

# North Yarragon BESS – Environmental Assessments

Bushfire, Hazard and Risk Impact Assessment

ZEN Energy Future Pty Ltd

Reference: 528157

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2026-02-06

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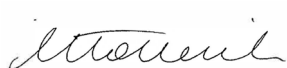

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## Contents

<b>1</b>	<b>Introduction</b>	<b>6</b>
1.1	Overview	6
1.2	Purpose	6
1.3	Scope of Assessment	8
1.4	Assumptions and Limitations	9
1.5	Exclusions	10
<b>2</b>	<b>Facility Overview</b>	<b>11</b>
2.1	Project Description	11
2.2	Project Area	11
2.3	Construction and Operation Phase	12
<b>3</b>	<b>Methodology</b>	<b>16</b>
3.1	Task 1: Dangerous Goods Screening	16
3.2	Task 2: Hazard and Risk Assessment	16
3.3	Task 3: BESS Recommendations	17
3.4	Task 4: Bushfire Assessment	17
<b>4</b>	<b>Task 1: Dangerous Goods Screening Assessment</b>	<b>19</b>
4.1	Dangerous goods storage	19
4.2	Dangerous Goods on Site	19
4.3	Summary of Dangerous Goods and Threshold Quantities	20
4.3.1	Lithium-ion Batteries	22
4.3.2	Transformer Oil	22
4.4	Dangerous Goods Regulatory Requirements	22
4.4.1	Placard Quantities	22
4.4.2	Manifest Quantities	23
4.4.3	Fire Protection Quantities	23
<b>5</b>	<b>Task 2: Hazard and Risk Assessment</b>	<b>25</b>
5.1	Hazard Identification	25
5.2	Risk Analysis	26
5.3	Risk Register	27
5.4	Other risk factors considered	27
<b>6</b>	<b>Task 3: BESS Recommendations</b>	<b>29</b>
6.1	General Recommendations	29
6.2	BESS (Lithium-ion battery) Recommendations	29
6.2.1	General BESS system design	29
6.2.2	Lithium-ion Batteries	30
6.2.3	Separation Distances	31
6.3	Transformer and Switchgear Recommendations	31
6.4	Natural Hazards Recommendations	33
6.5	Safety Management System Recommendations	33
6.5.1	Construction Phase Recommendations	33
6.5.2	Commissioning Phase Recommendations	34
6.5.3	Operations Phase Recommendations	34
6.6	Applicable Standards	35
<b>7</b>	<b>Bushfire Hazard Assessment</b>	<b>36</b>
7.1	Assessment of the planning scheme requirements	36

7.1.1	Victoria Planning Provisions .....	36
7.1.2	Site for development.....	41
7.1.3	Site bushfire assessment .....	44
7.2	Addressing risk to the BESS from the landscape (bushfire/grassfire) .....	47
7.2.1	Overall bushfire/grassfire risk.....	47
7.2.2	Addressing bushfire risks to the BESS.....	48
7.3	Bushfire Attack Level Assessment.....	49
7.4	Bushfire management recommendations.....	52
<b>8</b>	<b>Conclusion .....</b>	<b>54</b>

## Appendices

Appendix A: CFA Guideline Model Requirements

Appendix B: Risk Management Plan (preliminary)

## Figures

Figure 1. Indicative layout project area

Figure 2 Indicative layout design

Figure 3: Form and dimensions of an outer warning placard

Figure 4: Placard for storages of Class 9 packaged dangerous goods [20]

Figure 5. Locations of BMO and BPO

Figure 6: Site bushfire hazard assessment

Figure 7: Classification of vegetation: Grassland (Standards Australia, 2018)

Figure 8: Classification of vegetation: Woodland (Standards Australia, 2018)

Figure 9: Classification of vegetation: Forest (Standards Australia, 2018)

Figure 10: Classification of vegetation: Scrub (Standards Australia, 2018)

Figure 11. BAL mapping

## Tables

Table 1-1: Items required for compliance of BESS Facility with CFA Guidelines and Victorian Regulations

Table 2-1 Project land terms

Table 4-1: Threshold Quantities for BESS Hazardous Materials

Table 4-2: Threshold Quantities for Other Possible Hazardous Materials

Table 5-1 Potential Significant Hazards

Table 5-2: Hazard Consequence Assessment Matrix

Table 5-3: Hazard Likelihood Assessment Matrix

Table 5-4: Risk Rating Matrix

Table 6-1: Natural hazards description and recommendations

Table 7-1: Addressing information requirements within Clause 13.02-1S of the Victoria Planning Provisions (VPP) in relation to bushfire hazard identification

Table 7-2: Summary of measures to manage fire risk

Table 7-3. Vegetation classifications

Table 9-1: CFA Guideline Checklist Gap Analysis

Table 9-2: BESS Risk Register

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## Acknowledgement of Country

Aurecon acknowledges the Traditional Custodians of the lands, waters and skies where we work, live and play. We celebrate the diversity of Aboriginal and Torres Strait Islander peoples and their ongoing cultures and connections to lands, water and skies across Australia. In particular, we acknowledge their ongoing connection to Country and continuing environmental stewardship.

We acknowledge the Aboriginal and Torres Strait Islander Custodians of these lands and we pay our respects to Elders past and present.

*This imagery was created by Shanán Costello, a Sydney-based Aboriginal artist commissioned by Aurecon. Her fluid, colourful, and engaging digital drawings are a contemporary expression of Aboriginal art. This artwork reflects connection, partnership and growth and aims to illustrate Aurecon's genuine respect for Aboriginal Australians across the country.*

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## Executive Summary

This Bushfire, Hazard and Risk Assessment has been prepared by Aurecon on behalf of ZEN Energy Future Pty Ltd (ZEN Energy) for the development of a Battery Energy Storage System (BESS) facility at 713 Yarragon-Shady Creek Road, Yarragon, Victoria 3823. The site is located within the Baw Baw Local Government Area (LGA) and is legally described as Lot 1 TP334745 [1]. The proposed BESS, with a nominal installed capacity of up to 210 MW / 1680 MWh, is expected to include BESS modules, inverters, transformers, an on-site substation, and underground/overhead cabling for grid connection. It also involves access roads, a culvert bridge, an Operations and Maintenance Facility, water storage for firefighting, perimeter fencing, car parking, and site signage.

Due to dangerous goods being present on site and the facility being a BESS, a Bushfire, Hazard and Risk Assessment has been prepared to support the planning permit application for the Project as per the requirements of the Victoria Planning Provisions [2] and the local planning requirements of the Baw Baw Shire Council [3].

Under the Baw Baw Planning Scheme [3], Victoria Planning Provisions [2], and the *Planning and Environment Act 1987* [4], a BESS is defined as a 'Utility installation'. Pursuant to the Baw Baw Planning Scheme [3], a planning permit is required for Utility installation.

The Baw Baw Planning Scheme [3] and Victoria Planning Provisions [5] outline the decision guidelines for the application, whereby the responsible authority must consider:

- The effect on the environment, human health, and amenity of the area, and
- The degree of flood, erosion, or fire hazard associated with the location of the land and the use, development or management of the land so as to minimise any such hazard

Additionally, all renewable energy projects within the Country Fire Authority (CFA) jurisdiction in Victoria are required to submit plans showing conformance with the *Design Guidelines and Model Requirements for Renewable Energy Facilities* (CFA Guidelines) [6], which establishes the risk assessment methodology and key emergency and safety mitigations for renewable energy installations, including BESS facilities. Under the CFA guidelines, there is a requirement for hazard identification and the determination of appropriate dangerous goods storage and handling [6].

