency management planning.
- Incorporating CFA input re dangerous goods for battery storage facilities.
- Occupational Health and Safety requirements.
- Provision of information to, and consultation with CFA on the above-mentioned points.

This BDR forms part of the engagement process with CFA and is structured around the Guidelines. Relevant text from the Guidelines is provided at the start of each section under the appropriate headings.

5. Bushfire hazard assessment

The Guidelines require that the hazard identification and assessment strategies at Clause 13.02-1S be applied, using the best available science to identify the hazard posed by vegetation, topographic and climatic conditions. The hazard is to be assessed at the following scales:

- *'Landscape conditions - meaning the conditions in the landscape within 20 kilometres and potentially up to 75 kilometres from a site;*
- *Local conditions - meaning conditions in the area within approximately 1 kilometre from a site;*
- *Neighbourhood conditions - meaning conditions in the area within 400 metres of a site; and,*
- *The site for the development'* (Clause 13.02-1S Wodonga Planning Scheme).

The BPA coverage invokes AS 3959-2018, which requires a site assessment of the vegetation and topography up to 100 m around a building, for the purposes of determining the applicable BAL construction standard for that building (Standards Australia, 2020). Clause 13.02-1S also requires application of the AS 3959-2018 assessment method to ensure radiant heat flux will not exceed 12.5kW/m² for relevant buildings and, in this case, infrastructure.

This section includes an assessment of vegetation, topography and climate/weather considerations at:

- The wider landscape scale, for at least 20 km around the site (see Section 5 and Map 2).
- The local landscape scale extending up to 1 km from the site (see Section 5.1.2 and Map 3).
- The neighbourhood scale up to 400 m around the site boundary to identify any risk arising around the site beyond the BAL assessment zone (see Section 5.1.3 and Map 3).
- The site scale, for 100 m around proposed facility (see Section 5.2 and Map 4).

5.1 Landscape assessment

This section addresses bushfire risk from the broader landscape scale at 20km to the local landscape at 1km and show these risks in Map 2 and Map 3. An overview of the landscape at a 5km extent is also illustrated in Map 1 at the beginning of this report.

5.1.1 Broader landscape risk

The BESS is in the City of Wodonga Local Government Area (LGA) and located approximately 4 km south-east of Wodonga, 2 km north-west of the Baranduda township and 330 km north-east of Melbourne.

Baranduda lies at the north-eastern tip of the Baranduda Range, which forms part of the foothills of the Great Dividing Range extending to the south. The Murray River lies to the north between the urban areas of Wodonga and Albury, with Lake Hume to the east. The broader landscape comprises pastoral land on rolling hills, giving way to flatter undulating land to the north and the mountainous forested terrain of the Great Dividing Range to the south.

The broader landscape is characterised by:

- To the north of the site, the urban areas of Wodonga and Albury extends for over 10 km, with the vegetated Murray River corridor extending between the townships.
- To the south-west of the site, largely pastoral land extends over undulating terrain to the Indigo Valley.
- To the south, the smaller urban area of Baranduda sits at the north-eastern end of the Baranduda Range, with the pastoral land of the Yackandandah Valley beyond to the south.
- To the south-east of the site, the Kiewa River runs parallel to the Hume Reservoir, which dominates the landscape further to the east, with the Kiewa Valley comprising pastoral land with scattered trees along the river, with Mount Murramurrabong forming hilly bushland similar to the Baranduda Range.

The BMO covers the denser bushland to the south and the smaller, more fragmented treed areas closer to the site, including part of the larger property, but the BESS lease area is not within the BMO coverage. The wider landscape has an extensive fire history, predominantly to the west of the site but with a more recent pattern of fires in the bushland to the south . The most recent fire close to the site occurred in 2021, around 1.4 km to the west (see Map 2). Note that fire history data is only shown for Victoria.

The site could be approached by fire burning through the nearby farmland. The urban areas of Wodonga to the north-west and Bandiana and Killara to the north and the industrial area to the south-east would substantially buffer the site from the approach of a large grass fire from these directions. The hazard within 5 km of the site will likely decrease as urban development progresses at Leneva and Baranduda as envisioned by the Leneva & Baranduda Precinct Structure Plan.

A comprehensive local road network provides ready access to lower threat areas to the north of the site.

To assist in assessing landscape risk, four 'broader landscape types', representing different landscape risk levels, are described in the technical guide *Planning Applications Bushfire Management Overlay*. These are intended to streamline decision-making, and support more consistent decisions based on the landscape risk (DELWP, 2017).

The four types range from low-risk landscapes where there is little hazardous vegetation beyond 150 m of a site and extreme bushfire behaviour is not credible, to extreme risk landscapes with limited or no evacuation options and where fire behaviour could exceed BMO/AS 3959 assumptions (see Table 1).

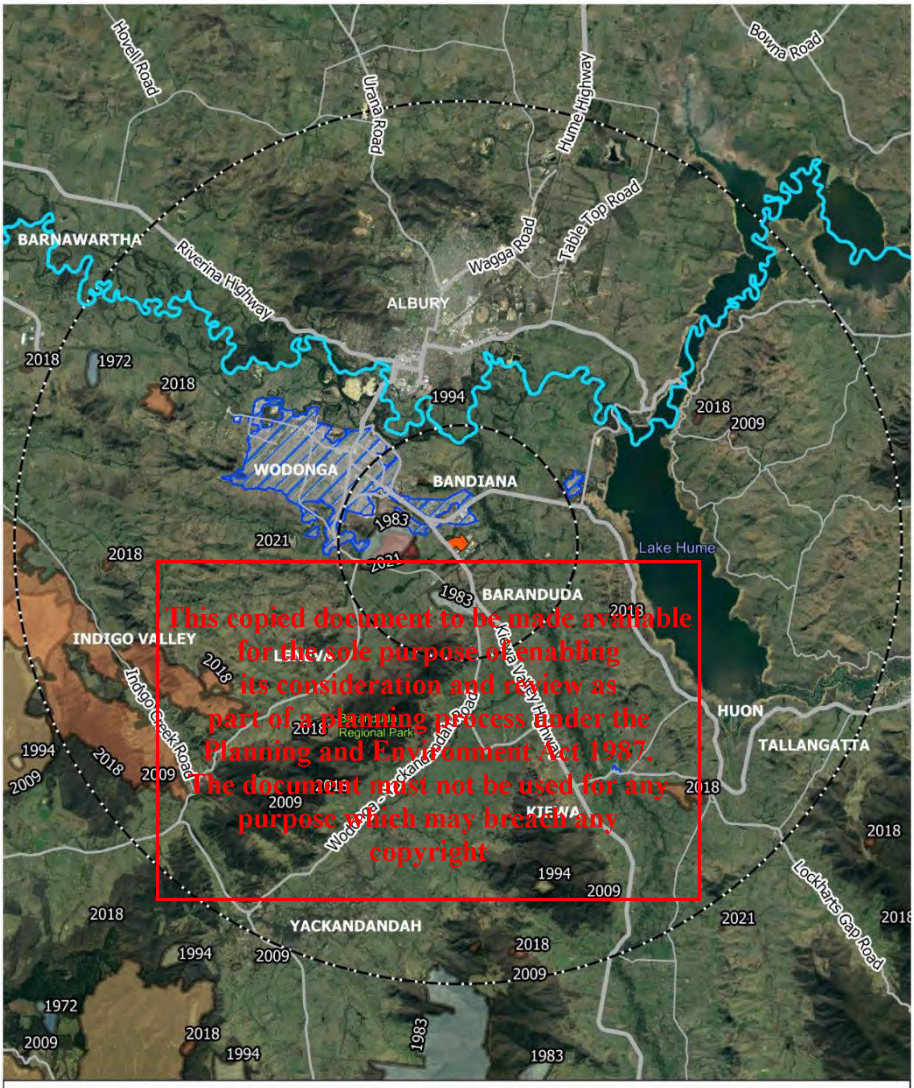
The site is exposed to Grassland to the north and in the larger property the BESS lease area is within and the north-east associated with the Wodonga Terminal Station adjacent to the site.

The site is in a moderate risk landscape, exposed to relatively short runs of fire through grassland to the north, north-west and north-east and potentially a much longer run from the south-west. The

immediately surrounding landscape accords with Broader Landscape Type 2. Access to lower threat areas is immediately available to the north.

Table 1 - Landscape risk typologies (from DELWP, 2017).

Broader Landscape Type 1	Broader Landscape Type 2	Broader Landscape Type 3	Broader Landscape Type 4
• *There is little vegetation beyond 150 metres of the site (except grasslands and low-threat vegetation).* • *Extreme bushfire behaviour is not possible.* • *The type and extent of vegetation is unlikely to result in neighbourhood-scale destruction of property.* • *Immediate access is available to a place that provides shelter from bushfire.*	• *The type and extent of vegetation located more than 150 metres from the site may result in neighbourhood-scale destruction as it interacts with the bushfire hazard on and close to a site.* • *Bushfire can only approach from one aspect and the site is located in a suburban, township or urban area managed in a minimum fuel condition.* • *Access is readily available to a place that provides shelter from bushfire. This will often be the surrounding developed area.*	• *The type and extent of vegetation located more than 150 metres from the site may result in neighbourhood-scale destruction as it interacts with the bushfire hazard on and close to a site.* • *Bushfire can approach from more than one aspect.* • *The site is located in an area that is not managed in a minimum fuel condition.* • *Access to an appropriate place that provides shelter from bushfire is not certain.*	• *The broader landscape presents an extreme risk.* • *Fires have hours or days to grow and develop before impacting.* • *Evacuation options are limited or not available.*
INCREASING RISK →			



Map 2 – Bushfire hazard landscape assessment.

5.1.2 Local landscape risk

Within the 1 km local assessment zone, the land predominantly comprises Grassland, with some Woodland spread across the southern part of the assessment zone as reflected in the BMO coverage of the area. To the north, the established urban areas of Bandiana and Wodonga are not in the BPA, but are separated from the site by the Grassland in the Middle Creek corridor. To the south, the vegetation between 400 m and 1 km from the site is predominantly Woodland, comprising plantations, roadside trees and remnant vegetation within pastoral properties.

5.1.3 Neighbourhood risk

Within 400 m, the neighbourhood scale bushfire risk to the site is largely consistent with that for 1 km. The commercial buildings of the Baranduda Enterprise Park to the south, are situated immediately over Baranduda Drive between Kiewa Valley Highway and Whytes Road, and form a large area of non-vegetated land. The Middle Creek corridor to the north and west creates an area of hazardous vegetation between the site and the wider landscape.

5.1.4 Credible bushfire scenarios

The most likely bushfire scenarios for a large landscape fire in Victoria are an approach from those directions typically associated with the direction of the wind on extreme fire danger days, i.e. from the north, north-west, west or south-west (Long, 2006).

The site could be impacted by a fast-moving grassfire similar to the 2021 fire shown in Map 2, which occurred under hot and windy conditions at the same time as a number of larger fires in the Ovens Valley and Upper Murray area. If such a fire approached from the southern edge of Bandiana, or burnt into the Middle Creek corridor under a strong south-westerly wind it would likely approach the BESS lease area.

Urban development in the surrounding area largely precludes long fire runs from the north, south and east.

Map 3 - Local landscape and neighbourhood assessment. Note the distribution of EVC data models Bioregional Conservation Status based on a 2005 extent and does not represent extant EVC cover.

5.2 Site assessment

The Guidelines require that an application assess bushfire risk according to Clause 13.02-1S *Bushfire Planning,*. Consequently, a bushfire hazard site assessment was conducted using the AS 3959-2018 methodology (Standards Australia, 2020) to determine the applicable vegetation classification/s and effective slope/s within 100 m of the BESS. This assessment informs the development of a Risk Management Plan.

5.2.1 Classified vegetation

Vegetation within a 100 m assessment zone around the BESS has been classified in accordance with the AS 3959 methodology. Classified vegetation is vegetation that is deemed hazardous from a bushfire perspective.

