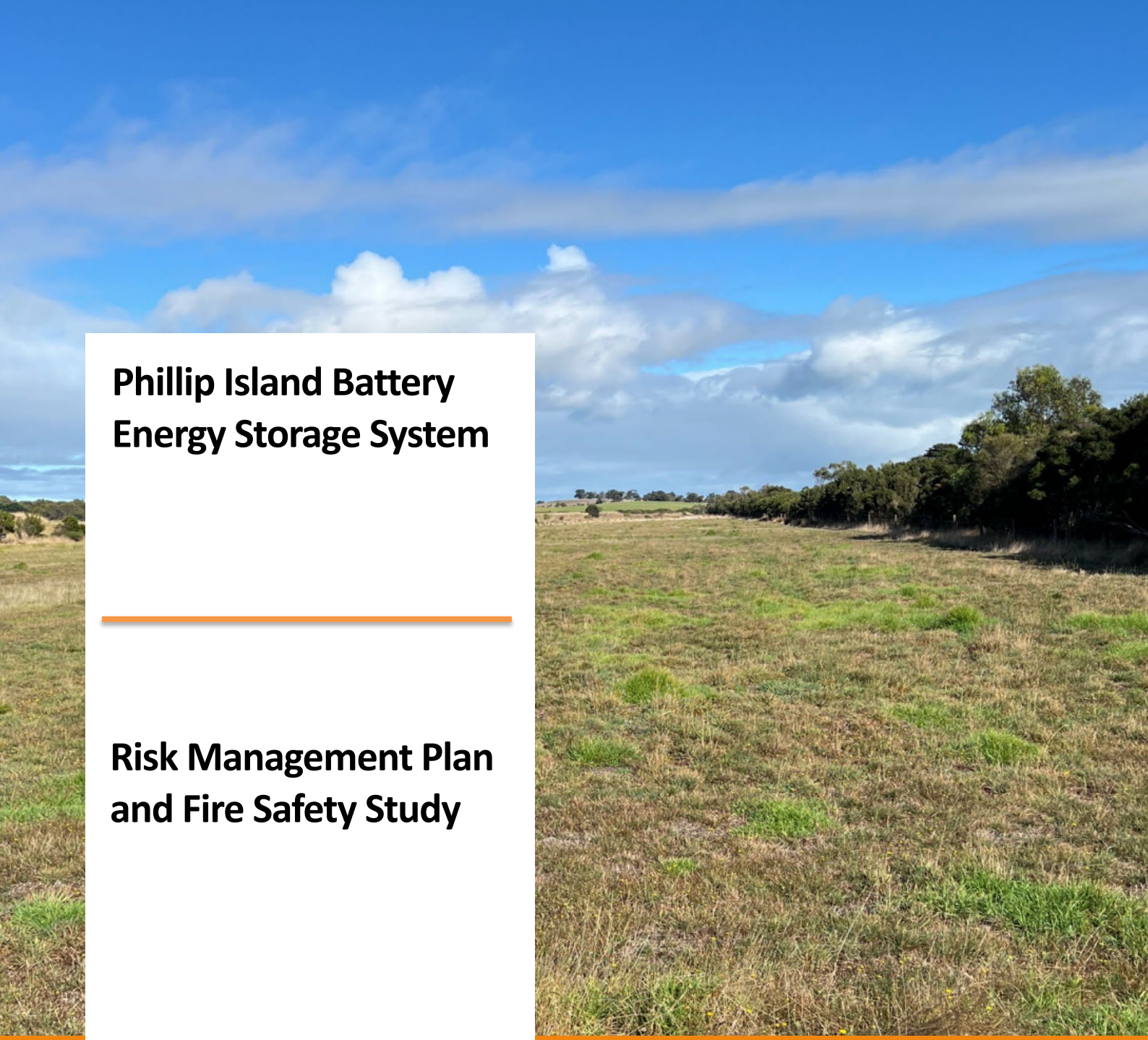

Phillip Island Battery Energy Storage System

Risk Management Plan and Fire Safety Study

May 2022

FIRE RISK Consultants

Cover photo –View of the BESS property (Fire Risk Consultants)