These requirements have been addressed in the form of a Bushfire, Hazard and Risk Assessment – comprising a Dangerous Goods (DG) screening assessment, Preliminary Impact Assessment, Bushfire Hazard Assessment and recommendations, and a preliminary Risk Management Plan

The dangerous goods screening assessment concluded:

- As the placard quantity thresholds for Class 9 as set out by Schedule 2 of the *Dangerous Goods (Storage and Handling) Regulations 2022* have been exceeded, placards are required. They should be displayed at every entrance for road vehicles and at the entrance of the buildings and rooms that store the batteries.
- As the manifest quantity thresholds for Class 9 as set out by Schedule 2 of the *Dangerous Goods (Storage and Handling) Regulations 2022*, are exceeded, a manifest of all Schedule 15 chemicals should be prepared and sent to WorkSafe Victoria. In addition, an updated emergency plan shall be prepared for the facility and provided to the Victorian Country Fire Authority for written advice.
- As the fire protection quantity thresholds for Class 9 as set out by Schedule 2 of the *Dangerous Goods (Storage and Handling) Regulations 2022*, are exceeded, written advice from the emergency services authority (i.e. CFA) shall be sought in relation to the design of the fire protection system for the premises. Following the review of a Risk Management Plan, the CFA Guidelines state that they (CFA) may request the preparation of a Fire Safety Study to be conducted for BESS facilities where the design, capacity, complexity, location, or proposed operations necessitate an enhanced, detailed analysis of requirements for fire and explosion safety systems.

The impact assessment demonstrates a potential for major consequences; implementation of risk controls will make these consequences unlikely, particularly for off-site effects. The recommended

technical and management safeguards proposed are intended to comply with the CFA Guideline to reduce the residual risk such that no identified hazards will pose a significant risk. These safeguards include:

- Site layout particularly the separation distances required to prevent the escalation of potential consequences,
- Design and layout of the BESS systems,
- Lithium-ion battery design,
- Transformers and switchgear design,

The assessment also recommends that a safety management system is implemented. The system should include the following safeguards prior to the commencement of commissioning or operation of the Project.

- Comprehensive, documented installation and operating procedures, with a regular audit/review system.
- Comprehensive, documented inspection and maintenance procedures with a regular audit/review system.
- Work Health and Safety Management Plan.
- Emergency Response Plan and Emergency Planning Program.
- Asset Management Plans and assurance activities (e.g. audits, monitoring or reporting).

Further study and planning will be undertaken as per CFA guidelines in the detailed design phase. This Hazard and Risk assessment also includes elements of the Risk Management Plan that will be developed as the project progresses and will support this future work.

The Bushfire Hazard Assessment found that the broader landscape surrounding the Project Area comprises largely of cleared farmland with paddocks that are occasionally separated by planted tree lines and riparian corridors, with no dense forested areas present nearby. The Project Area is considered to exhibit low-risk environmental attributes as per the CFA Guidelines. The primary landscape bushfire risk to the Project Area is from grassfire due to the potential for spot fires to occur within the treed or scrub vegetation in the landscape from bushfires in the north. Consequently, based on the condition of the landscape and limited patches of vegetation, extreme bushfire behaviour is considered unlikely. The site also has ready access and egress to safe areas around Yarragon that would provide safety in the event of a fire.

In accordance with Method 1 of *AS3959:2018*, the Bushfire Attack Level (BAL) rating for the site is primarily BAL-19 or lower due to the proposed 20 m Asset Protection Zone (APZ) being implemented between the vegetation buffer and the BESS infrastructure. It is recommended that the proposed 20 m APZ is adhered to for the duration of each fire season in perpetuity. Additionally, vegetation management should also be undertaken in accordance with the CFA guidelines *Landscaping for Bushfire – Garden Design and Plant Selection* (CFA, 2022).

This assessment concludes that the proposed BESS development, should be provided with the required mitigations and controls in order to meet the model requirements outlined for BESS infrastructure in the CFA Guidelines.

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## Glossary

Acronym/Term	Description
ADG	Australian Dangerous Goods
ADG Code	Australian Dangerous Goods Code
APZ	Asset Protection Zone
BAL	Bushfire Attack Level
BESS	Battery Energy Storage System
BMO	Bushfire Management Overlay
BPA	Bushfire Prone Area
CFA	Country Fire Authority
CFA Guidelines	<i>Design Guidelines and Model Requirements: Renewable Energy Facilities</i> (CFA, 2025)
DELWP 2020	Gippsland Bushfire Management Strategy 2020
DG	Dangerous Goods
EES	Electrical energy storage
EPA	Environment Protection Authority
EVC	Ecological Vegetation Class
FSS	Fire Safety Study
FZ	Farming Zone
ha	hectares
HAZID	Hazard Identification
HIPAP 2	Hazardous Industry Planning Advisory Paper No. 2
km	kilometres
LSIO	Land Subject to Inundation Overlay
LTI	Lost Time Incident
MTC	Medical treatment case
NCC	National Construction Code
OEM	Original Equipment Manufacturer
Project Area	The proposed subdivided land proposed to be used for the Project. This is proposed to be 18.31ha.
Property Boundary	This refers to the boundary of the Site.
(the) Proponent	ZEN Energy Future Pty Ltd (ZEN Energy)

<b>Acronym/Term</b>	<b>Description</b>
RWC	Restricted work case
SDS	Safety Data Sheet
(the) Site	The property at 713 Yarragon-Shady Creek Rd, Yarragon VIC 3823.
VPP	Victoria Planning Provisions

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## 1 Introduction

### 1.1 Overview

The Victorian Government's renewable energy target seeks to achieve 65% of electricity generation from renewable sources by 2030. ZEN Energy Future Pty Ltd (ZEN Energy) is developing its portfolio of renewable energy and storage assets.

ZEN Energy has secured an option to purchase a portion of the land at 713 Yarragon-Shady Creek Road, Yarragon Vic 3823, for the development of the North Yarragon BESS Project (the Project). The Project is part of a joint venture called ZEBRE, a joint venture between Taiwan Stock Exchange listed HD Renewable Energy (HDRE) and Australia's ZEN Energy, formed to build new renewable energy assets in Australia. ZEN Energy is currently progressing the development of the Project on behalf of the joint venture. The proposed site is located approximately 6 km north of Yarragon, near the Princes Freeway, and 10 km east of Warragul.

This Hazard and Risk Assessment, with a supporting Bushfire Assessment (Section 8) and preliminary Risk Management Plan (Appendix B), has been prepared to support the planning permit application for the Project in accordance with the Victoria Planning Provisions (VPP) [2], the Baw Baw Planning Scheme [3], and the *Planning and Environment Act 1987* [4].

Additionally, all BESS projects in Victoria must comply with the Victorian Country Fire Authority (CFA Guideline). The CFA *Design Guidelines and Model Requirements: Renewable Energy Facilities V4* [6] outline the Risk Assessment methodology and key emergency and safety mitigations required for renewable energy installations, including BESS facilities.

This Hazard and Risk Assessment provides a preliminary Risk Management Plan (Appendix B) including assessment of potential hazards associated with the facility and identifies key risk controls to be considered during the project's detailed design, to ensure compliance with the relevant regulatory requirements.

### 1.2 Purpose

This report has been prepared to accompany a planning permit application for the development of the North Yarragon BESS in accordance with the Baw Baw Planning Scheme [3], VPP [5] and the *Planning and Environment Act 1987* [4]. Under this legislation, a BESS is defined as a 'Utility installation' per Clause 73.03 of the Baw Baw Planning Scheme. This classification includes facilities used for the provision of utility services including the transmission, distribution and storage of power.

The proposed BESS is located within an area classified as Farming Zone (FZ) [1]. Pursuant to Clause 35.07 (subclauses 35.07-1, 35.07-3, and 35.07-4) of the Baw Baw Planning Scheme [3], a planning permit is required for use of the land for a utility installation, land subdivision and buildings and works.

Clause 35.07-6 (Decision guidelines) and Clause 65.01 (Approval of an application or plan) of the Baw Baw Planning Scheme [3] outlines the decision guidelines for the application, whereby the responsible authority must consider:

- The effect on the environment, human health and amenity of the area, and
- The degree of flood, erosion or fire hazard associated with the location of the land and the use, development or management of the land so as to minimise any such hazard.

These requirements have been addressed in the form of a Hazard and Risk Assessment with a supporting Bushfire Assessment with the proposed scope outlined in Section 1.3.