The classification system is not directly analogous to Ecological Vegetation Classes (EVCs) but uses a generalised description of vegetation based on the AUSLIG (Australian Natural Resources Atlas: No. 7 - Native Vegetation) classification system. The classification is largely based on the structural characteristics of the vegetation at maturity, but the key determinant should be the likely fire behaviour that it will generate.

The classification is based on the current and anticipated likely future long-term state of the vegetation.

Woodland

Treed vegetation to the north of the site (see Map 4) best accords with the Woodland group of AS 3959-2018. Woodland comprises areas with trees up to 30m tall and 10-30% foliage cover, dominated by eucalypts (and/or casuarina) with a prominent grassy understorey that may contain isolated shrubs (Standards Australia, 2020).

This area of vegetation is part of the Wodonga Retained Environment Network (WREN) and is anticipated to remain a bushfire hazard in perpetuity. Assessment of this area is based on the EVC benchmark/s to which the land is being revegetated (Albury-Wodonga Corporation, 2006). The benchmark in the local landscape are illustrated in Map 3 and summarized below.

- **EVC 55 Plains Grassy Woodland**
  % tree canopy cover – 15%
  Tree character species - White Cypress-pine, Grey Box, Yellow Box, But But
  'An open, eucalypt woodland to 15 m tall occurring on a number of geologies and soil types. Occupies poorly drained, fertile soils on flat or gently undulating plains at low elevations. The understorey consists of a few sparse shrubs over a species-rich grassy and herbaceous ground layer. Occurred extensively in the past but has been mainly cleared for agriculture, resulting in few intact remnants remaining' (DSE, 2004).

- **EVC 56 Floodplain Riparian Woodland**

  % tree canopy cover – 15%
  Tree character species - River Red-gum
  'An open woodland to 20 m tall usually dominated by Red Gum Eucalyptus *spp. over a medium to tall shrub layer with a ground layer consisting of amphibious and aquatic herbs and sedges. Occurs along the banks and floodplains of the larger meandering rivers and major creeks, often in conjunction with one or more floodplain wetland communities. Elevation and rainfall are relatively low and soils are fertile alluviums subject to periodic flooding and inundation'* (DSE, 2004).

Figure 3 – Woodland in the WREN reserve to the north-east.

Figure 4 – Grassland and patches of rejuvenating Woodland (right) to the north.

5.2.2 Grassland

Vegetation within the Middle Creek corridor to the north, the Wodonga Terminal Station to the north-east and within the larger property that the BESS lease areas is within, matches the AS 3959-2018 classification of Grassland, which is defined as all forms of vegetation (except Tussock Moorlands) including situations with shrubs and trees, if overstorey foliage cover is less than 10%. Includes pasture and cropland (Standards Australia, 2020).

Grassland vegetation is considered hazardous and therefore classifiable when it is not managed in a minimal fuel condition. Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack (e.g. short-cropped grass, to a nominal height of 100 mm) (Standards Australia, 2020). Grassland areas are assumed to be unmanaged and classifiable unless there is 'reasonable assurance' that they will be managed in perpetuity, in a low threat state, no more than 100 mm high.

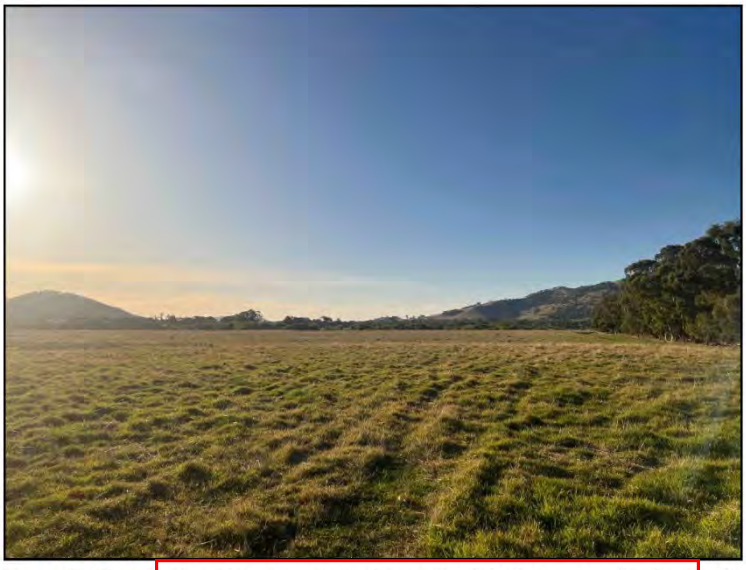


Figure 5 – Grassland on the property to the south of the lease area (background).

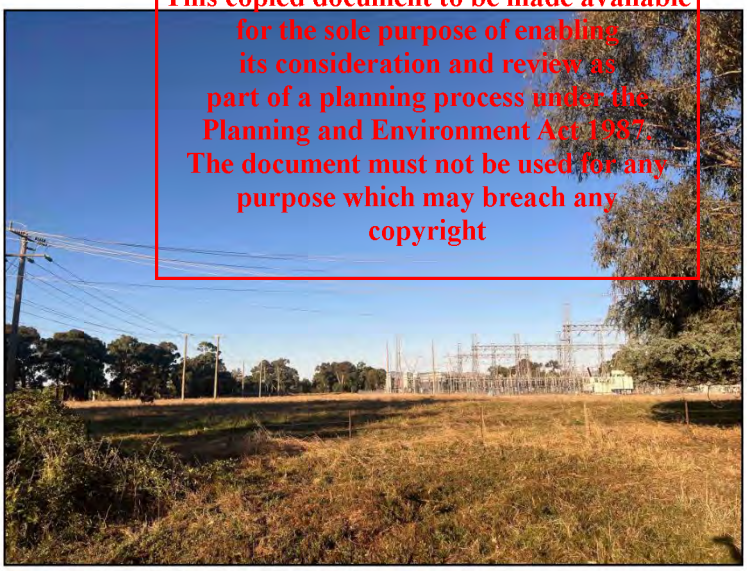


Figure 6 – Grassland on the neighbouring property to the east.

5.2.3 Excluded vegetation and non-vegetated areas

Areas of low threat vegetation and non-vegetated areas can be excluded from classification in accordance with Section 2.2.3.2 of AS 3959-2018, if they meet one or more of the following criteria:

(a) *'Vegetation of any type that is more than 100 m from the site.*
(b) *Single areas of vegetation less than 1 ha in area and not within 100 m of other areas of vegetation being classified vegetation.*
(c) *Multiple areas of vegetation less than 0.25 ha in area and not within 20 m of the site, or each other, or of other areas of vegetation being classified vegetation.*
(d) *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.*
(e) *Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings and rocky outcrops.*
(f) *Vegetation regarded as low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition, mangroves and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks'* (Standards Australia, 2020).

All vegetation on the site will need to be managed in a low threat state (i.e. as non-classified vegetation), therefore Map 1 does not show classified vegetation within the BESS lease area.

The low-threat areas excluded from classification include the treed windbreak running along the boundary with the Wodonga Terminal Station. Non-vegetated areas include dams and that part of the Wodonga Terminal Station within the 100 m site assessment zone (see Map 1).

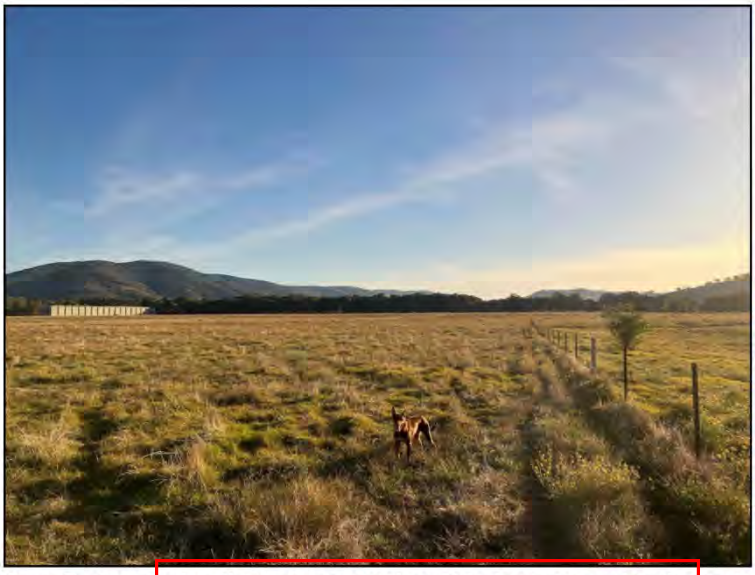


Figure 7 – Grassland on the northern boundary of the lease area and further to the north. Note, as the entire lease area will be managed, no classified vegetation will be retained on the site.

5.2.4 Topography

AS 3959 requires that the 'effective slope' be identified to determine the BAL and applicable vegetation setback distances. This is the slope of the land under the classified vegetation[4] that will most significantly influence the bushfire attack on a building. Two broad types apply:

- Flat and/or Upslope - land that is flat or on which a bushfire will be burning downhill in relation to the development. Fires burning downhill (i.e. on an upslope) will generally be moving more slowly with a reduced intensity.
- Downslope - land under the classified vegetation on which a bushfire will be burning uphill in relation to the development. As the rate of spread of a bushfire burning on a downslope (i.e. burning uphill towards a development) is significantly influenced by increases in slope, downslopes are grouped into five classes in 5° increments from 0° up to 20°.

The land rises slightly toward the site from the adjacent Middle Creek corridor to the north, creating an effective slope in the 'Downslope >0° to 5°' slope class. In all other directions, the effective slope is in the 'All upslopes and flat land' category (see Map 4).

[4] The slope of the land between the classified vegetation and the building is called the site slope, which in the Method 1 procedure of AS 3959 is assumed to be the same as the effective slope.

Map 4 – Bushfire hazard site assessment.

5.3 Fire weather

The Victorian planning and building systems use the Forest Fire Danger Index (FFDI) and the Grassland Fire Danger Index (GFDI) to represent the level of bushfire threat based on weather (and fuel) conditions. An FFDI 100/GFDI 130 (equivalent to a Catastrophic fire danger rating under the Australian Fire Danger Rating System) is applied in non-alpine areas of Victoria by the building system to establish building setback distances from classified vegetation in accordance with AS 3959-2018. The potential fire behaviour and impact under different Fire Danger Ratings (FDRs) is summarised in Table 2.

Table 2 - Fire Danger Ratings (Source: RFS 2023).

Grassland Fire Behaviour Index	Fire Danger Rating (FDR)	Description of conditions	
		Indicative fire behaviour	Potential for impact
100+	Catastrophic	Extremely rapid fire growth and increasing likelihood of large final fire area/size. Possibility for fire behaviour to become erratic and plume driven. Strong convective column formation. Wind speed and direction likely to be erratic at times.	Extremely high likelihood of agricultural/ pasture/crop/stock losses together with loss of rural assets such as homesteads, fencing machinery and buildings. Very limited visibility due to smoke and dust. Very high risk to the community related to inappropriate pre-considered plans, inadequate sheltering. Extremely strong winds are likely to impact infrastructure (e.g., power lines) and fall trees increasing the likelihood of obstructed roads and power outages.
50-99	Extreme	Extremely rapid fire growth and increasing likelihood of large final fire area/size. Possibility for fire behaviour to become erratic and plume driven. Strong convective column formation. Wind speed and direction likely to be erratic at times.	Increasingly high likelihood of agricultural/ pasture/crop/stock losses together with loss of rural assets such as homesteads, fencing machinery and buildings. Limited visibility due to smoke and dust. High risk to the community related to inappropriate pre-considered plans, inadequate sheltering. Strong winds are likely to impact infrastructure (e.g., power lines) and fall trees increasing the likelihood of obstructed roads and power outages.
24-49	High	Wind driven, rapidly spreading fires with potential for development into large fire area/size and with the potential for short distance spotting and long flame lengths.	High likelihood of agricultural/ pasture/crop/stock losses together with loss of rural assets such as homesteads, fencing machinery and buildings.
12-23	Moderate	Typically wind driven and rapidly spreading fires with the potential to gain size quickly.	Possible agricultural/ pasture/crop/stock losses together with loss of rural assets such as homesteads, fencing machinery and buildings.
6-11	No rating	Fires easily sustained. Typically wind driven fires that can spread quickly.	Community losses are unlikely however unattended or poorly prepared houses and infrastructure may be at risk.
0-5		Fire difficult to ignite and sustain. Fires generally unlikely to spread and likely to self-extinguish.	Community losses are unlikely.