Document history and date

Revision	Date	Description	By	Review	Approved
V1 - DRAFT	27/4/2022	Initial draft following assessment of available information and site visit.	M Potter	G Taylor	G Taylor
V2 – Final	12/5/2022	Final following feedback from the client.	M Potter	G Taylor	G Taylor

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

Disclaimer and Information Statement

This report is issued by Fire Risk Consultants Pty Ltd and the information in this report is current as at the date of publication. Any Bushfire Emergency Plan or Bushfire Response Plan is current only at the date of issue as it is up to you to maintain the Australian Standard AS3959:2018 (or equivalent) and AS3745:2018 (or equivalent) for the property and/or building. Failure to maintain the property and/or building to these standards may compromise an insurance policy if currently covering any of your assets or those of any third party that may be consequentially affected due such failure. If not insured, and if you are seeking insurance, this report may not influence the decision of any insurer not to offer cover. To the extent permitted by law, Fire Risk Consultants Pty Ltd will not be held liable for any claims, demands, costs or expenses for any personal injury, property damage or death arising out of failure by you to maintain the property and/or building to AS3959:2018 (or equivalent) and AS3745:2018 (or equivalent).

The information and/or the recommendations contained in this report have been compiled and based on the information, records, data and any other sources of information supplied by you. Whilst we have exercised all due care and skill in compiling the report, you should confirm the accuracy and reliability of the information and material we have relied upon in producing the report. The information contained in the report is confidential and you should only read, disclose, re-transmit, copy, distribute or act in reliance on the information as you are authorised to do so. This report may also contain information, systems or data which is the property of Fire Risk Consultants Pty Ltd and Fire Risk Consultants Pty Ltd has in no way waived or altered in any way its ownership right, or provided consent for use by the report recipient, unless expressly provided in the report.

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 have been engaged by TEC-C to develop a Risk Management Plan for the proposed Phillip Island Battery Energy Storage System (BESS). The BESS is relatively small and will be located in a farming area in a central area of Phillip Island.

The Risk Management Plan (RMP) is required to be developed in accordance with the guidance provided in the CFA Guideline *Design Guidelines and Model Requirements: Renewable Energy Facilities 2022*. The client has engaged with CFA prior to the preparation of this plan and they will be reengaged again once the plan has been approved by the design team.

Once this plan is completed, it will enable a Fire Management Plan and Emergency Management Plan to be developed.

The 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.

Bushfire risk has not been assessed as part of this RMP with the results of the xwb consulting review being utilised to guide the completion of the relevant risk assessments.

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

2 Project Overview

The project will install and connect a BESS at the site located at 100 Gap Road, Cowes. The project includes the following:

- Minor civil and foundation works including laying of crushed rock and security fencing.
- Installation of prefabricated outdoor enclosures housing battery modules and associated inverters capable of generating 5MW for two hours.
- Electrical connection between the battery modules and transformers within the BESS footprint
- Electrical connection to the local electricity distribution network.

The project will also install various fire safety systems including a fire hydrant system and detection and suppression systems within the battery enclosures.

3 Risk assessment process

To effectively assess the fire risk associated with the proposal, this report is structured to both address the *Design Guidelines and Model Requirements: Renewable Energy Facilities 2022* produced by CFA (CFA Guidelines) and to complete a risk assessment that meets section 5 of these Guidelines.

4 Analysis against CFA Guideline

CFA have produced Guidelines that outline their requirements to address fire risk within renewable energy installations. These guidelines are aligned to the planning permit conditions imposed by CFA on the Planning Permit for this project. Section 5 is provided below:

Section 5 – Fire Risk Management

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 risks and hazards at the facility to and from the battery energy storage system and related infrastructure.

b) Specify and justify, in accordance with Section 6.2 of this guideline:

- *The location of the battery energy storage system on-site and in the landscape.*
- *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 battery energy storage systems (and related infrastructure).*
- *The separation distance, based on radiant heat flux (output) as an ignition source, 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).*

c) 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.

d) Be peer-reviewed by a suitably qualified, independent third party.

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

The following table provides the model requirements from CFA's Guideline and how this project addresses the specific areas.