The Project must also comply with the Victorian CFA Guidelines, which establish the risk assessment methodology and key emergency and safety mitigations for renewable energy installations, including

BESS facilities. The key legislative and regulatory requirements applicable to BESS facilities in Victoria, as referenced in the CFA Guidelines, have also been summarised in Table 1-1.

Refer to Appendix A: CFA Model Requirements Analysis against CFA Guidelines for a summary of the gap assessment conducted for the BESS facility against CFA guidelines.

**Table 1-1: Items required for compliance of BESS Facility with CFA Guidelines and Victorian Regulations**

Section in CFA Guidelines	CFA Guideline	Relevant Regulation(s)
Section 2.3.2	<p>Where the facility includes a battery energy storage system or other significant quantities of dangerous goods, a request for emergency services written advice under Regulations 52 and/or 53 of the <i>Dangerous Goods (Storage and Handling) Regulations 2022</i> [7] may be required.</p> <p>Regulation 52 and 53 states that “An occupier of premises where dangerous goods are stored and handled in quantities that exceed the relevant quantities specified” must:</p> <ul style="list-style-type: none"> <li>■ request written advice of emergency services authority in relation to the design/alteration of the fire protection system</li> <li>■ ensure that a written plan for dealing with any emergency associated with the storage and handling of dangerous goods on those premises is developed, implemented and maintained; and communicated to the relevant people</li> </ul>	<p><i>Dangerous Goods (Storage and Handling) Regulations 2022</i> [7]</p> <p style="text-align: center; color: red; font-weight: bold; font-size: 2em;">ADVERTISED PLAN</p>
Section 2.3.1	<p>All buildings on site are required to comply with the National Construction Code (NCC). Where fire safety matters listed under Regulation 129 in the <i>Building Regulations 2018</i> do not meet the ‘deemed to satisfy’ provisions of the NCC, the report and consent of the fire authority Chief Officer is required.</p>	<p><i>Building Regulations 2018</i> [8]</p>
Section 3.1	<p>Section 28 of the OHS Act states the following in relation to the duty of designers: “A person who designs a building or structure or part of a building or structure who knows, or ought reasonably to know, that the building or structure or the part of the building or structure is to be used as a workplace must ensure, so far as is reasonably practicable, that it is designed to be safe and without risks to the health of persons using it as a workplace for a purpose for which it was designed.”</p> <p>Persons who have management or control of workplaces have obligations under the OHS Act to ensure the health and safety of people ‘so far as is reasonably practicable’. This legislation requires consideration of risk control measures and safe systems of work, which for renewable energy installations may relate to the development of systems and activities for:</p> <ul style="list-style-type: none"> <li>■ Housekeeping, including management of vegetation</li> </ul>	<p><i>Victorian Occupational Health and Safety Act 2004 (OHS Act)</i></p> <p><i>Occupational Health and Safety Regulations 2017</i> [9]</p>

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Section in CFA Guidelines	CFA Guideline	Relevant Regulation(s)
	<ul style="list-style-type: none"> <li>■ Security (fencing, monitoring, alarms, etc.)</li> <li>■ Undertaking hot works</li> <li>■ Ignition source control</li> <li>■ Vehicle, plant and equipment maintenance requirements.</li> </ul>	
Section 2.4	<p>Sections 113A and 83BA of the Electricity Safety Act 1998 require major electricity companies and specified operators of at-risk electric lines to prepare and submit a Bushfire Mitigation Plan to Energy Safe Victoria for acceptance.</p> <p>Sections 6 and 7 of the <i>Electricity Safety (Bushfire Mitigation) Regulations 2023</i> contain the requirements for Bushfire Mitigation Plans.</p>	<i>Electricity Safety (Bushfire Mitigation) Regulations 2023</i>

Further to this, the specific purpose of the Bushfire Assessment is to describe bushfire hazards in the broader landscape and at the site level, the existing and likely future conditions on the land that influences the bushfire risk and identify the bushfire protection measures that are required for the proposed BESS and associated buildings to reduce the risk to life and property from bushfire to an acceptable level.

## 1.3 Scope of Assessment

This Hazard and Risk Assessment (including a Bushfire Assessment) will review the Project against the requirements of the CFA Design Guidelines and Model Requirements: Renewable Energy Facilities V4 [6]. This assessment covers:

- Facility description, including infrastructure details, activities, and operating hours
- A site plan depicting infrastructure (location of BESS, power/grid connections, powerlines, generators, diesel storage, buildings), site entrances, exits and internal roads; fire services (water tanks, fire hydrants, fire hose reels and emergency access); and neighbouring properties
- A preliminary screening assessment to determine if the BESS facility triggers any specific screening criteria in relation to the storage and handling of dangerous goods and fire risk
- A desktop Hazard Identification exercise to identify hazards in accordance with CFA guidelines for renewable energy facilities
- Assess the associated risks with storage and handling of dangerous goods at the proposed BESS facility, and potential mitigation measures
- Recommend risk reduction measures to be applied during the design, construction and operations of the BESS
- Review Fire System/Safety design requirements for compliance with good practice for BESS facilities
- Description of the existing vegetation and bushfire hazards, including within the site and surrounding landscape
- A site assessment of the proposed BESS location to comply with the requirements of the *Australian Standard AS3959:2018 Construction of buildings in bushfire prone areas* (Standards Australia, 2018). The site assessment records:
  - categorised vegetation on site, including:

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- vegetation type (e.g. Woodland, Scrub, Grassland etc.)
- effective slope under vegetation
- distance and slope between the proposed permanent or temporary buildings (such as any battery storage or construction site offices) and any mapped categorised vegetation.
- any areas of excluded vegetation (as per Section 2.2.3.2 of AS 3959:2018).
- A preliminary Risk Management Plan summary table
- A bushfire landscape hazard assessment in accordance with Bushfire Planning Clause 13.02-1S of the Baw Baw Planning Scheme, to provide details of the bushfire hazards in the broader landscape considering bushfire scenarios as well as egress to built-up areas
- Bushfire awareness measures including site induction and brigade familiarisation
- Mitigation measures such as vegetation management and site maintenance. BAL contours are provided for design and construction of the facility.
- Vegetation management, including fuel (vegetation) reduction, landscape screening and maintenance plan/procedure
- A table cross-referencing where each CFA guideline/requirement has been addressed in the proposal.

## 1.4 Assumptions and Limitations

The following assumptions and limitations apply to this report:

- This document also provides an overview of the methodology used and recommendations to mitigate bushfire risk in accordance with relevant standards. It should be noted that these recommendations cannot guarantee the buildings will survive a bushfire event on every occasion, due to the unpredictability of bushfires and the condition of surrounding vegetation.
- The Battery Technology Original Equipment Manufacturer (OEM) selection will not be finalised at this stage of the project. However, the battery system is anticipated to consist of battery enclosures containing lithium-ion battery modules. The quantities of batteries indicated in this document are considered indicative and have been estimated conservatively, representing the maximum expected values.
- Quantities of other hazardous materials, specifically transformer oil, diesel (fuel for generation and minor maintenance machinery), and miscellaneous chemicals, have been approximated based on other similarly designed BESS projects. Once quantities and types of hazardous materials are confirmed, the triggers under the *Dangerous Goods (Storage and Handling) Regulations 2022* [7] will need to be reassessed. It is assumed that no fixed storage of petrol or other flammable liquids will be on site, only some minor quantities might be used for activities such as maintenance. Petrol and flammable liquids have been calculated separately to diesel, which is classified as a combustible liquid. It is also conservatively assumed that the transformer oil is a Class 9 dangerous good and not a non-hazardous substance such as a K-Class transformer oil.
- The outcomes of this bushfire assessment are limited to the BESS site and immediate surrounds, and the proposed project definition as outlined in Section 2.1.
- It is assumed that the BESS facility will be managed via risk and emergency management plans, which need to be prepared in consultation with the CFA. Should further information become available regarding the conditions at the site, the assessment, findings, and recommendations for this assessment may change.
- While the measures identified in this assessment, when fully implemented, can assist in reducing the residual fire risk to the project, they cannot fully guarantee assets will survive a bushfire or grassfire on every occasion due to the unpredictable nature of bushfires and extreme weather. Continual

evaluation and review of this document, fire risk conditions at the site, and updating management practices may assist in further reducing the residual fire risk over the life of the project.