Note that the benchmark of an FFDI 100 represents a 'one size fits all' model of extreme fire weather conditions for the state, but which has been exceeded during some significant fire events, including in Victoria on 'Black Saturday' 2009. Therefore, it is important to note that this is not necessarily the *worst-case* conditions for any location, including the BESS site.

In southern Australia, since the 1950s there has been an increase in the length of the fire weather season and an increase in extreme fire weather. It is projected that there will be further increase in the number of dangerous fire weather days and a longer fire season for southern and eastern Australia (CSIRO/BOM, 2022a). There is a 'high confidence' that climate change will result in a harsher fire weather climate for the Murray Basin sub-region that the study area is in, with 'high' or 'very high' confidence that there will be more hot days and warm spells and less rainfall (CSIRO/BMO, 2022b).

Currently the CFA and DTP have no published policy on FFDI/GFDI recurrence intervals. There is, therefore, no compelling rationale for applying a different FFDI/GFDI from the 'default' FFDI 100/GFDI 130 threshold currently used throughout non-Alpine areas of Victoria in the planning and building system.

6. Risk Management Plan

The Guidelines require a Risk Management Plan to be developed for all renewable energy facilities, including BESSs, to address the threat of bushfire. The Risk Management Plan may also require a Fire Safety Study (see Section 6.6). Responses to each of the points in the Model Requirements of the Guidelines are summarised below, whilst also referring to more detailed descriptions elsewhere in this BDR.

Model Requirements – all facilities

A Risk Management Plan must be developed for facilities with battery energy storage systems, in conjunction with CFA, before development starts.

The Risk Management Plan must:

a) *Describe the infrastructure (natural and built), landscape, nature of operations and occupancy of the facility.*

b) *Describe the risks and hazards at the facility to and from the battery energy storage system and related infrastructure.*

c) *Specify and justify, in accordance with Section 4.2 of this guideline:*

- *The **location** of the battery energy storage system in the landscape and the proposed infrastructure on-site.*
- ***Emergency vehicle access** to and within the facility that:*
  - *Includes site access points of a number suitable to the size and hazard of the facility (a minimum of two).*
  - *Provides access to battery energy storage systems, substations and fire service infrastructure.*
- ***Firefighting water supply** for the facility.*
- *A **fire break** width of 10m or greater, based on radiant heat flux (output) as an ignition source:*
  - *Around the perimeter of the facility.*
  - *Between any landscape buffer/vegetation screening and infrastructure.*
- *The **separation distance**, based on radiant heat flux (output) as an ignition source, between:*
  - *Adjacent renewable energy infrastructure (eg., between adjacent battery containers/enclosures).*
  - *Battery containers/enclosures and related battery infrastructure, buildings/structures, and vegetation.*
- ***All other controls** for the management of on- and off-site hazards and risks at the facility (including all proposed battery energy storage system safety and protective systems).*

d) *Provide an evidence-based determination of the effectiveness of the risk controls against the identified hazards, including justification for the omission of any battery safety and protective system/s.*

e) *Form the basis for the design of the facility.*

6.1 Facility description

The Baranduda BESS will comprise a battery array, substation and associated infrastructure. A detailed description of the facility, its operations and occupancy, and the landscape context in which it is set is provided in Sections 1 and 5 of this report respectively.

6.2 Identification of bushfire risk

Section 5 of this BDR identifies the bushfire risk arising from the proposed location of the BESS in the landscape and its siting in relation to the surrounding vegetation and land use. The key bushfire risks are:

- A landscape scale grassfire approaching from the south-west.
- A smaller fire starting on the southern edge of Bandiana.
- Ember attack from bushfire in a bushland reserve within the local landscape.
- Radiant heat/flame exposure from a fire Woodland and Grassland within the 100 m site assessment zone.
- A malfunction of/damage to the BESS or related infrastructure within the site that results in a bushfire ignition.

6.3 Emergency vehicle access and water supply

Section 7.2.1 of this BDR describes the emergency vehicle access to/from the facility, the key points of which include:

- Two (2) access/egress points for emergency vehicles.
- Access roads within and around the facility with a minimum width of 6 m at the narrowest point, providing access to and around the BESS infrastructure, substation and fire fighting static water supply.
- A XXX L static water supply in an above ground, non-combustible tank with appropriate fittings and signage, including an integrated hydrant system (see Map 6).

6.4 Fire breaks and separation distances

Section 7.2.5 of this BDR identifies the width and distribution of fire breaks within/around the facility, which are illustrated in Map 5 and Map 6. They include:

- Fire breaks around the perimeter of the facility for 12 m between BESS infrastructure and any vegetation including landscape buffers containing screening vegetation.
- Setbacks from classified vegetation adjacent to the site (Grassland) by managing vegetation on the site as low-threat or non-vegetated areas to provide minimum separation distances for infrastructure of:
  - 22 m to the north-west and north-east.
  - 19 m to the south-east.
  - 53 m to the south-west.

- A separation distance based on potential for ignition by radiant heat flux, as determined by the Fire Safety Study (see Section 6.6), of:
  - XXX m between all adjacent battery containers/infrastructure.
  - XXX m between battery containers/infrastructure and screening vegetation.

6.5 Other controls and design elements

Additional controls and design elements addressing bushfire are listed below:.

- Fire suppression systems (see Section 7.2.3).
- BESS safe operating procedures (see Section 9).

6.6 Fire Safety Study

For battery energy storage systems, the Guidelines state that the CFA expects that a Fire Safety Study is conducted and recommends that it reflects the content and structure of NSW Planning's *Hazardous Industry Planning Advisory Paper 2: Fire Safety Study Guidelines* (NSW Government, 2011) to address risks from the proposed technologies.

Any Fire Safety Study of the Baranduda BESS, if required, will be provided by others as a separate report.

To inform the required setback distance between battery units and screening vegetation, any Fire Safety Study must identify the radiant heat flux output of a BESS lithium-ion unit when fully involved in fire and the distance at which that radiant heat decreases to 12.5 kW/m². Note if the distance is less than 12 m, the proposed fire break around the facility will need to be widened.

7. Facility location and design

The Guidelines require that the location and design of the facility is considered in terms of both of the following bushfire risk scenarios:

- The bushfire risk posed by the facility to nearby communities, infrastructure, and assets.
- The bushfire risk posed by surrounding areas to the facility.

7.1 Facility location

'Renewable energy facilities are to be located in low-risk environments wherever possible, to reduce the risk of external fire impacting the facility and its consequences' (CFA, 2023).

Additional Requirement – BESS specific
Wherever possible, battery energy storage systems must be sited in low-risk environments, such as where the BMO and LSIO do not apply. The Risk Management Plan must inform the siting for battery energy storage systems.

Model Requirements – all facilities
Planning applications for all renewable energy facilities proposed in high-risk environments must address the following:

a) An assessment against policy outcomes in Clause 13.02-1S (Bushfire Planning) where the facility is located in a Bushfire Prone Area (BPA).
b) 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.
c) The impact of bushfire on the infrastructure (eg. ember attack, radiant heat impact, flame contact).
d) Assessment of whether the proposal will result in an increase in risk to adjacent land and how the proposal will reduce risks at the site to an acceptable level.

The hazard assessment in Section 5 has identified the landscape risk to be moderate and the BMO does not apply to the site. The site is in a designated BPA and as such has been assessed against Clause 13.02-1S.

7.1.1 Assessment against Clause 13.02-1S

The facility can comply with all the relevant objectives and requirements of Clause 13.02-1S, including setbacks from classified vegetation to reduce radiant heat flux to less than 12.5 kW/m². A full itemized response addressing the requirements of Clause 13.02-1S can be found in Section 11 of this BDR.

7.1.2 Impact on nearby communities, infrastructure, and assets

The potential impact of the Baranduda BESS on nearby communities, infrastructure and assets will be determined and documented by the Fire Safety Study (see Section 6.6), which will outline the likelihood and consequence of ignitions within the site.

Nearby features of interest that should be considered include:

- Townships of Bandiana and Killara – 1 to 2 km to the north.
- Township of Baranduda – 3 km to the south.
- Industrial land in Baranduda – 1 km to the south-east.
- Wodonga Power Station on the adjacent property to the north-east.

7.1.3 Impact of bushfire on BESS infrastructure

The risk of bushfire impact on BESS infrastructure will be mitigated to an appropriate level via the application of the design and operational requirements of the Guidelines (CFA, 2023). This is largely achieved by application of the following design features:

- Setbacks from classified vegetation for BESS infrastructure to reduce radiant heat flux to less than 12.5 kW/m².
- A 12 m wide fire break that includes a perimeter road around the facility.
- Access road widths of 6 m or more.
- A static water supply of XXX L in a non-combustible, above-ground tank with compliant fire authority outlet/s and couplings.
- Fire detection and suppression equipment.
- Management of vegetation on site in a low threat condition.
- Appropriate consideration of the bushfire risk during the construction, commissioning, and operational phases of the facility.
- An emergency management plan covering bushfire.

7.1.4 Risk to adjacent land

The risk to adjacent land will be determined and documented by the Fire Safety Study (see Section 6.6), however the risk is considered to be appropriately mitigated if it complies with the objectives and requirements in the Guidelines.

The site is not covered by the BMO or LSIO, however the BMO applies to an area approximately 80 m from the edge of the site.

Section 5 identifies the level of bushfire risk at a range of scales and has determined that the broader landscape is a moderate risk landscape, with the risk closer to the site decreasing as the hazard at the local, neighbourhood and site-scales being predominantly Grassland.

7.2 Facility design

'Renewable energy facilities must be designed to eliminate or reduce the risk of fire occurring and if it does occur, its consequences' (CFA, 2023).

Model Requirements – all facilities

a) *Construction of a four (4) metre perimeter road within the perimeter fire break.*
b) *Roads must be of all-weather construction and capable of accommodating a vehicle of fifteen (15) tonnes (eg., no compacted earth).*
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. Ensure any fencing along access routes allows for width of fire vehicles.*
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.*
e) *Dips in the road should have no more than a 1 in 8 (12.5% or 7.1°) entry and exit angle.*
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. At least one passing bay must be incorporated where roads are less than 600 metres long.*
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, substations and grid connection areas.*
h) *The provision of at least two (2) but preferably more access points to each part of the facility. The number of access points must be informed through a risk management process, in consultation with the CFA.*

7.2.1 Emergency vehicle access

The Guidelines require that access for emergency vehicles is provided at the Baranduda BESS, that complies with the Model Requirements below.

The proposed emergency vehicle access will meet (and in some cases exceed) the requirements of the Guidelines by ~~providing a network of roads constructed of~~ bitumen and/or crushed rock with a width of 6 m at the narrowest point (see Section Map 6).

Each of the access requirements listed above will be met, as illustrated in Map 5, Figure 1 and Figure 8. Further information and illustrative examples relating to the access requirements can be found in Appendix B.

Model Requirement – BESS specific

At least two access points are to be provided into each section where battery energy storage systems are located. The number and location of vehicle access points must be determined in consultation with CFA.

The Baranduda BESS will have two access points, as follows:

- Primary access – driveway of approximately 400 m connecting the facility to Baranduda Drive near the south-eastern corner of the site.

- Secondary access –in the north-west (opposite) corner of the site, connecting the facility to Kiewa Valley Highway.

The distance between the two access/egress points is approximately 920 m (see Map 5).