Table 1 - Response to CFA Guideline

Model requirement	Compliance	Comments
Section 3 – consulting with CFA		
Early consultation, prior to the development of the planning permit application, ensures that CFA can effectively consider emergency response implications.	✓	CFA has been consulted and they have assessed the Planning Permit application and provided proposed conditions. CFA will continue to be consulted throughout the development of the Risk Management Plan, Fire Management Plan and Emergency Management Plan.
Section 4 – Planning Applications		
Planning applications must address all relevant aspects of fire safety, including landscape and bushfire hazards, and hazards to and from the proposed technologies.	✓	The Planning Permit application has been made and this report forms part of the response to CFA's conditions.
Section 6- Facility Location and Design		
Section 6.1 – Facility Location		
Planning applications for all renewable energy facilities proposed in high-risk environments must address the following, in addition to providing an assessment against policy at Clause 13.02-1S (Bushfire Planning):	✓	The assessment against clause 13.02-1S of the Bass Coast Planning Scheme has been undertaken by xwb consulting and Phillip Island Planning Services.
a) The impact of any ignitions arising from the infrastructure (solar panels, wind turbines, battery energy storage systems, electrical infrastructure) on nearby communities, infrastructure and assets.	✓	This report considers the impact of fires that leave the property. Refer to Table 7 for the assessment detail.
b) The impact of bushfire on the infrastructure (eg. ember attack,	✓	This report considers the impact of bushfire on the infrastructure. Refer to Table 8 for the assessment detail.

radiant heat impact, flame contact).		
c) 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.	✓	This report considers this matter and provides various strategies to reduce the impact on the surrounding areas.
Section 6.2 – Facility Design		
Section 6.2.1 – Emergency vehicle access		
All facilities		
a) Construction of a four (4) metre perimeter road within the perimeter fire break.	✓	A four metre wide perimeter road is being provided within the fire break.
b) Roads must be of all-weather construction and capable of accommodating a vehicle of fifteen (15) tonnes.	✓	This has been included within the design.
c) Constructed roads should be a minimum of four (4) metres in trafficable width with a four (4) metre vertical clearance for the width of the formed road surface.	✓	This has been included within the design.
d) The average grade should be no more than 1 in 7 (14.4% or 8.1°) with a maximum of no more than 1 in 5 (20% or 11.3°) for no more than fifty (50) metres.	✓	The site is mainly flat with only small slopes present. There are no roads that will require assessment of the grade.
e) Dips in the road should have no more than a 1 in 8 (12.5% or 7.1°) entry and exit angle.	✓	The site is mainly flat with only small slopes present. There are no roads that will require assessment of dips.
f) Roads must incorporate passing bays at least every 600 metres, which must be at least twenty (20) metres long and have a minimum trafficable width of six (6) metres. Where roads are less than 600 metres long, at least one passing bay must be incorporated.	✓	The site is located close to the Public Road. However, the site design has included a site turnaround provision on the property. The roads do not exceed 600 metres in length on the property.

g) Road networks must enable responding emergency services to access all areas of the facility, including fire service infrastructure, buildings, and battery energy storage systems and related infrastructure.	✓	The entrance driveway along with the perimeter road provides effective access to all parts of the property.
h) The provision of at least two (2) but preferably more access points to the facility, to ensure safe and efficient access to and egress from areas that may be impacted or involved in fire. The number of access points must be informed through a risk management process.	✓	The property is provided within a main entrance that provides a safe approach option for firefighters whilst also providing sufficient off road parking if required. There is also an emergency exit gate on the southern side of the development which provides the secondary access if required. This access point allows access to a flat area adjoining the property.
Section 6.2.2 Firefighting Water Supply		
All Facilities		
a) Water access points must be clearly identifiable and unobstructed to ensure efficient access.	✓	The fire hydrant system will be located inside the main entrance and is in a location that firefighters can access safely prior to entering the BESS area.
b) Static water storage tank installations must comply with AS 2419.1-2005: Fire hydrant installations – System design, installation and commissioning.	✓	A 10,000 litre static water supply will be provided onsite that provides protection from bushfires in the event that the street supply fails.
c) The static water storage tank(s) must be an above-ground water tank constructed of concrete or steel.	✓	This has been included within the design.
d) The static water storage tank(s) must be capable of being completely refilled automatically or manually within 24 hours.	✓	This has been included within the design. The street supply can provide 20l/s at 50.3 metres residual pressure head.
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	✓	The 10,000 litre water supply will be provided inside the main entrance.