- This assessment does not apply to adjoining works and infrastructure being built concurrently or subsequently as part of separate projects or extensions to this Project.

## 1.5 Exclusions

The assessment exclusions are listed below:

- Fire Safety Study and Final Fire Management Plan
- Emergency response planning and Emergency Management Plan

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## 2 Facility Overview

### 2.1 Project Description

The Project proposes a BESS with a nominal installed capacity of up to 210 MW / 1680 MWh (Figure 1).

The Project is expected to incorporate the following design features:

- BESS modules, inverters and transformers.
- Construction of internal access roads and access (and egress) points including a culvert bridge over the creek.
- Cabling (33 kV) to provide a connection between the battery modules and inverters and on-site substation.
- On-site substation including transformer to step up from 33 kV to the connection voltage of 220 kV.
- Underground or overhead cabling (33 kV) to connect the on-site substation to the Hazelwood Terminal Station to Rowville Terminal 220kV transmission line.
- An Operations and Maintenance Facility.
- Water storage (including firefighting water supply and fire water runoff containment).
- Fencing around the perimeter of the BESS facility.
- Car parking.
- Business identification signage, at site entry.

### 2.2 Project Area

The Site is located at 713 Yarragon-Shady Creek Road, Yarragon VIC 3825, approximately 125 km from Melbourne. The nearest town is Yarragon, approximately 7.5 km south of the Project Area.

The Site is defined by Yarragon-Shady Creek Road to the east, extending 1.3 km to the west and is approximately 51 hectares.

The Project Area is approximately 18.31 ha and is located in the north-west corner of the broader Site. A dwelling is located within the Site on the eastern side, with access from the dwelling to Yarragon-Shady Creek Road. The Project Area will be subdivided from the Site.

Shady Creek, running north to south, is located approximately 1km east of the Site. A tributary of Shady Creek runs through the north-east section of the Site and a small section of the Project Area. The Hazelwood Terminal Station to Rowville Terminal 220kV transmission line runs east to west through the south-western corner of the Site.

The terrain of the Project Area is comprised of undulating cleared open paddocks, currently used for livestock grazing. Vehicle access to the Project Area is proposed from Yarragon-Shady Creek Road with an access road running along the north side of the Site.

The exact location of the BESS infrastructure will be determined through detailed design, once a BESS supplier has been selected and will be in accordance with commitments made in this planning application. The Project Area and indicative layout are shown in Figure 1 below. There are 17 residential receptors within a 2 km radius of the development with the closest sensitive residential receptor located 782m southeast of the BESS compound. This is more than 200m distance required for a utility BESS facility to a habitable structure.

Terms used to define land for the Project are outlined in Table 2-1, below.

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Table 2-1 Project land terms

Term	Definition
Site	The property at 713 Yarragon-Shady Creek Rd, Yarragon VIC 3823
Property Boundary	This refers to the boundary of the Site (used within figures).
Project Area	The proposed subdivided land proposed to be used for the Project. This is proposed to be 18.31 ha.

On-site receptors include the main site office.

## 2.3 Construction and Operation Phase

### Construction

Methodology, program and timing of the construction works are currently indicative and dependent upon planning approvals and the selected contractor. It is anticipated that the construction activities will take place over a 24-month timeframe and will involve the following key works:

- Site mobilisation, installation of a perimeter fence
- Construction of main site access road, watercourse crossing
- Earthworks to level the site and create bench surfaces for the BESS equipment, storage and removal of spoil (including the treatment of contaminated soil, where required), drainage, establishment of laydown area
- Civil works to prepare internal access roads, equipment foundations and trenches for electrical and communications cabling
- Delivery, installation and connection of batteries, inverters and associated infrastructure
- Construction of substation and connection to the transmission network
- Installation of operation & maintenance building including storage area and site office
- Testing and commissioning

Construction work is expected to be undertaken six days per week and will generally occur during the following construction hours:

- Monday to Friday: 6:00 am – 6:00 pm
- Saturday: 7:00 am – 1:00 pm (assumed standard construction hours on Saturdays)

At its peak, construction of the BESS would have a maximum of 60 staff on-site. The expected worker origins are approximately 20% from Yarragon and 80% from Melbourne. Workers are expected to travel to site in light vehicles.

### Operation

The battery facility will be available for operation 24 hours a day, 7 days a week. Typical operation will be one charge cycle (approximately 9 hours) and one discharge cycle (8 hours) per day.

The operation and monitoring of the battery facility is largely automated. There are expected to be two full-time workers on the site from 8am to 5pm on Monday to Friday. Additionally, a small team will access the site approximately five days a month to undertake inspections and perform maintenance activities.

It is expected that the battery facility will be operating for approximately 30 years. Following this period, there will be a decision to either refurbish/deploy an alternative Proposal on the site or

decommissioning of site will occur. If the latter option is elected, all equipment will be safely removed from site and recycled where possible. The site will then be rehabilitated to its original condition and agricultural use can resume on the site.

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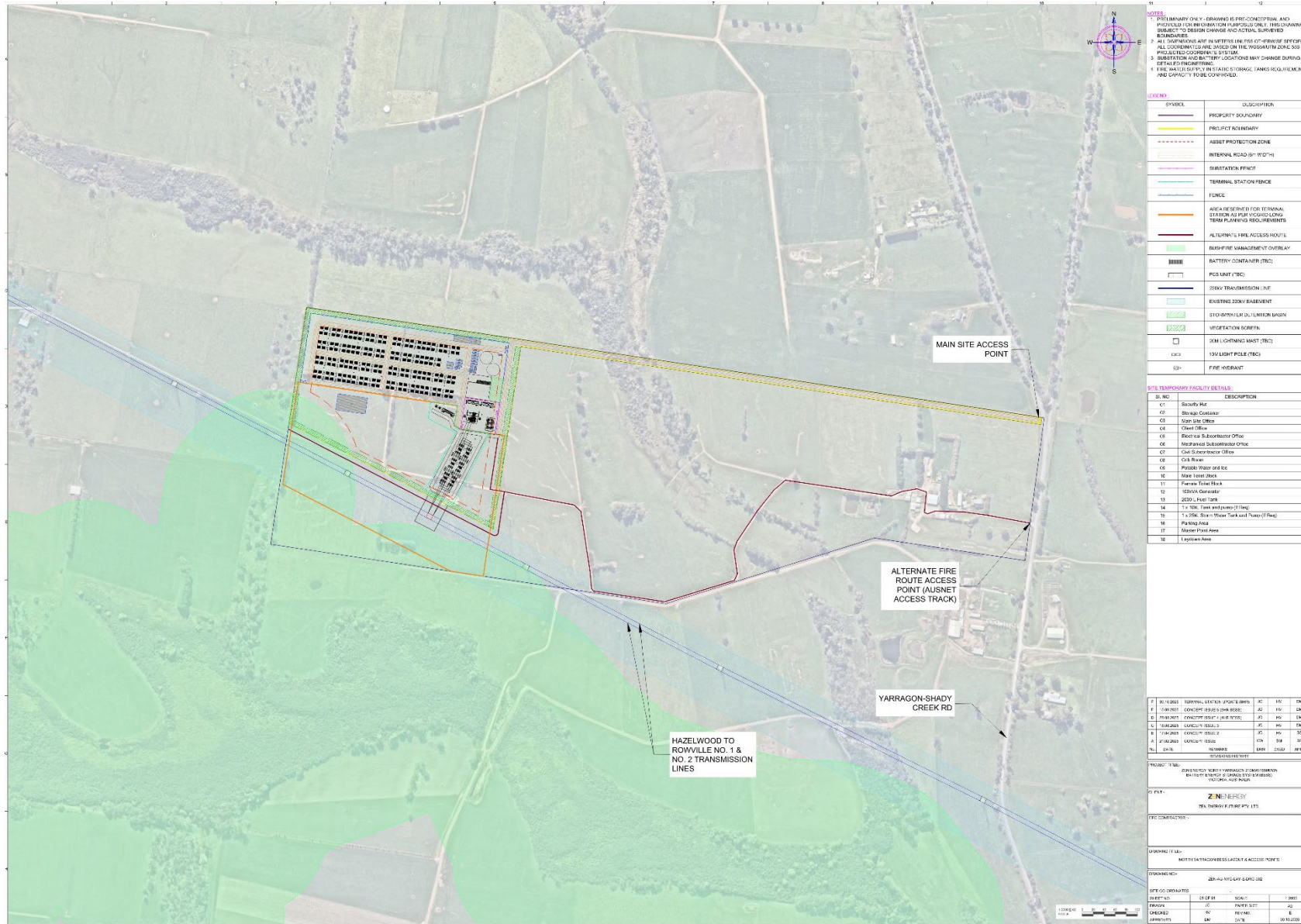