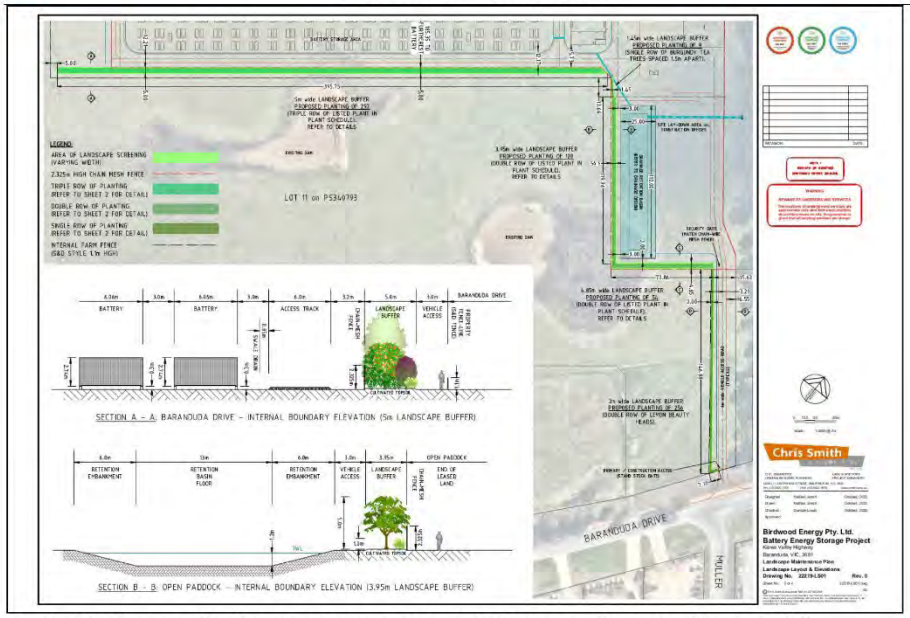


Figure 8 - Illustrative cross-section of access, screening vegetation and BESS infrastructure (Chris Smith and Associates, 2023).

7.2.2 Firefighting water supply

'In the event of a fire (structure fire, grassfire or bushfire), sufficient water must be available and safely accessible to emergency responders and trucks to ensure that fire suppression activities are safe, timely, effective and not hindered in any way. Firefighting infrastructure must be designed to allow effective response to the risks and hazards at the facility. Fire water must be provided to cover buildings, control rooms, substations and grid connections. The quantity of water supply must be established through a comprehensive risk management process that considers all relevant hazards, documented in the Risk Management Plan, in consultation with CFA' (CFA, 2023).

Model Requirements – all facilities

a) *Water access points must be clearly identifiable and unobstructed to ensure efficient access.*
b) *Static water storage tank installations must comply with AS 2419.1-2021: Fire hydrant installations – System design, installation and commissioning.*
c) *The static water storage tank(s) must be an above-ground water tank constructed of concrete or steel.*
d) *The static water storage tank(s) must be capable of being completely refilled automatically or manually 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.).*
f) *The hard-suction point must be provided, with a 150mm full bore isolation valve (**Image 1** in Appendix C) 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 (**Image 2** in Appendix C) with a matching blank end cap to be provided.*
g) *The hard-suction point must be positioned within four (4) metres to 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.*
i) *The road access and hardstand must be kept clear at all times.*
j) *The hard-suction point must be protected from mechanical damage (eg. bollards) where necessary.*
k) *Where the access road has one entrance, a ten (10) metre radius turning circle must be provided at the tank.*
l) *An external water level indicator must be provided to the tank and be visible from the hardstand area.*
m) *Signage (**Image 3** in Appendix C) indicating 'FIRE WATER' and the tank capacity must be fixed to each tank.*
n) *Signage (**Image 4** in Appendix C) must be provided at the front entrance to the facility, indicating the direction to the static water tank.*

Additional Requirements – BESS specific

A fire protection system suitable for the risks and hazards at the facility must be provided.

For battery energy storage systems, the water supply quantity must:

- *Enable effective cooling of surrounding infrastructure.*
- *Account for reasonable duration of fire events based on the proposed battery chemistry.*
- *Account for local weather conditions and potential fire weather conditions.*
- *Provide for the safety of firefighters.*

The fire protection system must be designed in line with the requirements of AS 2419.1-2021: Fire hydrant installations, Clause 3.9: Open Yard Protection, in consultation with CFA.

For the purposes of determining system requirements, the 'yard area' referenced within AS 2419.1, Table2.2.5(D) may be considered that of the battery installation, including the minimum 10m fire break around the battery infrastructure, rather than the entire area of the yard or site.

Emergency response experience from battery energy storage system incidents indicates that larger quantities of water may be required.

The objectives will be met for the Baranduda BESS by addressing the Model and Additional Requirements.

The Baranduda BESS will provide a XXX L static water supply in X tank/s located in the south-eastern corner of the facility central area (see Map 5). The tank/s will be provided with appropriate construction, fittings, signage and distances from infrastructure in accordance with the above requirements. See Appendix C for further detail and illustrations on specific signage/layout examples.

The amount of cooling to be provided to infrastructure and the duration of fire in relation to battery chemistry will be determined in the Fire Safety Study (see Section 6.6). Appropriate design responses will be incorporated based on the findings of the Fire Safety Study.

Local fire weather conditions are considered in Section 5.3 and the design response to this is application of the Model Requirements, including weather monitoring as part of the Emergency Management Plan (see Section 10).

The safety of firefighters will be provided by incorporating the Model Requirements for the facility design, operation, and emergency management planning.

Model Requirements – BESS specific

Where battery energy storage systems are ancillary to solar or wind energy facilities and proposed within a single centralised location, fire protection in accordance with the model requirements in this section must be provided.

1) *For facilities with battery energy storage systems, the fire protection system must include at a minimum:*

a) Where reticulated water is available, a fire hydrant system that meets the requirements of AS 2419.1-2021: Fire hydrant installations, Section 3.9: Open Yard Protection, and Table 2.2.5(D): Number of Fire Hydrants Required to Flow Simultaneously for Protected - Open Yards.

Except, that 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.

(see **Image 5** in Appendix C)

OR

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 2419.1-2021: Fire Hydrant installations, Table 2.2.5(D) for open yards flowing for a period of no less than four hours at 20L/s, whichever is the greater.

ii. The quantity of static fire water storage is to be calculated from the number of hydrants required to flow from AS 2419.1-2021: Fire hydrant installations, Table 2.2.5(D).

(E.g., For battery installations with an aggregate area of over 27,000m², 4 (four) hydrant outlets are required to operate at 10L/s for four hours, which equates to a minimum static water supply of 576kL.)

iii. Fire hydrants are to be provided such 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.

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).

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. (E.g., Fire water tanks are to be located closer to the site entrance that the battery energy storage system).

vi. The fire water supply must comply with AS 2419.1-2021: Fire hydrant installations, Section 5: Water storage tanks.

(see **Image 6** in Appendix C)

The Baranduda BESS is a 'centralised' facility and will be provided with a XXX L water tank and hydrant system that complies with all the Model Requirements under item *b)* above. Further details of the water supply requirements can be found in Appendix C. The tank/swill be located in the south-eastern corner of the facility, close to the primary access route (see Map 5).

While it is not applicable to the Baranduda BESS (as it falls under the 'centralised' stream), the Guidelines also state:

'Where battery energy storage systems are decentralised, that is, proposed in multiple locations such as amongst solar panel arrays, fire water must be available for each container/enclosure/cabinet' (CFA, 2023).

Model Requirements – BESS specific

1) *For facilities with decentralised battery energy storage systems, the fire protection system must include at a minimum:*
   a) *Where reticulated water is available, a fire protection system as per Model Requirement (1a) under 'Centralised Battery Energy Storage Systems'.*

OR

   b) *Where no reticulated water is available, a firewater supply in static storage tanks, where a minimum 45,000L static water tank is provided within 120m of each battery container. The aggregate quantity of fire water supply at the facility must be no less than 288,000L to the satisfaction of CFA.*

(see **Image 7** in Appendix C)

7.2.3 Fire detection and suppression equipment

'In addition to fire water supplies, suitable fire detection and suppression equipment must be provided at the facility. This includes first-aid equipment such as fire extinguishers and fire hose reels' (CFA, 2023).

Model Requirements – All facilities

Suitable fire detection and suppression equipment must be provided:

a) *For on-site buildings and structures, including gas installations, in accordance with the National Construction Code.*
b) *For storages of dangerous goods, according to the requirements of any Australian Standards for storing and handling of dangerous goods.*
c) *For electrical installations, a minimum of two (2) suitable fire extinguishers must be provided within3m-20m of each PCU.*
d) *In all vehicles and heavy equipment, each vehicle must carry at least a nine (9)-litre water stored-pressure fire extinguisher with a minimum rating of 3A, or other firefighting equipment as a minimum when on-site during the Fire Danger Period.*

The Baranduda BESS will comply with all the above requirements.

7.2.4 Landscape screening and on-site vegetation

The Guidelines state that *"any proposed or existing vegetation must be considered in the Risk Management Plan for its potential to intensify and propagate fire within and away from the site."* (CFA, 2023).
This involves consideration of the type (species), density, height, location and overall width of the screening.

Facilities must be designed so that the radiant heat flux from vegetation does not create the potential for ignition of on-site infrastructure or other vegetation. Similarly, any screening vegetation

must be far enough from BESS infrastructure so as not to be ignited by a nearby battery that is fully involved in fire.

A landscaping design has been prepared by Chris Smith and Associates (2023) showing the proposed layout and properties of screening vegetation for the Baranduda BESS.

This screening vegetation will comprise:

- Four distinct rows of screening vegetation within 'landscape buffers' labelled Sections A-D, which are at 90° angles to one another.
- Triple, double and single-row plantings with a maximum 5 m width in the landscape buffers.
- A maximum height of 8 m for the tallest species (Weeping Pittosporum).
- A 12 m separation distance between BESS infrastructure and screening vegetation (note the minimum requirement is 10 m).
- An additional 3 m separation distance on the opposite side to BESS infrastructure between screening vegetation and the site boundary.

Illustrative representations of vegetation in the screening buffers in relation to access, fire breaks and BESS infrastructure are shown in Figure 8 (in Section 7.2.1), and Figure 9 and Figure 10 below.

Further detail of the appropriate setback distance between will be provided in the Fire Safety Study (see Section 6.6), including the radiant heat output of a battery unit that is fully involved in fire.

The Guidelines provide specific direction for vegetation management around substations and electric lines. The entire substation will be surfaced to eliminate all vegetation including grasses. Substations and electric lines must also comply with the *Electricity Safety Regulations 2020* of the *Electricity Safety Act 1998*, based on an assigned fire hazard rating by CFA, which is available upon request.

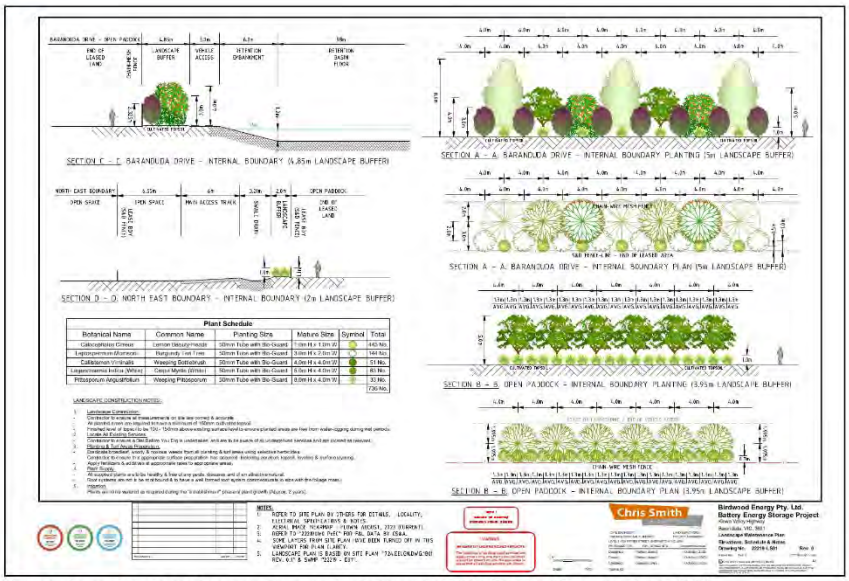


Figure 9 - Cross-section screening vegetation types for the Baranduda BESS (Chris Smith and Associates, 2023).