(solar panels, wind turbines, battery energy storage systems, etc.).		
f) The hard-suction point must be provided, with a 150mm full bore isolation valve (Figure 1) equipped with a Storz connection, sized to comply with the required suction hydraulic performance. Adapters that may be required to match the connection are: 125mm, 100mm, 90mm, 75mm, 65mm Storz tree adapters (Figure 2) with a matching blank end cap to be provided.	✓	This has been included within the design.
g) The hard-suction point must be positioned within four (4) metres to a hardstand area and provide a clear access for emergency services personnel.	✓	This has been included within the design.
h) An all-weather road access and hardstand must be provided to the hard-suction point. The hardstand must be maintained to a minimum of 15 tonne GVM, eight (8) metres long and six (6) metres wide or to the satisfaction of the CFA.	✓	This has been included within the design.
i) The road access and hardstand must be kept clear at all times.	✓	This has been included within the design.
j) The hard-suction point must be protected from mechanical damage (eg. bollards) where necessary.	✓	This has been included within the design.
k) Where the access road has one entrance, a ten (10) metre radius turning circle must be provided at the tank.	✓	This has been included within the design.
l) An external water level indicator must be provided to the	✓	This has been included within the design.

tank and be visible from the hardstand area.		
m) Signage (Figure 3) indicating 'FIRE WATER' and the tank capacity must be fixed to each tank.	✓	This has been included within the design.
n) Signage (Figure 4) must be provided at the front entrance to the facility, indicating the direction to the static water tank.	✓	This has been included within the design. Note that the static water supply is located just inside the main entrance.
Battery Energy Storage Systems		
1) For facilities with battery energy storage systems, the fire protection system must include as a minimum:		
a) A fire hydrant system that meets the requirements of AS 2419.1-2005: Fire hydrant installations, Section 3.3: Open Yard Protection, and Table 3.3: 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.	✓	A fire hydrant system that meets the requirements of AS2419.1:2005 will be provided.
Section 6.2.4 – Fire Breaks		
A fire break must be established and maintained around:		
a) The perimeter of the facility, commencing from the boundary of the facility or from the vegetation screening inside the property boundary.	✓	The perimeter fence has been setback to enable 1 four metre access road located within a 10 metre fire break around the entire perimeter of the facility.
b) The perimeter of control rooms, electricity compounds, substations and all other buildings onsite. The width of fire	✓	All infrastructure is protected by the provision of a 10 wide fire break.

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.		
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 6.2.5 – 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 chosen for this project is the CATL BESS. This system is certified to UL9540A with a test report available for assessment if required. The battery layout is a row of individual containers that are designed to have a pack of 18 containers stored on the south western area of the property and a smaller pack of 14 containers on the north eastern area of the property. The two packs of containers are separated by approximately 20 metres that ensures fire spread between the two packs is limited. Each of the packs is also divided in two and provided with an air space between the containers of approximately 500mm. Each of the containers is fitted with a liquid cooling device, smoke detection and fire suppression systems that ensures the ability for fire spread is negligible. The containers are constructed of non combustible materials (metal) and will also limit fire spread between the containers.
b) A fire break around the battery energy storage system and related infrastructure, of a width	✓	A fire break of 10 metres is being provided around the entire perimeter of the battery facility.