Figure 1. Indicative project layout

**NOTES**

1. PRELIMINARY ONLY - DRAWING IS PRELIMINARY AND PROVIDED FOR INFORMATION PURPOSES ONLY. THE DRAWING IS SUBJECT TO DESIGN CHANGE AND ACTUAL SURVEYED CONDITIONS.
2. ALL DIMENSIONS ARE GIVEN UNLESS OTHERWISE SPECIFIED. ALL COORDINATES ARE BASED ON THE AUSTRALIAN ZONE 503 PROJECTIONS (GDA 1984).
3. SUBSTATION AND BATTERY LOCATIONS MAY CHANGE DURING DETAILS DEVELOPMENT.
4. FIRE WALLS TO BE IN ACCORDANCE WITH TANKS REQUIREMENT AND CAPACITY FOR CONFORMANCE.

**LEGEND**

SYMBOL	DESCRIPTION
[Solid line]	PROPERTY BOUNDARY
[Dashed line]	PROJECT BOUNDARY
[Dotted line]	ASSET PROTECTION ZONE
[Thin solid line]	INTERNAL ROAD (5-10' W/TH)
[Thick solid line]	SUBSTATION FENCE
[Thin solid line]	TERMINAL STATION FENCE
[Thin solid line]	FENCE
[Thick solid line]	AREA RESERVED FOR TERMINAL STATION AS PER LOGGED LONG TERM PLANNING REQUIREMENTS
[Thick solid line]	ALTERNATE FIRE ACCESS ROUTE
[Green shaded area]	BUSHFIRE MANAGEMENT OVERLAY
[Hatched area]	BATTERY CONTAINER (TBC)
[Hatched area]	POLE UNIT (TBC)
[Blue line]	33KV TRANSMISSION LINE
[Green shaded area]	EXISTING 220KV BASEMENT
[Green shaded area]	STORMWATER DRAINAGE BASIN
[Green shaded area]	VEGETATION SCREENING
[Square symbol]	50M LIGHTING MAST (TBC)
[Square symbol]	10M LIGHT POLE (TBC)
[Circle symbol]	FIRE HYDRANT

**SITE TEMPORARY FACILITY DETAILS**

SYMBOL	DESCRIPTION
C1	Security Hut
C2	Storage Container
C3	Store Shed
C4	Chem Office
C5	Electric Substation Office
C6	Mechanical Substation Office
C7	Civil Substation Office
C8	Civil Room
C9	Process Room
C10	Male Toilet Block
C11	Female Toilet Block
C12	WC/Urinal
C13	2000L Fuel Tank
C14	1.5 TON (5000L) Water Tank
C15	1.5 TON (5000L) Water Tank (Fuel)
C16	1.5 TON (5000L) Water Tank (Fuel)
C17	Parking Area
C18	Master Plan Area
C19	Log Cabin Area

**REVISIONS**

NO.	DESCRIPTION	DATE	BY	CHK
1	ISSUED FOR PERMIT APPLICATION	20/08/2024	JD	JD
2	ISSUED FOR PERMIT APPLICATION	20/08/2024	JD	JD
3	ISSUED FOR PERMIT APPLICATION	20/08/2024	JD	JD
4	ISSUED FOR PERMIT APPLICATION	20/08/2024	JD	JD
5	ISSUED FOR PERMIT APPLICATION	20/08/2024	JD	JD

**PROJECT INFO**

PROJECT NAME: ZEN ENERGY YARRAGON SHADY CREEK BATTERY AND SUBSTATION (YARRAGON SHADY CREEK BATTERY)