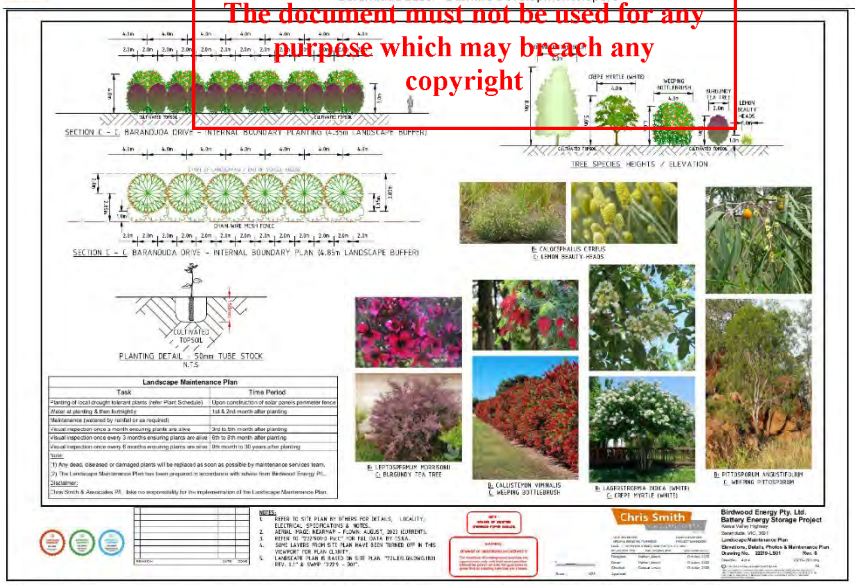


Figure 10 – Proposed screening vegetation plan including indicative species' (Chris Smith and Associates, 2023).

7.2.5 Fire breaks

The Guidelines state that fire breaks are required, which are defined as *'a gap in fuel (vegetation) that reduces the potential for fire to enter or leave an area. Firebreaks may also be used for emergency vehicle access'* (CFA, 2023).

Model Requirements – all facilities
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.*
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.

The Baranduda BESS will provide fire breaks at least 10 m, and in places up to 12m, wide around the 'facility' elements (being BESS infrastructure but not the substation) and areas of vegetation (including screening vegetation). The fire breaks will comprise:

- 3 m wide swale drains of crushed rock adjacent to the centralised battery storage area.
- A 6 m-wide loop access road constructed of bitumen.
- A 3.2 m wide 'boundary zone' of crushed rock between the access road and site boundary or, on the southern aspect, the landscape buffer (screening vegetation).

In addition to the fire breaks, there will be low threat vegetation setback areas comprising screening vegetation (in the form of landscape management) that is kept mown to less than 100 mm in height. These low threat vegetation setbacks in combination with the 10-12 m wide fire breaks, effectively reduce the potential for ignition of infrastructure, by reducing radiant heat flux from a fire in the adjacent Grassland to less than 12.5Kw/m^2. The width of the low threat setbacks are:

- 22m to the north and east.
- 19m to the south and west.

Model Requirement – BESS specific
A fire break must be established and maintained around battery energy storage systems and related infrastructure.

This Model Requirement is met by the above conditions, however the Guidelines go on to state that *'In addition to radiant heat flux (output) from vegetation, the width of fire breaks between vegetation and battery energy storage systems must be at least the distance where the radiant heat flux (output) from the battery energy storage system fully involved in fire does not create the potential for ignition of vegetation'* (CFA, 2023).

The findings of the Fire Safety Study (see Section 6.6) will determine whether the setback distance required from burning BESS infrastructure is achieved by the setbacks required from classified vegetation or whether the setback distance needs to be increased.

7.2.6 Design specific to facility type

The Guidelines specify that the current versions of *NFPA 855: Standard Installation of Stationary Energy Storage Systems*, *UL 9540: Energy Storage System Requirements* and *FM Global Property Loss Prevention Data Sheet 5-33 (2020) Electrical Energy Storage Systems*, should be used in the design and operation of battery energy storage systems, except where they are varied by The Guidelines.

Model Requirements – BESS specific

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.

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, pavement, 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.

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. Minimises the potential for fires in battery containers/enclosures to impact on-site and off-site infrastructure.

2) *Battery energy storage systems must be:*

a) Located so as to be reasonably adjacent to a site vehicle entrance (suitable for emergency vehicles).

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.)

c) Provided with in-built fire and gas detection systems. Where these systems are not provided, measures to effectively detect fires within containers must be detailed within the Risk Management Plan.

d) Provided with explosion prevention via sensing and venting, or explosion mitigation through deflagration panels.

e) Provided with suitable ember protection to prevent embers from penetrating battery containers/enclosures.

f) 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.

g) Installed on a non-combustible surface such as concrete.

h) Provided with adequate ventilation.
i) Provided with impact protection to at least the equivalent of a W guardrail-type barrier, to prevent mechanical damage to battery containers/enclosures.
j) Provided with enclosed wiring and buried cabling, except where required to be above-ground for grid connection.
k) Provided with spill containment that includes provision for management of fire water runoff.

While at this stage, many design elements including the BESS model/make are yet to be determined, particularly regarding *2) G) – k)* above, the Model Requirements above can be met by the proposed facility design. Many of the requirements are principally concerned with the radiant heat setbacks and/or fire breaks (see Sections 7.2.5 and Map 5) or access (see Section 7.2.1 and Appendix B).

7.2.7 Safety and protective systems

Additional Requirements – BESS specific
Battery Energy Storage System Safety and Protective Systems
Safety and protective systems will vary in battery energy storage systems based on battery technologies, chemistries, and the preferences of manufacturers. These systems may add a layer of protection during high-consequence emergency scenarios.

CFA recommends that battery energy storage systems are equipped with the following elements:

Battery management/monitoring systems *for monitoring the state of battery systems to ensure safe operation.*
Systems for detecting *smoke, heat (thermal runaway) and toxic gas (off-gassing) within battery containers. Detection systems for off-gassing must be single-triggered and provide for both lighter and heavier than air gasses.*
Systems to prevent heat/fire spread *within battery containers (such as thermal barriers, shut-down separators, isolation systems, cooling systems).*
Systems to prevent explosion *within battery containers (such as ventilation, pressure relief and exhaust systems).*
Systems to prevent water ingress *to battery containers and appropriate ingress protection (IP) ratings for containers/cabinets and/or battery modules.*
Warning and alarm systems *within the battery containers, and/or the facility, to enable early warning for faults, operation of the battery energy storage system above 'normal'/safe parameters, smoke, off-gassing, and fire.*

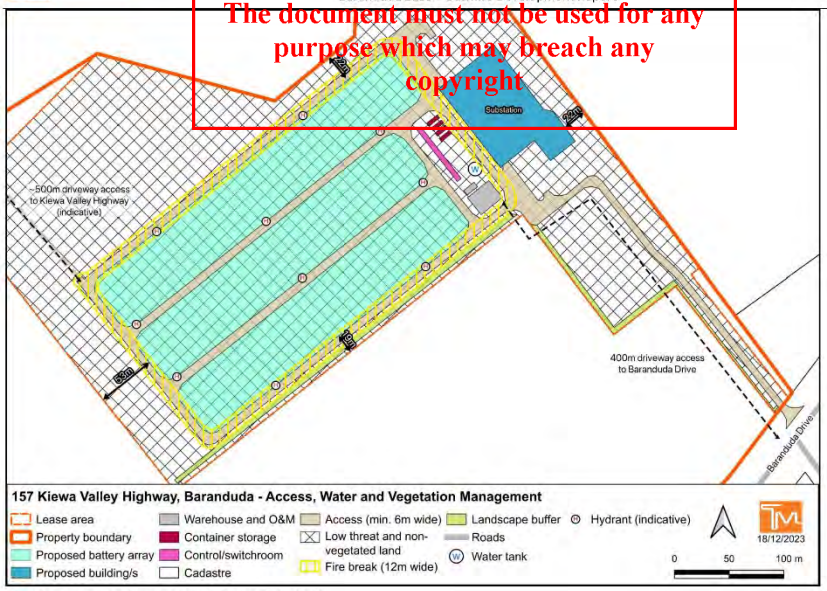
The Baranduda BESS facility will incorporate a number of protective systems, appropriate to the abovementioned reccomendations, comprising:

- CCTV monitoring of/in each battery container and related infrastrucure element.
- Smoke detectors fitted within each battery container.
- Fire/heat prevention systems including:
  - Thermal barriers between individual battery cells (TBD).
  - Sprinkler system (TBD).
  - Shut down separators (TBD).
  - More (TBD).
- Ventilation/exhaust units and deflagration panels (TBD).

- Full weatherproofing to prevent water ingress (TBD).
- Alarm systems compliant with Australian Standard XXX.

The final safety and protective systems within the Baranduda BESS are yet to be determined and will be updated in a subsequent version of this report once further information, including that from the Risk Management Plan, is incorporated into the final design.

Map 5 – Facility design including setbacks, fire break and access for the Baranduda BESS.



Map 6 – Access and water at the Baranduda BESS.

8. Facility construction and commissioning

'Fire risks must be identified and effectively managed during the construction and commissioning of renewable energy facilities' (CFA, 2023)

A response to this objective will be provided by incorporating the Recommended Risk Controls below, which are applicable to all renewable energy facilities. Note the exact timing of implementing these items is yet to be determined. A response to the requirements below is not within the scope of this BDR.

8.1 Construction

8.1.1 Fire detection and suppression systems

a) *'Install and commission fire detection and suppression systems for the facility at the earliest possible stage of construction.*
b) *Provide first-aid firefighting equipment, such as fire extinguishers, appropriate to the identified emergency scenarios, at all construction portables/buildings on-site, in the vicinity of all construction activities, and in site-based vehicles.*
c) *Provide the required fire protection equipment for any storages of dangerous goods as per the relevant Australian Standards'* (CFA, 2023).

8.2 Commissioning

8.2.1 Fire Risk Management

a) *'Obtain appropriate permits for work during the Fire Danger Period and ensure that any conditions on permits are adhered to.*
b) *Adhere to restrictions on Total Fire Ban or days of elevated fire danger according to CFA's website.*
c) *During the Fire Danger Period, ensure vehicle operators are instructed to remain on tracks and are not permitted to drive through paddocks.*
d) *Restrict smoking to prescribed areas and provide suitable ash and butt disposal facilities.*
e) *Provide remotely-accessible site/system security monitoring at the facility'* (CFA, 2023).

8.2.2 Personnel Training

a) *'Provide training for personnel in the use of on-site first-aid firefighting equipment, and responsibilities during emergencies.*
b) *Ensure all on-site personnel complete CFA's online training module 'Bushfire Safety for Workers'* (CFA, 2023).

8.2.3 Emergency Management

Model Requirement – all facilities
An Emergency Management Plan must be developed for the construction and commissioning phase before development starts.

The requirement to provide an Emergency Management Plan (including bushfire) is detailed in Section 10 of this BDR.

a) *'The Emergency Plan must address the requirements of Section 7 of this guideline.*
b) *An emergency communication system must be provided that is reliable and will operate in the event of power failure.*
c) *CFA must be notified at least seven (7) days prior to the commissioning of any high-risk infrastructure at the facility (e.g., battery energy storage systems)'* (CFA, 2023).

8.2.4 Occupational Health and Safety

'CFA recommends the development of safe work procedures for the facility, encompassing but not limited to:

a) *Electricity and chemical management.*
b) *Vegetation management.*
c) *Site security.*
d) *Ignition source control, including hot works.*
e) *Infrastructure, equipment, and vehicle maintenance.*
f) *Emergency management'* (CFA, 2023).