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.*		
c) A layout of site infrastructure that: i. Considers the safety of emergency responders. ii. Minimises the potential for grassfire and/or bushfire to impact the battery energy storage system. iii. iii. Minimises the potential for fires in battery containers/enclosures to impact on-site and offsite infrastructure.	✓	The main entrance to the property is from Gap Road and sufficient space is provided on the property to park whilst undertaking an initial assessment of the site. The main entrance area also provides a turnaround facility for emergency vehicles that enter the property to then turnaround without having to enter the battery storage area. The BESS area has been setback from the boundaries and additional space is provided to limit the impact of a bushfire. The area is surrounded by grassland mainly associated with farming activities. Due to the sandy soil on Phillip Island, it is highly likely that the fuel loads in the surrounding paddocks will be low. The separation being provided between the battery enclosures and other infrastructure and the surrounding grassed areas is sufficient to limit a fire spreading off the property.
2) Battery energy storage systems must be:		
a) Located so as to be reasonably adjacent to a site vehicle entrance (suitable for emergency vehicles).	✓	This has been included within the design.
b) Located so that the site entrance and any fire water tanks are not aligned to the prevailing wind direction (therefore least likely to be impacted by smoke in	✓	The provision of site entrances at the north and south of the property ensures that firefighters can make a choice about which access they utilise in an emergency.

the event of fire at the battery energy storage system.)		
c) Provided with in-built detection and suppression systems. Where these systems are not provided, measures to effectively detect and/or suppress fires within containers must be detailed within the Risk Management Plan.	✓	The BESS is provided with detection and suppression systems. The detection system will be a series of smoke detectors connected to a Fire Indicator Panel that will transmit a signal when activated to a control room. The Emergency Management Plan will then guide the response to the detector activation The suppression system will be a Stat-x fire suppression system that conforms with NFPA 2010. The suppression system will also be connected through to the Fire Indicator Panel. The detection and suppression systems will be installed prior to arrival at the site.
d) Provided with suitable ember protection to prevent embers from penetrating battery containers/enclosures.	✓	The battery containers are fitted with screens to prevent birds and insects to enter the container. The doors are sealed to prevent dust penetration. Housekeeping is an ongoing task at the site and during the fire danger period, all vegetation accumulation against the base of the containers and on horizontal surfaces will be removed.
e) Provided with suitable access roads for emergency services vehicles, to and within the site, including to battery energy storage system(s) and fire service infrastructure.	✓	Driveway access is provided that allows access and parking inside the main entrance along with perimeter access around the battery storage area.
f) Installed on a non-combustible surface such as concrete.	✓	The battery area and the supporting infrastructure are being stored on a concreate area.
g) Provided with adequate ventilation.	✓	The batteries are stored with sufficient ventilation around and between the pack of containers.
h) Provided with impact protection to at least the equivalent of a W guardrail-type barrier, to prevent mechanical	✓	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.

damage to battery containers/enclosures.		
i) Provided with enclosed wiring and buried cabling, except where required to be above-ground for grid connection.	✓	This has been included within the design.
j) Provided with spill containment that includes provision for management of fire water runoff.	✓	An assessment has occurred, and the site is provided with fire water runoff through the stormwater design and the design of the site. Upon blocking the swale drain near the creek, the site will store approximately 144,000 litres of fire water runoff. Procedures have been included within the Emergency Management Plan.
Section 7 – Facility Construction and Commissioning		
Section 7.1.4 – Emergency Management		
An Emergency Management Plan must be developed for the construction and commissioning phase of the facility.	✓	An Emergency Management Plan will be developed for both the construction and operations phase.
Section 8 – Facility Operation		
Section 8.1 – Vegetation and Fuel Management		
Facility operators must undertake the following measures during the Fire Danger Period:		
a) Grass must be maintained at or below 100mm in height during the declared Fire Danger Period.	✓	This requirement will be included within the Fire Management Plan.
b) Long grass and/or deep leaf litter must not be present in areas where heavy equipment will be working, during construction or operation.	✓	This requirement will be included within the Fire Management Plan.
c) Restrictions and guidance must be adhered to during the Fire Danger Period, days of high (and above) fire danger and Total Fire Ban days (refer to www.cfa.vic.gov.au).	✓	This requirement will be included within the Fire Management Plan.