CLIENT: ZEN ENERGY

PROJECT CONTRACTOR: ZEN ENERGY PROJECTS PTY LTD

DESIGN CONTRACTOR: NORTH WATERWAYS DESIGN & ACCESS POINTS

DESIGN NO: ZEN-PS-2024-001

DATE OF DESIGN: 20/08/2024

SCALE: 1:500

PROJECT NO: ZEN-PS-2024-001

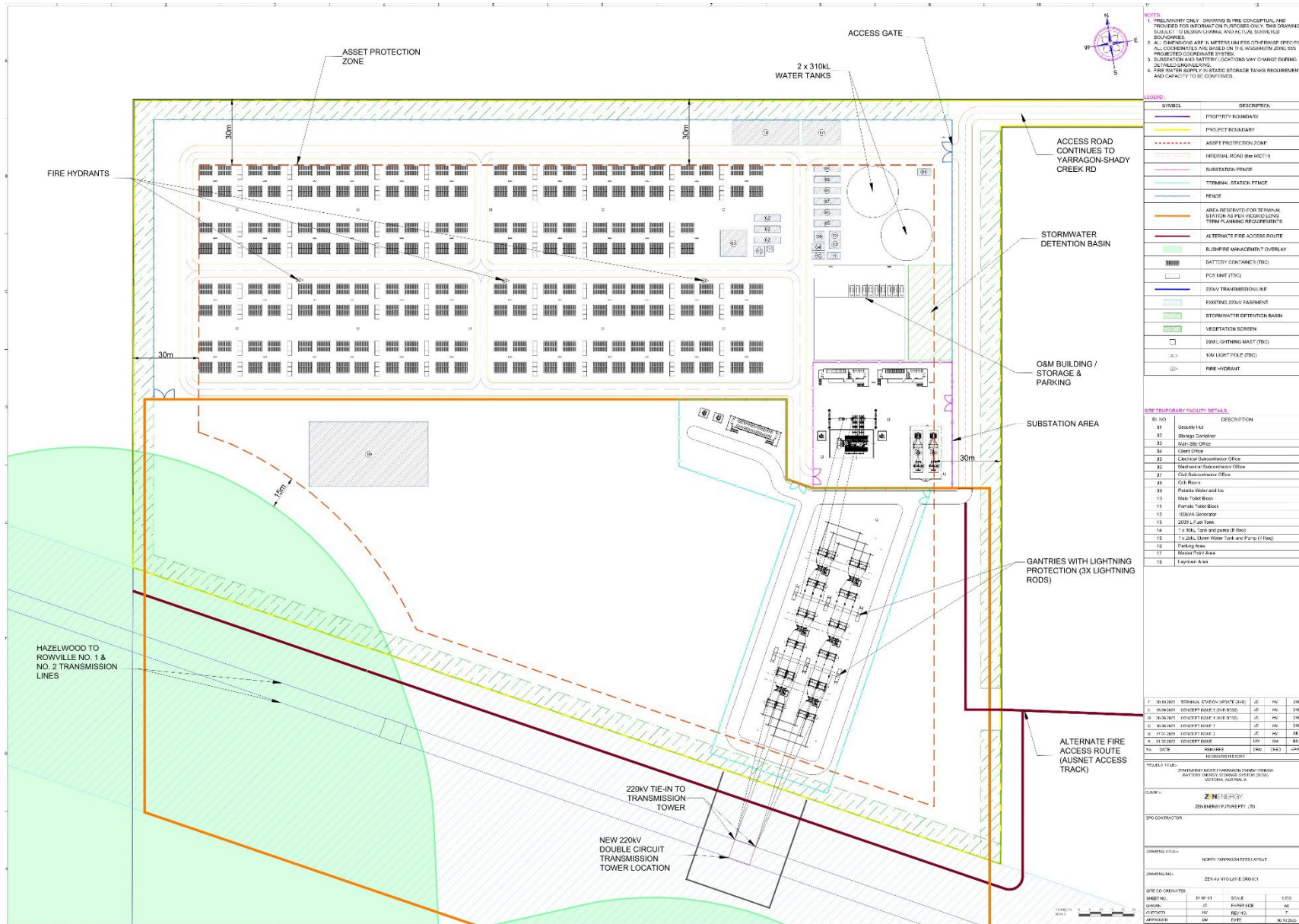
PROJECT NAME: ZEN ENERGY YARRAGON SHADY CREEK BATTERY AND SUBSTATION

PROJECT NO: ZEN-PS-2024-001

DATE: 20/08/2024

SCALE: 1:500

# ADVERTISED PLAN



**NOTES:**  
 1. PRELIMINARY ONLY - DRAWING IS PRELIMINARY AND PROVIDED FOR INFORMATION PURPOSES ONLY. THIS DRAWING IS SUBJECT TO DESIGN CHANGES AND ACTUAL SURVEYED BOUNDARIES.  
 2. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SPECIFIED. ALL DIMENSIONS ARE BASED ON THE VEGETATION ZONE 200 PROTECTED COORDINATE SYSTEM.  
 3. SUBSTATION AND BATTERY LOCATION MAY CHANGE DURING THE PROJECT DEVELOPMENT.  
 4. FIRE WATER SUPPLY AS STATIC STORAGE TANKS REQUIREMENT AND CAPACITY TO BE CONFIRMED.

**LEGEND:**

SYMBOL	DESCRIPTION
[Solid line]	PROPERTY BOUNDARY
[Dashed line]	PROJECT BOUNDARY
[Dotted line]	ASSET PROTECTION ZONE
[Thin solid line]	INTERNAL ROAD (6m WIDTH)
[Thick solid line]	SUBSTATION FENCE
[Thin solid line]	TERMINAL STATION FENCE
[Thin solid line]	FENCE
[Orange line]	AREA RESERVED FOR TERMINAL STATION AS PER VICRoad LONG TERM PLANNING REQUIREMENTS
[Red line]	ALTERNATE FIRE ACCESS ROUTE
[Green hatched area]	BUSHFIRE MANAGEMENT OVERLAY
[Green rectangle]	BATTERY CONTAINER (TBC)
[White rectangle]	PCS UNIT (TBC)
[Blue line]	220KV TRANSMISSION LINE
[Light blue hatched area]	EXISTING 220KV FASSEMBLY
[Green hatched area]	STORMWATER DETENTION BASIN
[Green hatched area]	VEGETATION SCREEN
[Square symbol]	30M LIGHTING MAST (TBC)
[Circle symbol]	15M LIGHT POLE (TBC)
[Square symbol]	FIRE HYDRANT

**SITE TEMPORARY FACILITY DETAILS:**

SI NO	DESCRIPTION
31	Storage Unit
32	Storage Container
33	Main Site Office
34	Client Office
35	Electrical Substation Office
36	Maintenance Substation Office
37	Control Room Office
38	Oil Room
39	Portable Water and Ice
10	Main Tank Block
11	Portable Toilet Block
12	1000VA Generator
13	200L Fuel Tank
14	1.5 Mln. Tank and pump (TBC)
15	1.5 Mln. Storm Water Tank and Pump (TBC)
16	Parking Area
17	Maintenance Area
18	Explosion Area

NO.	REVISIONS	DATE	BY	CHKD	APPD
1	ISSUED FOR TENDERS	20/01/2024	JC	HC	JM
2	ISSUED FOR TENDERS	20/01/2024	JC	HC	JM
3	ISSUED FOR TENDERS	20/01/2024	JC	HC	JM
4	ISSUED FOR TENDERS	20/01/2024	JC	HC	JM
5	ISSUED FOR TENDERS	20/01/2024	JC	HC	JM
6	ISSUED FOR TENDERS	20/01/2024	JC	HC	JM

**CLIENT:** ZENERGY ZSHENERGY FUTURE PPT, LTD.

**ERC CONTRACTOR:**

**DESIGNER:** NORTH WINDS ENGINEERING

**DATE OF PREPARATION:** 20/01/2024

**PROJECT NO.:** ZELVAVV01/2024

**PROJECT NAME:** ZELVAVV01/2024

**PROJECT LOCATION:** ZELVAVV01/2024

**PROJECT STATUS:** PRELIMINARY

**PROJECT NO.:** ZELVAVV01/2024

**PROJECT NAME:** ZELVAVV01/2024

**PROJECT LOCATION:** ZELVAVV01/2024

**PROJECT STATUS:** PRELIMINARY

Figure 2 Indicative layout design

## 3 Methodology

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The assessment is conducted in four tasks. These include

- Section 3.1: Task 1 Dangerous Goods Screening
- Section 3.2: Task 2 Hazard and Risk Assessment
- Section 3.3: Task 3 Basis for BESS Recommendations
- Section 3.4: Task 4 Bushfire Assessment and resulting recommendations.

### 3.1 Task 1: Dangerous Goods Screening

The screening evaluates the storage of dangerous goods against thresholds set by the *Dangerous Goods (Storage and Handling) Regulations 2022* [7]. This screening compares the quantities of Dangerous Goods stored and handled with the Placarding Quantity, Manifest Quantity and Fire Protection Quantity thresholds defined in Schedule 2 of the *Dangerous Goods (Storage and Handling) Regulations 2022* [7].

If the storage quantities exceed the thresholds for placarding, manifests, or fire protection, the relevant Dangerous Goods regulatory requirements will be provided in Section 4.4.

### 3.2 Task 2: Hazard and Risk Assessment

Following the screening assessment, a Hazard and Risk Assessment will focus on major incident scenarios that may result in impacts beyond the facility boundary, defined as “off-site”. In this context, “impact” can be defined as the potential for significant injury and fatality, damage to infrastructure and the environment (e.g. water & soil contamination). The analysis will focus on identifying and evaluating these scenarios to ensure that any risks with the potential to extend off-site are appropriately managed and mitigated.

The approach which is also in line with WorkSafe Victoria [11] includes:

- **Hazard Identification:** Identifying significant on-site and off-site hazards that may pose off-site risks, including potential fire sources and operational risks (e.g. electrical faults, chemical releases, bushfires, floods).
- **Risk Documentation:** Developing a risk assessment table to document key hazards, detailing the nature and characteristics of each risk, and applying controls based on the hierarchy of controls [12] and industry best practices.
- **Consequence Analysis:** Assessing the consequences of identified hazards to determine their potential impact on adjacent facilities or sensitive receptors. Hazards with no significant impacts are screened out, while those with possible impacts are carried forward.
- **Frequency Analysis:** Evaluating the frequency of hazards that have been carried forward from the consequence assessment.
- **Risk Assessment and Evaluation:** Assessing the overall risk by combining the consequence and frequency analyses for hazards with potential off-site impacts.

For this assessment, a qualitative approach was assumed to be appropriate and sufficient to evaluate the potential impacts on neighbouring land uses based on the following:

- The expected types and quantities of chemicals stored and handled at the BESS facility (lithium-ion batteries and diesel) are not expected to pose significant off-site risks (inclusive of batteries that are installed and operational).

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- There are no sensitive surrounding land uses within 200 m of the facility (i.e. residential areas, schools, hospitals, aged care or childcare facilities) [12]

Additionally, risk assessment is a continuous and iterative process. The Hazard and Risk Assessment should be regularly reviewed and updated throughout each stage of the project to address any emerging risks and ensure ongoing safety.