9. Facility operation

'Fire risks must be effectively managed for the duration of the operational life of renewable energy facilities' (CFA, 2023).

This objective will be met by implementing a Fire Management Plan and vegetation/fuel management as per the Model and Additional Requirements below.

9.1 Fire Management Plan

Model Requirement – all facilities
A Fire Management Plan must be developed for the facility, in consultation with CFA, before development starts.

Model Requirement – all facilities
If your facility is at-risk of bushfire, prevention and preparedness activities must be detailed in the Fire Management Plan.

Terramatrix understands that a Fire Management Plan for the Baranduda BESS is being prepared by others on behalf of Birdwood Energy Pty Ltd, which will detail all the necessary on-site fire safety hazards and controls. The Fire Management Plan will either incorporate into the facility's Emergency Plan (see Section 10) or provided as a standalone document.

As the site is in a designated BPA it is at-risk of bushfire, therefore the Fire Management Plan must incorporate prevention and preparedness activities specific to bushfire. This can be as a standalone Bushfire Emergency Management Plan if appropriate.

The Guidelines require that the Fire Management Plan incorporates the information in Table 3 below.

Table 3 - Fire Management Plan structure and content (CFA, 2023).

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 Plan.*
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 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 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 (servicing/maintenance, housekeeping inspections, external audits), review processes for risk control effectiveness.*
Procedures for review of the Fire Management Plan.	*Review triggers and schedule, organisational accountability for the Plan, allocated responsibilities (to persons or roles) for the ongoing review and development of the Plan.*

9.2 Fire hazards and risk controls

9.2.1 Vegetation and fuel management

The requirements below provide a framework for the management of vegetation and other fuels (such as debris) on the site during its operational life. The Baranduda BESS will meet all the requirements for landscaping design (see Section 7.2.4) and maintenance via procedures that actively manage vegetation and clear debris that would be a hazard in the event of a bushfire. This applies to all vegetation on the site, including all grass within the lease area, screening vegetation and any other landscaping elements (see black hatched area in Map 5).

Model Requirements – all facilities

Facility operators must undertake the following measures during the Fire Danger Period:

a) *Grass must be maintained to a height of 100 mm or less at all times during the declared Fire Danger Period.*
b) *Long grass and/or deep leaf litter must not be present in areas where heavy equipment will be working, during construction or operation.*
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).*
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.*

Additional Requirements – BESS specific

Containers/enclosures and infrastructure for battery energy storage systems must be maintained to be clear of vegetation, including grass, for at least ten (10) metres on all sides, or greater as informed by the Risk Management Plan.

The proposed fire break around Baranduda BESS infrastructure will be 12 m wide (see Map 5), which exceeds the minimum requirement for separation distance and aligns with the Risk Management Plan in Section 6. Note that this setback distance may need to be informed by the findings of a Fire Safety Study (see Section 6.6). The fire break will comprise non-combustible surfaces including an access road of 6 m width , a 3 m wide swale drain and a fence buffer of 3 m width, which will each be constructed of materials such as bitumen, and/or crushed rock or equivalent (see Section 7.2.5).

Additional requirements – all facilities

Managing Vegetation On-Site

- *Gutters, roof surfaces and valleys, kerbs, traps, sumps, bunds, drains, rooves or any other accumulation points for leaf litter, dry vegetation, or any other combustible materials must be cleared, and the debris removed from site.*
- *Vegetation management activities must be conducted across the entire facility (e.g., grass slashing or mowing, removal of dead/fallen vegetation).*
- *Extraneous materials or vegetation in firebreaks at the site perimeter, at external building walls, and at other any site plant/assets must be cleared and removed from site.*
- *Extraneous or unnecessary materials (fuel loads) must be removed from site, e.g., mulch piles; dilapidated/stored vehicles, plant or equipment; excess fuel/chemicals; any combustible waste materials. Vehicles must not be parked on unmanaged vegetation.*

In addition to the above Model and Additional Requirements, any proposed vegetation, such as the screening vegetation, must not create a hazard to BESS infrastructure. This can be achieved by managing all vegetation on site so that it is 'low threat' and eligible for one or more of the vegetation exclusion criteria in AS 3959-2018 (see Section 5.2.3).

The Guidelines also state that for substations and electric lines *'Vegetation management within any electric line easement is to be such that falling trees would not impact the transmission lines, towers, and associated infrastructure (CFA, 2018).*

Additional guidance on vegetation management can be taken from defendable space maintenance standards that apply to BMO affected areas. The site is not covered by the BMO, so the following standards from Clause 53.02-5 of the Wodonga Planning Scheme are not mandatory:

- *'Grass must be short cropped and maintained during the declared fire danger period.*
- *All leaves and vegetation debris must be removed at regular intervals during the declared fire danger period.*
- *Within 10 metres of a building, flammable objects must not be located close to the vulnerable parts of the building.*
- *Plants greater than 10 centimetres in height must not be placed within 3metres of a window or glass feature of the building.*
- *Shrubs must not be located under the canopy of trees.*
- *Individual and clumps of shrubs must not exceed 5 square metres in area and must be separated by at least 5 meters.*
- *Trees must not overhang or touch any elements of the building.*
- *The canopy of trees must be separated by at least 5 metres.*
- *There must be a clearance of at least 2 metres between the lowest tree branches and ground level'* (Clause 53.02-5 Wodonga Planning Scheme).

9.2.2 Arc flash hazard management

'Electrical equipment must be designed to reduce risks associated with arc flash hazards. Where an arc flash hazard exists it must be identified and managed.
There must be clear demarcation of arc boundaries to at least 10 m from arc flash outlet flaps (blow-out panels) on PCUs, where there is a hazard to personnel' (CFA, 2023).

The above is not within the scope of this BDR. Further guidance can be found at:
<https://www.esv.vic.gov.au/industry-guidance/electrical/electrical-technical-information/arc-flash-hazard-management>

9.2.3 Facility and system monitoring and maintenance

Model Requirement – 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. Any fire must be notified to 000 immediately.

Additional Requirements – BESS specific
For battery energy storage systems, appropriate monitoring and intervention measures must be provided to ensure that the following are rapidly identified and notified to 000 immediately:

- *Any shorts, faults, temperature increases above normal parameters (e.g. precursor to thermal events/runaway).*
- *Equipment failures with the potential to ignite or propagate fire.*
- *Off-gassing, smoke or fire.*

The provision for direct alarm monitoring to the fire brigade for battery energy storage system automatic detection systems must be considered.

The abovementioned monitoring procedures will be adhered to during the operational life of the Baranduda BESS.

Model Requirements – 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.

Additional Requirements – BESS specific
Battery energy storage systems, including the battery management system and any associated safety systems, must be regularly serviced to the manufacturer's specifications.
A procedure, including a schedule and relevant personnel accountabilities, must be developed in relation to the inspection of battery energy storage systems.
Battery energy storage systems are to be regularly inspected for the following:

- *Any signs of mechanical damage to the external containers/enclosures.*
- *Any accumulation of combustible materials (including leaf litter) in or within ten (10) metres of any battery energy storage systems and related infrastructure.*

Any identified issues must be immediately rectified.

The above Model and Additional Requirements require regular maintenance checks on all parts of the facility. The Baranduda BESS will comply with these requirements by having a plan that specifies the maintenance schedule for each aspect of the facility during operation.

The following monitoring/maintenance requirements also apply to BESS facilities and will be complied with:

Additional Requirements – BESS specific

A Fire Management Plan for a facility that incorporates a battery energy storage system must also include:

a) *A schedule, list of activities and accountabilities for the inspecting, testing, monitoring and servicing of the battery and its monitoring, safety and protective systems.*
b) *Monthly inspections of battery enclosures/containers and related infrastructure for physical damage. Any damage must be immediately assessed and rectified by a suitably qualified person.*
c) *Seismic activity as a trigger for inspecting, testing and servicing of the battery energy storage system and its related infrastructure. Any damages or changes in operating parameters must be immediately assessed and rectified by a suitably qualified person.*
d) *Regular inspection and removal of all combustible materials near the battery enclosures/containers and related infrastructure.*

9.2.4 Dangerous goods storage and handling

The Guidelines states that [illegible] signage, cleaning materials, training, documentation must be compliant with the *Dangerous Goods (Storage and Handling) Regulations 2022*.

This has implications for bushfire risk on the site and to nearby areas (see Section 7.1.2).

9.2.5 Housekeeping

The Guidelines state that regular housekeeping is required that addresses the following:

a) *'Hazard identification - ensuring that infrastructure, plant, equipment, vehicles and safety/warning signs show no signs of damage or dilapidation.*
b) *Facility access - ensuring all vehicle site access points, including emergency access points, are clear and accessible.*
c) *Fire protection systems and equipment – ensuring that all equipment is unobstructed, clearly identifiable, in-service and performing optimally.*
d) *Vegetation management - ensuring that any accumulation of combustible materials is cleared from infrastructure, buildings and fire breaks, and removed from the site.*
e) *Security measures - ensuring that fences, gates, and security cameras are inspected for damage, and that any damage is immediately actioned (e.g., repaired or replaced)'* (CFA, 2023).

Housekeeping inspections must be conducted regularly at least every three months and again one month prior to the Fire Danger Period. Further information can be found at the following link:

<https://www.cfa.vic.gov.au/plan-prepare/building-planning-regulations/renewable-energy-fire-safety>

9.2.6 Fire risk review

The Guidelines state that *'fire risk must be effectively managed at operating facilities to meet obligations for providing a safe workplace under the OHS Act'* (CFA, 2023).

This can be achieved by reviewing and updating the Fire Management Plan, Risk Management Plan and Emergency Management Plan (all prepared by others) if there is a near miss or incident at the facility.

10. Emergency Planning

'Emergencies at renewable energy facilities must be planned for and effectively managed' (CFA, 2023).

Emergency planning documentation for bushfire can be incorporated in an 'all hazards' Emergency Management Plan (EMP) or it can be in the form of a standalone Bushfire Emergency Management Plan (BEMP). Terramatrix has not been engaged to design a BEMP at this stage, therefore this report does not contain a formal response to The Guidelines' Model Requirements, however the relevant requirements are listed below.

10.1 Emergency plans

Model Requirement – all facilities
An Emergency Management Plan must be developed specific to the facility, in conjunction with CFA, before development starts.

Additional Requirements – BESS specific
Emergency Plans for facilities with battery energy storage systems must additionally include:

a) Contact information for 24/7/365 specialist technical support for the battery energy storage system.
b) Emergency response procedures based on identified risks and hazards of the battery energy storage system and related infrastructure, including but not limited to:
  i. Electrical infrastructure faults and fire.
  ii. Battery energy storage system damage or faults, including battery monitoring faults, temperature increases above normal operating parameters, electrical faults, chemical spills or reactions, off-gassing, thermal runaway, smoke and fire.
  iii. Bushfire and grassfire.
  iv. The management of fire water runoff.
c) Details of the elements monitored/controlled by the Battery Management System (BMS), including internal temperature, state of charge, voltage, etc. and the locations this information is available (e.g., at the BESS containers, in an on-site control room, off-site monitoring facilities).
d) A plan for partial and full decommissioning of the battery energy storage system in the event of an emergency incident that renders the facility inoperable or unsafe, before its anticipated end-of-life.
e) Any information that supports the considerations in Appendix B: Emergency Response Considerations for Large-Scale Battery Energy Storage Systems

This information must also be provided within the facility's Emergency Information Book.

Additional information is required on the following aspects of emergency planning:

- Emergency response procedures.
- Evacuation and shelter-in-place.
- Personnel training.
- Emergency exercises.
- Reviewing emergency plans.

The above is not within the scope of this BDR.

10.2 Provision of Emergency Information

Model Requirements – 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.