d) All vehicles and heavy equipment must carry at least a nine (9)-litre water stored-pressure fire extinguisher with a minimum rating of 3A, or firefighting equipment as a minimum when on-site during the Fire Danger Period.	✓	This requirement will be included within the Fire Management Plan.
Section 8.2 – Maintenance		
All Facilities		
Inspection, maintenance and any required repair activities must be conducted for all infrastructure, equipment and vehicles at the facility. Maintenance must be in line with any relevant Australian Standards and the manufacturer's requirements.	✓	This requirement will be included within the Fire Management Plan.
Section 8.4 Facility and System Monitoring		
All Facilities		
Appropriate monitoring for facility infrastructure must be provided, to ensure that any shorts, faults or equipment failures with the potential to ignite or propagate fire are rapidly identified and controlled, and any fire is notified to 000 immediately.	✓	In addition to the detection and suppression systems, the site will be provided with a SCADA system that will monitor the day to day operations of the batteries and associated infrastructure. The system includes a range of sensors that are preprogramed to send alert messages and includes: • Over temperature • Under temperature • Under voltage warning • Power off fault • Voltage and current changes. These alerts are automatically transmitted to a monitoring centre. There are appropriate levels of back up communication systems installed in the event of power failures or other events that may interrupt the communications connections.

Section 9 – Fire Management Planning		
All Facilities		
A Fire Management Plan must be developed for the facility, in conjunction with CFA, before commissioning of the facility.	✓	A Fire Management Plan will be developed prior to the commissioning of the BESS. This Plan will be provided to CFA for their consideration and feedback.
Section 10 – Emergency Management Planning		
All Facilities		
An Emergency Management Plan must be developed specific to the facility, in conjunction with CFA, prior to commissioning of the facility.	✓	An Emergency Management Plan will be developed prior to the commissioning of the BESS. This Plan will be provided to CFA for their consideration and feedback.
Section 10.2.1 – Developing an Emergency Information Book		
All Facilities		
An Emergency Information Book must be developed and available to emergency responders. Emergency Information Books must be located in Emergency Information Containers, provided at each vehicle entrance the facility.	✓	An Emergency Information Book will be provided at the main entrance and the emergency entrance in a container that is protected from weather.

5 Risk Assessment

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 – Guideline*s 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.

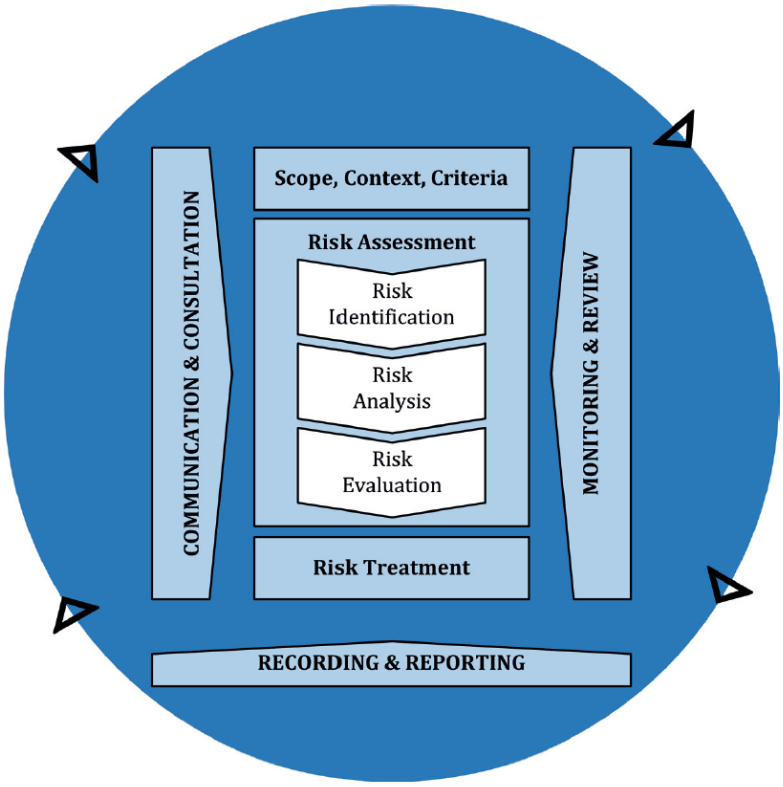

Figure 1 - Overview of AS/NZS ISO 31000-2018 risk management process

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 Guideline outlines the types of hazards that may need to be considered in relation to BESS infrastructure at the design, construction and operation phases.