## 3.3 Task 3: BESS Recommendations

Based on the findings from the Hazard and Risk Assessment, recommendations will be made if necessary. These recommendations will be informed by relevant Australian standards and guidelines such as:

- CFA Design Guidelines and Model Requirements: Renewable Energy Facilities V4.4 [6]
- AS/NZS 5139-2019: Electrical installations – Safety of battery systems for use with power conversion equipment
- AS 1940-2017: The storage and handling of flammable and combustible liquids.

An analysis of the BESS facility against the CFA guidelines' Model Requirements was also conducted and can be found in Appendix A. These recommendations also include the additional requirements and studies (such as a fire management plan) for BESS facilities as listed under the applicable policy considerations (Table 1-1).

The identified recommendations and mitigation measures should be considered during detailed design and while developing the Fire and Emergency Management Plan for the Project.

## 3.4 Task 4: Bushfire Assessment

The following sources of information were reviewed to inform the preparation of this bushfire hazard assessment:

- VicPlan [13]
- Victoria Planning Provisions [2]
- NatureKit [14]
- *Design Guidelines and Model Requirements: Renewable Energy Facilities* [6]
- *Planning Permit Application Bushfire Management Overlay – Technical Guide* [15].

For the purposes of bushfire hazard assessment, areas of vegetation within the Study Area (Figure 1) considered to pose a bushfire threat are classified according to the vegetation classes defined as per AS3959:2018 [16]. Under Clause 2.2.3 and Table 2.3 of AS3959:2018, vegetation is classified into the following classes:

- **Forest:** includes tall open forest, woodland and low open forests which includes trees up to or over 30m tall and 30%-70% foliage coverage. This category also includes mature pine plantations
- **Woodland:** includes trees up to 30m high with a 10% - 30% foliage coverage.
- **Shrubland:** includes heath that is found in wet areas, poor soil conditions and 1 m – 2 m high as well as low shrubland that is <2m high, 30% foliage coverage and has an understorey.
- **Scrub:** includes closed and open scrub which can range from wet or rocky areas with poor soil conditions and contain a mixed species composition.
- **Mallee/Mulga:** includes low trees or tall shrubs, usually >2 m tall with sparse grassy understorey.
- **Rainforest:** includes trees with a >90% foliage cover, mixed species understorey and is not dominated by eucalypts.

- **Grassland:** includes all forms of grasses (except tussock moorlands) and where managed in a minimal fuel condition and non-curing cropland is regarded as a low threat vegetation.
- **Tussock Moorland:** includes all forms for vegetation where the overstorey is dominated by Button-grass.

AS3959-2018 also describes situations where vegetation is classified as 'low threat' due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, nature strips, windbreaks etc.

Details of the bushfire hazards within the Project Area were determined during a field assessment of the Study Area undertaken on 18 January 2024 (which occurred concurrently with the ecological assessment). The site assessment was completed using method 1 of AS3959-2018. This assessment confirmed the effective slope, vegetation class and bushfire protection measures present on the proposed BESS. Bushfire hazards situated beyond the Project Area were determined based on observations from publicly accessible locations during the site inspection and aerial photo interpretation.

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## 4 Task 1: Dangerous Goods Screening Assessment

### 4.1 Dangerous goods storage

Dangerous Goods (DG) screening of the proposed development was conducted to determine if the development must adhere to specific requirements under Victorian legislation. The following regulations and codes were reviewed against the proposed hazardous materials and quantities from the concept report:

- *Dangerous Goods (Storage and Handling) Regulations 2022* [7]
- *Occupational Health and Safety Act 2004* [17]
- *Australian Dangerous Goods Code* [18]

The hazardous chemicals on site (i.e. Class 9 lithium-ion batteries, diesel, transformer oil, SF<sub>6</sub> gas) are not listed in Schedule 14 of the *Occupational Health and Safety Regulations 2017* and hence, their storage quantities do not trigger a major hazard facility classification.

The *Dangerous Goods (Storage and Handling) Regulations 2022* [7] set out the requirements for the use, handling, and storage of hazardous chemicals at a workplace. Specifically, this report assesses requirements for exceeding placard, manifest, and fire protection quantities found in Schedule 2 of those regulations.

A summary of the expected hazardous materials to be stored and handled on-site for the project are listed in Table 4-1 and Table 4-2.

Where the storage quantities exceed the thresholds for placarding, manifests, or fire protection, the relevant DG regulatory requirements will be provided.

### 4.2 Dangerous Goods on Site

The hazardous materials being screened have been separated into two categories: BESS hazardous materials and other possible hazardous materials.

Table 4-1 below details the hazardous materials associated with a BESS unit.

The selection of the Battery Technology Original Equipment Manufacturer (OEM) is not finalised at this stage. However, for the purposes of this assessment, it is anticipated that the battery system will consist of battery enclosures containing lithium-ion battery modules. It is assumed that the batteries will be delivered pre-assembled, meaning all substances required by the units are built into the battery enclosure and do not need to be added during installation at the Site.

Table 4-2 provides a list of non-battery hazardous materials which are expected to be present in various quantities on site and may be part of adjacent infrastructure (e.g. transformers) to the BESS facility. In cases where the packing group is ambiguous, the worst-case scenario is assumed.

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## 4.3 Summary of Dangerous Goods and Threshold Quantities

Table 4-1: Threshold Quantities for BESS Hazardous Materials

Material	UN No.	DG Class	Category	Packing Group	Project Storage Quantities <sup>2</sup>	Dangerous Goods Threshold			Exceedance
						Placarding	Manifest	Fire Protection	
Lithium-ion Batteries (LIB)	3536	9	Miscellaneous dangerous goods and article	II	<b>Battery Storage</b> 31,061 kg	1,000 kg	10,000 kg	20,000 kg	Placarding, manifest, and fire protection thresholds exceeded (LIB or combined with transformer oil).
					<b>Batteries in Use<sup>1</sup></b> Total on site is <b>11,554,816 kg</b>	N/A <sup>1</sup>	N/A <sup>1</sup>	N/A <sup>1</sup>	

**Notes:**

- Lithium-ion batteries **in use** are not subject to the requirements of the *Dangerous Goods (Storage and Handling) Regulations 2022* as per Regulation 6 (c) and, hence, do not have a prescribed storage threshold under Schedule 2 of the *Dangerous Goods (Storage and Handling) Regulations 2022*.
- Quantity is for UN3536 i.e. the battery weight

Table 4-2: Threshold Quantities for Other Possible Hazardous Materials

Material	UN No.	DG Class	Category	Packing Group	Project Storage Quantities	Dangerous Goods Threshold			Exceedance
						Placarding	Manifest	Fire Protection	
Diesel (Fuel for minor maintenance machinery)	1202	C1 Combustible Liquids		N/A	Total on site is up to one 2,000L Diesel fuel tank ( <b>2 kL</b> )	10,000 L (10 kL)	100,000 L (100 kL)	100,000 L (100 kL)	None exceeded

Material	UN No.	DG Class	Category	Packing Group	Project Storage Quantities	Dangerous Goods Threshold			Exceedance
						Placarding	Manifest	Fire Protection	
Transformer Oil (Transformer coil insulation)	Various	9	Miscellaneous dangerous goods and articles	II	Total on site is <b>250,000 L (250 kL)</b>	1,000 kg or L	10,000 kg or L	20,000 kg or L	Placarding, manifest, and fire protection thresholds exceeded. (Transformer oil or combined with LIB)
Sulfur hexafluoride (SF <sub>6</sub> )	1080	2.2	Non-flammable, non-toxic	N/A	Switchgears	Not prescribed within Class 2.2 dangerous goods for <i>the Dangerous Goods (Storage and Handling) Regulations 2022</i>			

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A summary of the dangerous goods greater than manifest quantities is discussed in detail below.

### 4.3.1 Lithium-ion Batteries

Lithium-ion batteries are classified as Class 9 Miscellaneous Dangerous Goods. However, Clause 6(c) of *the Dangerous Goods (Storage and Handling) Regulations 2022* states that the regulations do not apply to “dangerous goods that are batteries while they are in use”.