Additional Requirements – BESS specific

Operators of facilities with battery energy storage systems must inform emergency responders of hazards. This information must be provided within the site's Emergency Information Book, and must include:

- *a) Specifications for safe operating conditions for temperature.*
- *b) 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.*
- *c) 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 associated vapour clouds), and the effects of fire on the battery energy storage system (e.g., explosion, release of toxic gases).*
- *d) Details of the elements monitored/controlled by the Battery Management System (BMS), including internal temperature, state of charge, voltage, etc. and the locations this information is available (e.g., at the BESS containers, in an on-site control room, off-site monitoring facilities).*
- *e) Details of all provided battery safety and protective systems, including a description, the activation process/automatic trigger, and associated hazards.*
- *f) 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/shut-down and de-energised during emergencies.*

Emergency information will be provided for emergency services and readily accessible in the event of an emergency. Further guidance on the provision of an Emergency Information Booklet can be found in published CFA documents online (CFA, 2019).

11. Clause 13.02-1S Bushfire response

The strategies stipulated in Clause 13.02-1S, are detailed in the following sub-sections, and a summary response to the relevant strategies is provided about how the proposed Baranduda BESS development responds to the strategies.

11.1 Protection of human life strategies

Priority must be given to the protection of human life.

Prioritising the protection of human life over all other policy considerations

The facility is in a moderate risk location. The protection of human life can be prioritised by application of the Model and Additional Requirements in the Guidelines, complying with applicable building regulations for construction in a BPA, and ensuring the BESS infrastructure and other buildings are located where radiant heat can be expected to be below 12.5kW/m².

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.

As identified in Section 5, the site is in a moderate risk landscape and is not covered by the BMO. Therefore, if future buildings and infrastructure are setback sufficiently from any hazardous vegetation such that radiant heat can be expected to be below 12.5kW/m², the risk can be deemed to be acceptable.

The nearest *lowest* risk locations are considered to be the urban-residential and township areas of Bandiana and Wodonga 0.5 km to the north, that are not in the BPA (see Map 1 and Map 2).

Reducing the vulnerability of communities to bushfire through consideration of bushfire risk in decision-making at all stages of the planning process

This report provides the basis for incorporating bushfire risk into decision making associated with planning development in the facility.

The proposal responds to the Guidelines prepared by CFA and can meet the Model and Additional Requirements for BESS facilities. This includes consideration of the bushfire risk during the planning, construction, and operational phases of the facility.

It is considered that development of the facility can appropriately implement the strategies in the Guidelines and Clause 13.02-1S that aim to prioritise protection of human life.

11.2 Bushfire hazard identification and assessment strategies

The bushfire hazard must be identified and an appropriate risk assessment be undertaken.

Applying the best available science to identify vegetation, topographic and climatic conditions that create a bushfire hazard.

This report identifies the hazard in accordance with the commonly accepted methodologies of AS 3959-2018 and, as appropriate, additional guidance provided in and *Planning Advisory Note 68 Bushfire State Planning Policy Amendment VC140* (DEWLP, 2018).

The type and extent of (hazardous) vegetation within 100 m of the facility has been identified and classified into AS 3959-2018 vegetation groups. Classification was based on the anticipated long-term state of the vegetation, EVC mapping, aerial imagery, site assessment, published guidance on vegetation assessment for bushfire purposes and experience with the fuel hazard posed by the vegetation types that occur within the region.

GIS analysis of publicly available 10 m contour data for the area was undertaken (see Map 4).

In relation to climatic conditions and fire weather, the AS 3959-2018 default FFDI 100/GFDI 130 benchmark used in the Victorian planning and building system, has been applied as discussed in Section 5.3.

Considering the best available information about bushfire hazard, including the map of designated bushfire prone areas prepared under the Building Act 1993 or regulations made under that Act.

The extent of BPA coverage has been considered (see Section 4.3) and is shown in Map 1 and Map 2. This is based on the most recent BPA mapping for the area.

Applying the Bushfire Management Overlay in planning schemes to areas where the extent of vegetation can create an extreme bushfire hazard.

As identified in Section 1, no part of the site is covered by the BMO (see Map 3). This is considered appropriate and reflects recent statewide BMO mapping and the Wodonga Planning Scheme.

Considering and assessing the bushfire hazard on the basis of:

- ***Landscape conditions - meaning the conditions in the landscape within 20 kilometres and potentially up to 75 kilometres from a site;***
- ***Local conditions - meaning conditions in the area within approximately 1 kilometre from a site;***
- ***Neighbourhood conditions - meaning conditions in the area within 400 metres of a site; and***
- ***The site for the development.***

The hazard has been assessed and described at the required scales (see Section 5).

At the local scale, the assessment follows the AS 3959-2018 methodology applied in a BPA, of classifying vegetation and topography within 100 m of the facility (see Map 4).

At the landscape scale a 20 km, 5 km and 1 km radius of the site has been applied (see Map 1, Map 2 and Map 3) in accordance with guidance about assessing risk for planning scheme amendments in the Planning Advisory Note 68 (DEWLP, 2018).

Consulting with emergency management agencies and the relevant fire authority early in the process to receive their recommendations and implement appropriate bushfire protection measures.

Terramatrix understands there has been multiple correspondence between Birdwood Energy and the CFA and/or FRV regarding the Baranduda BESS proposal. A video conference was held on 11/11/2023, with representatives from CFA, Birdwood Energy, Terramatrix, and contracted site designers present, outlining the response and expectations for a planning application. Outcomes from that meeting have informed this BDR.

Ensuring that strategic planning documents, planning scheme amendments, planning permit applications and development plan approvals properly assess bushfire risk and include appropriate bushfire protection measures.

The Guidelines, Clause 13.02-1S, and the building regulations invoked by the BPA coverage, including the bushfire hazard landscape assessment, specify the general requirements and standards for assessing the risk. These have been used in this BDR as appropriate and bushfire protection measures have been identified commensurate with the risk.

Not approving development where a landowner or proponent has not satisfactorily demonstrated that the relevant policies have been addressed, performance measures satisfied or bushfire protection measures can be adequately implemented.

If the Model and applicable Additional Requirements of the Guidelines, the objectives and strategies of Clause 13.02-1S, and the building regulations for construction in a BPA,

are complied with, as outlined in this report, then the risk can be deemed to be acceptably mitigated such that development can proceed.

11.3 Settlement planning strategies

Settlement planning must strengthen the resilience of settlements and communities and prioritise protection of human life. As the Baranduda BESS is not settlement planning, these strategies are not applicable and no response is required. The settlement planning strategies are, however, listed below.

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 3959-2009 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009).

Ensuring the availability of, and safe access to, areas assessed as a BAL-LOW rating under AS 3959-2009 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009) 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 reduce 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.

Assessing alternative low risk locations for settlement growth on a regional, municipal, settlement, local and neighbourhood basis.

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 3959-2009'

11.4 Areas of high biodiversity conservation value

Ensure settlement growth and development approvals can implement bushfire protection measures without unacceptable biodiversity impacts by discouraging settlement growth and development in bushfire affected areas that are of high biodiversity conservation value

There are no apparent additional biodiversity impacts associated with the findings of this bushfire assessment.

12. Conclusion

Terramatrix was engaged by Birdwood Energy to prepare a report the proposed Baranduda battery energy storage system, that responds to the planning and building controls that address bushfire.

The site in a designated BPA but no part of the lease area is covered by the BMO.

This report details how the bushfire hazard to the proposed Baranduda BESS has been assessed at various scales, in accordance with Clause 13.02-1S in the Wodonga Planning Scheme, the AS 3959-2018 methodology as invoked by the Victorian building regulations, and additional guidance, as appropriate, provided in *Planning Advisory Note 68 Bushfire State Planning Policy Amendment VC140* (DEWLP, 2018). The report also responds to the Model and Additional Requirements in the CFA *Design Guidelines and Model Requirements: Renewable Energy Facilities*. At this stage of the design process for the Baranduda BESS, some elements of the Guidelines are yet to be addressed and will be incorporated in subsequent stages of planning.

The landscape is one of moderate bushfire risk. Bushfire behaviour can reasonably be expected to be within AS 3959-2018 presumptions and design parameters. The type and extent of classified (hazardous) vegetation within 100 m of the facility has been identified and classified into AS 3959-2018 vegetation groups, based on the extant modelled EVC mapping, aerial imagery and site assessment. The classification is based on the current and likely future state of the vegetation and identifies that the hazard is Grassland in the paddocks of adjoining properties and Woodland in the WREN reserve to the north-east.

Overall, the topography on and around the site, within the 100 m assessment zone comprises minor downslopes to the north where the land falls toward Middle Creek. For the purposes of determining setbacks from classified vegetation to reduce radiant heat flux to less than 12.5 kW/m², the applicable slope classes are 'Downslope >0° & ≤5° under Grassland and Woodland to the north and 'All slopes and flat land' under the Grassland in all other directions.

The development can appropriately prioritise the protection of human life and meet the objectives of Clause 13.02-1S, largely by:

- Ensuring future buildings and infrastructure will not be exposed to a radiant heat flux above 12.5 kW/m², which is commensurate with a BAL-12.5 construction standard.
- Implementing the applicable Model and Additional Requirements of the Guidelines.

To reduce radiant heat flux to less than 12.5kW/m², low threat or non-vegetated setbacks from classified vegetation would be required for a minimum distance of:

- 19 m from Grassland to the south, west and east.
- 22 m from Grassland to the north.
- 41 m from Woodland to the north-east.

Elements of the Guidelines including the Model and Additional Requirements which have been addressed (or will be, where recommended in this report) are:

- A Risk Management Plan, which includes a Fire Safety Study.
- Consideration of the facility location and design.
- Consideration of the construction, commissioning and operational phases.
- Emergency management planning.

The design elements incorporated into the Baranduda BESS, which have been taken from the Model and Additional Requirements of the Guidelines are:

- Two points of emergency vehicle access/egress to the facility and a road encircling the facility that is at least 6 m wide.
- A XXX L static water supply on site with a compliant tank and hydrant system.
- Fire detection and suppression systems.
- A 12 m wide fire break around BESS infrastructure in the central facility area that is clear of any vegetation (existing or proposed).
- A minimum BAL-12.5 construction standard for any buildings on the site.

Once all of the Model and Additional Requirements have been incorporated in the development plans, the Baranduda BESS will be able to comply with Clause 13.02-1S *Bushfire Planning* and the Guidelines, therefore ensuring that the bushfire risk to the site can be mitigated to an acceptable level in order to allow development to proceed.

13. Appendix A - BALs explained

Bushfire Attack Level (BAL)	Risk Level	Construction elements are expected to be exposed to...	Comment
BAL-Low	VERY LOW: There is insufficient risk to warrant any specific construction requirements but there is still some risk.	No specification.	At 4 kW/m^2 pain to humans after 10 to 20 seconds exposure. Critical conditions at 10 kW/m^2 and pain to humans after 3 seconds. Considered to be life threatening within 1 minute exposure in protective equipment.
BAL-12.5	LOW: There is risk of ember attack.	A radiant heat flux not greater than 12.5 kW/m^2	At 12.5 kW/m^2 standard float glass could fail and some timbers can ignite with prolonged exposure and piloted ignition.
BAL-19	MODERATE: There is a risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to radiant heat.	A radiant heat flux not greater than 19 kW/m^2	At 19 kW/m^2 screened float glass could fail.
BAL-29	HIGH: There is an increased risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to an increased level of radiant heat.	A radiant heat flux not greater than 29 kW/m^2	At 29 kW/m^2 ignition of most timbers without piloted ignition after 3 minutes exposure. Toughened glass could fail.
BAL-40	VERY HIGH: There is a much increased risk of ember attack and burning debris ignited by windborne embers, a likelihood of exposure to a high level of radiant heat and some likelihood of direct exposure to flames from the fire front.	A radiant heat flux not greater than 40 kW/m^2	At 42 kW/m^2 ignition of cotton fabric after 5 seconds exposure (without piloted ignition).
BAL- FZ (i.e. Flame Zone)	EXTREME: There is an extremely high risk of ember attack and a likelihood of exposure to an extreme level of radiant heat and direct exposure to flames from the fire front.	A radiant heat flux greater than 40 kW/m^2	At 45 kW/m^2 ignition of timber in 20 seconds (without piloted ignition).