5.3 Analysis of fire risk

BESS infrastructure is largely acknowledged as having limited potential to cause fires and is considered reasonably safe. There have been fires previously and these have been considered during the assessment of risk outlined within this report.

It is important the assessment of risk considers the various stages of the project including construction and the operation 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 be considered in the future. 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].

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

[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

development. The ongoing maintenance of the infrastructure and development is critical to ensure the ongoing management of fire risk.

All of 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:

Figure 2 - 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.
Staff and firefighters	The response to a fire by staff, contractors or firefighters can be dangerous due to the various safety hazards associated with a fire in this type of infrastructure.

The above list may not be exhaustive however it is believed that it 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 3 x 3 matrix has been developed that enables the effective consideration of risk and to enable a comparison between the outcome of the 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 2 - Likelihood table

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

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 3 - Risk assessment consequence table

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

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

Table 4 - Risk rating table

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

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

5.5.3 Risk analysis worksheets

The following worksheets have assessed the hazards identified in section 4.4 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 5 - 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.
LIKELIHOOD	Likely
JUSTIFICATION	The information provided in relation to the BESS design including the sensors and associated alerts will reduce the potential for an electrical hazard to result in a fire. The CATL battery system is also tested to conform with UL9540A and other Standards.
CONSEQUENCE	Moderate
JUSTIFICATION	The consequence of an electrical hazard causing a fire is limited due to the various risk treatments that are required by the CFA Guideline including: • Non-combustible surface that won't support fire spread through vegetation accumulation • SCADA monitoring system that will send alerts to the monitoring centre • Compliance with UL9540A • Appropriate separation between battery containers and other infrastructure • Smoke detection system connected to a Fire Indicator Panel that will alert the monitoring centre • Fire suppressions system that will discharge a fire suppressant into the container when activated manually or automatically.
RISK RATING	High

STRATEGY TO LOWER RISK	The requirements outlined within the response to the CFA Guideline will be sufficient to ensure the risk doesn't increase beyond medium. The additional requirements include:
	• Development of Emergency Management Plan that includes in addition to that required by CFA:
	  ○ A system to communicate effectively between the monitoring centre and the onsite staff and contractors.
	  ○ Provision of 24/7 contact details for the fire brigade to contact in the event of an emergency or threat of an emergency.
	• Developing a procedure that requires a technician to be deployed to the site when the site monitoring communications are down.
	• The Fire Indicator Panel (FIP) will be zoned to enable quick identification of the area of the facility that has caused an alarm.

RESIDUAL RISK	Medium (unlikely/moderate)

Table 6 - 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 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.
LIKELIHOOD	Unlikely
JUSTIFICATION	The monitoring systems that will be installed will send alerts to the monitoring station. These include smoke detection and fire suppression systems and the day to day monitoring system that will trigger an immediate response is alerted. 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 smoke detector or fire suppression system activation. Upon activation of the fire protection systems, 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. Prior to commissioning commencing, the SCADA system and FIP will be connected to the monitoring service. A procedure will be established to enable the FIP to be isolated during construction or maintenance works to prevent unnecessary activation of the suppression system 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. The majority of the infrastructure that supports the BESS is non combustible or has low quantities of combustible materials.
CONSEQUENCE	Minor
JUSTIFICATION	The consequence of a fire affecting adjoining areas of the plant is likely to be minor. The various protection systems, early notifications and other treatments will ensure that early intervention can occur.
RISK RATING	Low
STRATEGY TO LOWER RISK	Due to the low rating, no additional strategies are required to be implemented beyond compliance with the CFA Guideline as outlined in Section 4.
RESIDUAL RISK	Low

Table 7 - Risk assessment - Fire causing offsite impacts

RISK	Fire causing offsite impacts
CAUSE	Any fire on the property that can spread to adjoining properties most likely through vegetation connectivity, on bushfire risk days can start fires in the surrounding landscape that can threaten the community.
LIKELIHOOD	Unlikely
JUSTIFICATION	The compliance with CFA Guidelines requires a range of mitigation strategies implemented including: • Concrete surface under the battery containers and other infrastructure. • Provision of a fire break and additional managed area between the fire break and the boundary fence. • The battery systems are contained within the metal cabinets and any fire activity will mostly stay within the cabinets.
CONSEQUENCE	Minor
JUSTIFICATION	The bushfire assessment completed by XWB consulting identified the low risk landscape surrounding the BESS property. The Phillip Island area has not experienced large bushfires in the past and this would be due to a mix of vegetation types, efficient identification of fires and numerous landscape features that would slow or stop a fires spread including roads and residential properties. There are a number of roads surrounding the BESS area that if a bushfire was caused, the fire would quickly need to cross a road to impact on residential dwellings.
RISK RATING	Low
STRATEGY TO LOWER RISK	The site Emergency Management Plan will include a procedure for contacting the Municipal Fire Prevention Officer (MFPO) in the event that the vegetation on adjoining properties becomes a fire risk. The MFPO may, following an assessment issue a Notice requiring the vegetation be managed. Any vegetation growth on the property will be managed and removed. In particular 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.
RESIDUAL RISK	Low

Table 8 - Risk assessment - Offsite fire impacting on the site

RISK	Offsite fire impacting on the site
CAUSE	A bushfire burning through the surrounding landscape can enter the property and threaten the infrastructure by potentially starting new fires.
LIKELIHOOD	Unlikely
JUSTIFICATION	The bushfire assessment completed by XWB consulting identified the low risk landscape surrounding the BESS property. The Phillip Island area has not experienced large bushfires in the past and this would be due to a mix of vegetation types, efficient identification of fires and numerous landscape features that would slow or stop a fires spread including roads and residential properties. There are a number of roads surrounding the BESS area that if a bushfire was caused, the fire would quickly need to cross a road to impact on residential dwellings. The provision of a firebreak and other managed areas will limit the ability for a bushfire to impact on the property. The likely bushfire approach will be through the adjoining grassland and it is unlikely for this to produce elevated radiant heat due to the low fuel loads.
CONSEQUENCE	Minor
JUSTIFICATION	The ability for a bushfire to generate sufficient radiant heat in the surrounding landscape is unlikely. 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 to impact on the BESS from a bushfire in the surrounding landscape.
RISK RATING	Low
STRATEGY TO LOWER RISK	Within the Emergency Management Plan ensure the following is included: • When either a severe, extreme or code red day is forecast, ensure all vegetation maintenance activities are up to date.
RESIDUAL RISK	Low

Table 9 - 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 smoke detection system that is monitored 24/7 will also alert technicians and if required, the fire brigade to the site early.
CONSEQUENCE	Minor
JUSTIFICATION	There is a waterway on the western side of the development and excess water that can't be contained on the site will enter this area because of the swale drain design. The distance between the BESS and the Ocean is approximately 6 kilometres. Most of this creek area is dry and only flows when sufficient rainfall occurs. The Emergency Management Plan will specify the requirement to obtain civil works operators to attend the site and create a bunded area.
RISK RATING	Low
STRATEGY TO LOWER RISK	As the risk is low, there are no additional strategies required to manage this risk.
RESIDUAL RISK	Low

Table 10 - Risk assessment – Staff and firefighters

RISK	Staff and firefighters
CAUSE	The response to a fire by staff, contractors or firefighters can be dangerous due to the various safety hazards associated with a fire in this type of infrastructure.
LIKELIHOOD	Likely
JUSTIFICATION	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 Guideline does impose a variety of controls onto the management of the site through the Emergency Management Plan and how CFA interacts with the site if they are called to a fire. The 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.
RISK RATING	High
STRATEGY TO LOWER RISK	The arrangements for monitoring the Fire Indicator Panel through the operators 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 or property 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	Medium

6 Conclusion

The assessment of risk for the Phillip Island Battery Energy Storage System has resulted in a low to medium risk being realised. The low risk is driven by the compliance with the CFA Guideline during the design phase.

The system and procedures that are being implemented during design, construction and operations will ensure that any risk is managed to an acceptable level. Historically, fire events involving these types of facilities is because of inappropriate procedures that hasn't considered the risk of fire effectively. This RMP has considered these examples in the development of treatments.

There is no doubt that a BESS 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.