Source: derived from AS 3959-2018 (Standards Australia, 2020).

14. Appendix B – Access requirements

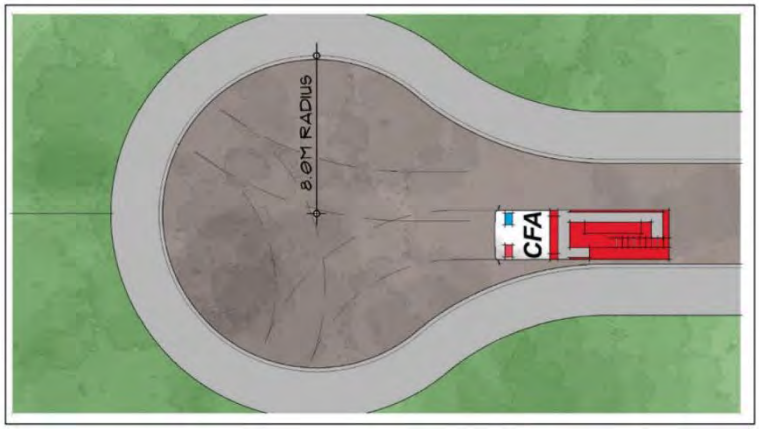


Image 1: Court-bowl style, minimum 8m radius (CFA, 2023).

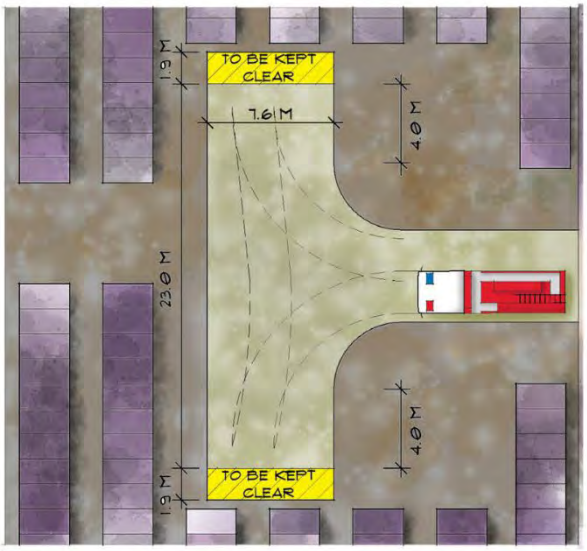


Image 2: 'T' head style (CFA, 2023).

15. Appendix C – Water requirements

Image 1: 150 mm Full bore isolation valve (CFA, 2023).

Image 2: 125 mm, 100 mm, 90 mm, 75 mm and 65 mm Storz tree adapters (CFA, 2023).

Image 3: Fire water signage to comply with AS 2419.1 Section 5.4.5 (CFA, 2023).

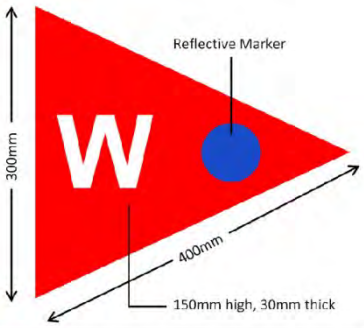


Image 4: Directional signage: fade resistant, fixed to rigid post in contrasting lettering, white sign writing on red background, with a circle reflective marker. 'W' in 150 mm upper case lettering (CFA, 2023).

Image 5: Best-practice arrangement of fire service infrastructure for facilities with battery energy storage systems with reticulated water supply meeting the performance requirements of AS 2419.1-2021: Fire hydrant installations (CFA, 2023).

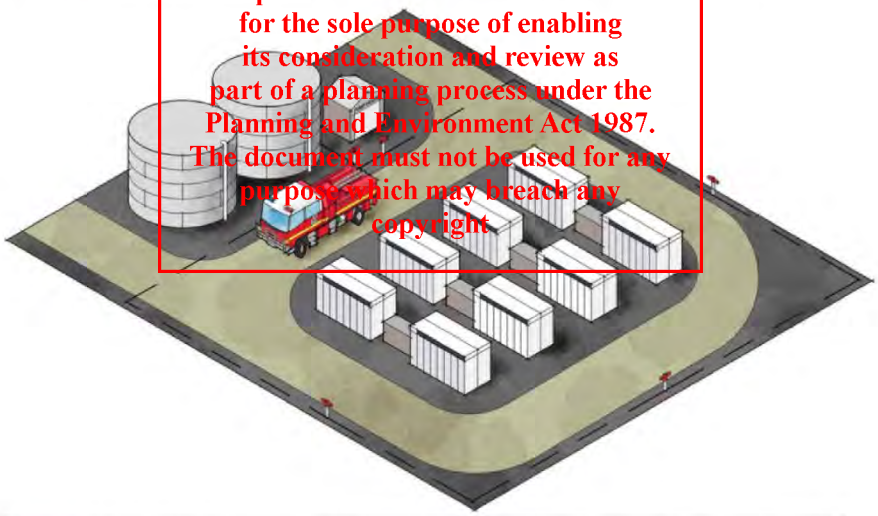


Image 6: Best-practice arrangement of fire service infrastructure at facilities with battery energy storage systems without reticulated water supply, or a reticulated water supply that does not meet the performance requirements of AS 2419.1-2021: Fire hydrant installations (CFA, 2023).

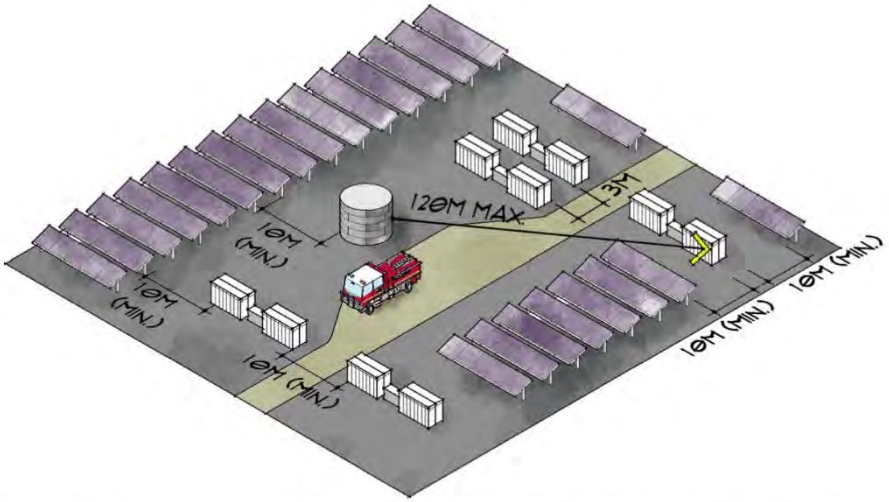


Image 7: Potential arrangement for fire water supply tank(s) for facilities with decentralised battery energy storage systems with no reticulated water supply to the site (CFA, 2023).

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Appendix B – Wind Data

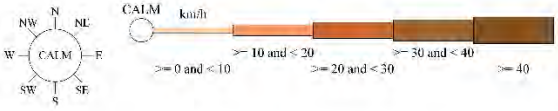
Rose of Wind direction versus Wind speed in km/h (01 Jun 1983 to 30 Nov 2007)

Custom times selected, refer to attached note for details

ALBURY AIRPORT

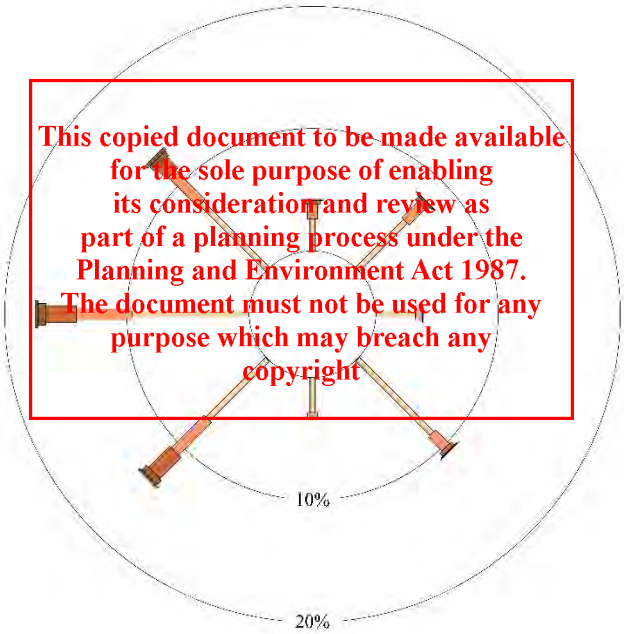
Site No: 072146 • Opened Jan 1973 • Still Open • Latitude: -36.0691° • Longitude: 146.9531° • Elevation 165m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



3 pm
8437 Total Observations

Calm 26%



Rose of Wind direction versus Wind speed in km/h (01 Jun 1983 to 30 Nov 2007)

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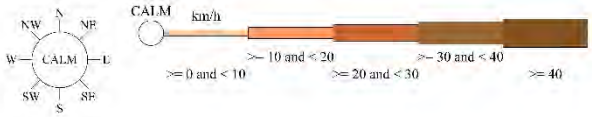
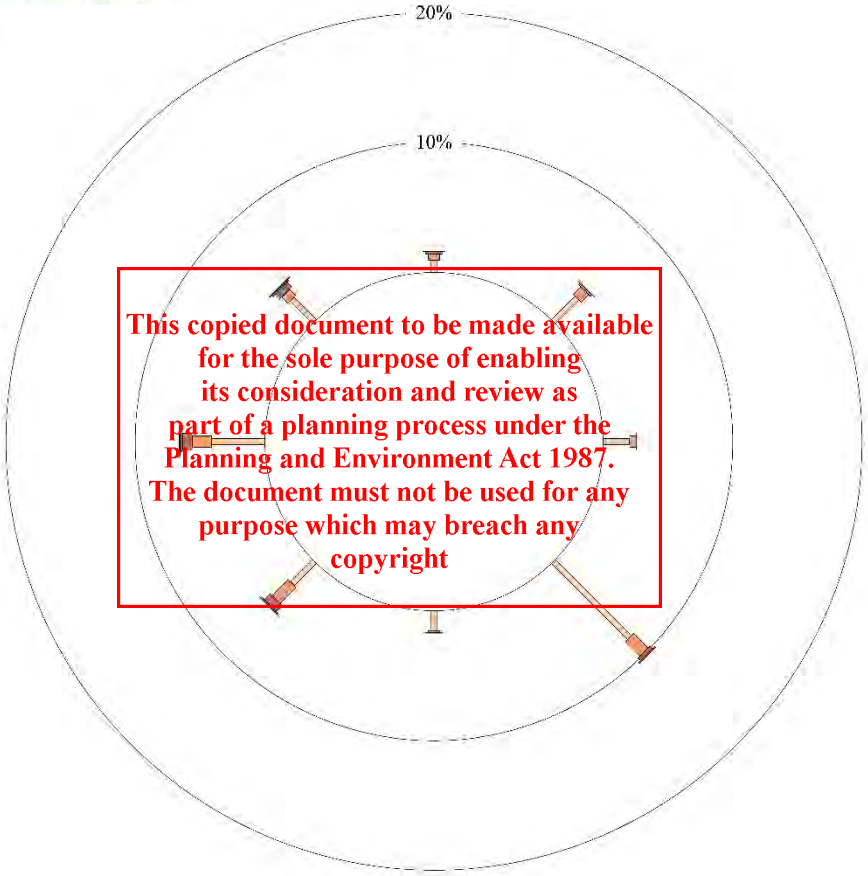


9 am
8677 Total Observations

Calm 65%



Appendix C – UL9540A test sequence

Figure 1.1
Schematic of Test Sequence