The facility is expected to store several tonnes worth of lithium-ion batteries (additional BESS units) on site (i.e. for repair or replacements), meaning not all batteries on site will be in use.

Once installed and connected, lithium-ion batteries are not considered Dangerous Goods. As such, lithium-ion batteries that are in use within the facility are excluded from the requirements of Schedule 2, and only lithium-ion batteries in storage are required to be assessed against the General Screening Thresholds in Table 4-1.

The content of the battery, lithium, poses little threat to people or property. However, the potential of thermal runaway effects may lead to fire and explosion hazards [19]. As such, the risks of lithium batteries in use have been considered as part of this study, and mitigation measures for Li-ion batteries are further discussed in Section 7.2.

### 4.3.2 Transformer Oil

The site is expected to include 62 Medium Voltage transformers, 2 Auxiliary transformers, and 1 High Voltage transformer, all of which may contain transformer oil. It is conservatively assumed that the transformer oil is a Class 9 dangerous good and not a non-hazardous such as a K-Class transformer oil.

There is a potential for the transformer oil to lead to a pool fire if ignited however this consequence will not pose significant off-site risk. Risks related to transformers are considered, with recommended mitigation measures further discussed in Section 7.3.

## 4.4 Dangerous Goods Regulatory Requirements

### 4.4.1 Placard Quantities

In accordance with Regulation 46 of the *Dangerous Goods (Storage and Handling) Regulations 2022* [7] if any placarding thresholds are exceeded, “HAZCHEM” outer warning placards are to be displayed at every entrance for road vehicles. The placard must display the word “HAZCHEM” in red letters not less than 100 mm high and of the style shown in Figure 3, on a white or silver background. Note: Red means the colour Signal Red in accordance with AS 2700S:2011.



Figure 3: Form and dimensions of an outer warning placard

In accordance with Regulation 47, where dangerous goods are stored and handled, any storage of packaged dangerous goods that exceeds the quantity specified Schedule 2 must be placarded.

- The placard must be kept clean, in good order, and unobstructed
- The placard must be located so that it is clearly legible by persons approaching the placard; and separate from any other sign or writing that contradicts, qualifies, or distracts attention from the placard.
- The placard must be located:
  - at the entrance to any building in which the dangerous goods are stored; and

- within a building, at the entrance to each room or other closed or walled section of the building in which the dangerous goods are stored; and adjacent to any external storage area where the dangerous goods are stored.
- adjacent to any external storage area where the dangerous goods are stored.

## Transformer Oil and Lithium-ion Batteries

The maximum allowable placard quantity of Class 9 Miscellaneous Dangerous Goods as per Schedule 2 of *Dangerous Goods (Storage and Handling) Regulations 2022* is 1,000 kg. The proposed quantity of transformer oil and LIB exceeds the placard quantity and thus must comply with Regulation 47 of *Dangerous Goods (Storage and Handling) Regulations 2022* [7].

For packaged UN Class 9 Miscellaneous Dangerous Goods the placard must have:

- the form shown in Figure 4; and
- be of sufficient size to accommodate the labels to be displayed on it.
- In relation to Figure 4, the Class label must have sides at least 100 mm long.



Figure 4: Placard for storages of Class 9 packaged dangerous goods [20]

### 4.4.2 Manifest Quantities

Following the Screening Assessment (Task 1) in Section 4.3, it was determined that manifest quantities have been exceeded.

Regulation 64 of the *Dangerous Goods (Storage and Handling) Regulations 2022* [7] states that “An occupier of premises where notifiable goods are present must ensure that the Authority is provided with a notification of the presence of those goods that complies with subregulation (2)”. Under subregulation (2)(c)(viii) and (ix), the operator of the facility has the duty to notify the Authority (WorkSafe Victoria) of dangerous goods exceeding manifest quantities.

The maximum allowable manifest quantities of Class 9 Materials (lithium-ion batteries and transformer oil) as per Schedule 2 of the *Dangerous Goods (Storage and Handling) Regulations 2022* [7] are 10,000 kg. The proposed quantities of **31,061 kg** lithium-ion batteries (in storage) and **250,000 L** transformer oil to be stored at site exceed the manifest quantity, therefore:

- In accordance with Regulation 44 of the *Dangerous Goods (Storage and Handling) Regulations 2022*, the occupier of premises must ensure that the manifest is kept on premises in a location or place where it is readily accessible to the emergency services authority (CFA).
- An emergency plan should be prepared for the site and provided to the Country Fire Authority as per the requirements of Regulation 53 of the *Dangerous Goods (Storage and Handling) Regulations 2022* [7].
- WorkSafe Victoria must be notified of dangerous goods exceeding manifest quantities in accordance with Regulation 64 of the *Dangerous Goods (Storage and Handling) Regulations 2022* [7].

### 4.4.3 Fire Protection Quantities

The maximum allowable fire protection quantity of Class 9 Materials (lithium-ion batteries and transformer oil) as per Schedule 2 of the *Dangerous Goods (Storage and Handling) Regulations 2022* is 20,000 kg [7]. The

proposed quantity (**31,061 kg** of stored lithium-ion batteries and **250,000 L** of transformer oil) to be stored at site exceeds the fire protection quantity, therefore:

In accordance with Regulation 52 of *Dangerous Goods (Storage and Handling) Regulations 2022* [7], where dangerous goods are stored and handled in quantities that exceed the relevant fire protection thresholds, the occupier must:

- Request the written advice of CFA in relation to the design of the fire protection system for the premises; and
- In establishing the fire protection system for the premises, have regard to that written advice

Additionally, after a review of a Risk Management Plan, CFA may request the preparation of a Fire Safety Study (FSS) (which forms part of the Risk Management Plan) be conducted, in line with the NSW *Hazardous Industry Planning Advisory Paper No. 2 (HIPAP 2) Fire Safety Study Guidelines*, and provided to CFA's Specialist Risk and Fire Safety Unit for facilities with battery energy storage system(s) where design, capacity, complexity, location, or proposed operations necessitate an enhanced, detailed analysis of requirements for fire and explosion safety systems. A Fire Safety Study, as outlined in HIPAP 2, aims to assess and document the effectiveness of fire prevention, detection, and mitigation measures specific to the site's hazards, ensuring compliance with fire safety standards and reducing risks to people and property. If required, this would be conducted prior to development commencing.

Further, the CFA design guideline for renewable facilities [6] states that the management of fire water runoff must also be addressed. CFA recommends that infrastructure is provided for the containment and management of contaminated fire water runoff from battery energy storage systems. Infrastructure may include bunding, sumps and/or purpose-built, impervious retention facilities. A fire water management plan, relevant at detailed design phase, may consist of the containment and disposal of contaminated fire water. CFA also recommends a containment and management capacity equivalent to the on-site fire protection system. Containment is to be provided as per *AS 4681- 2000: The storage and handling of class 9 dangerous goods* (Section 7.3.9: Control of run-off) .

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## 5 Task 2: Hazard and Risk Assessment

Section 4(2) of the Victorian Occupational Health and Safety Act 2004 [17] states “persons who control or manage matters that give rise or may give rise to risks to health or safety are responsible for eliminating or reducing those risks so far as is reasonably practicable”.

Following the screening assessment (refer Section 4), it was determined that a Hazard and Risk Assessment should be conducted as manifest quantities have been exceeded and the BESS poses potential fire risks.

### 5.1 Hazard Identification

Hazard Identification (HAZID) aims to identify all reasonably foreseeable hazards and associated events that may arise due to the operation of the facilities and define the relevant controls through a systematic and structured approach.

All (32) potential significant hazards that may pose a risk to the Project or an off-site risk were identified and documented in a Risk Register as a preliminary Risk Management Plan (refer to Appendix B) and summarised in Table 5-1. The consequences of each of the identified hazards were assessed to determine if such consequences may impact off-site adjacent facilities or sensitive receptors

Table 5-1 Potential Significant Hazards

No.	Source	Hazard
1.	Lithium-ion Battery	Arcing or short-circuit
2.	Lithium-ion Battery	Battery cell fire hazard
3.	Lithium-ion Battery	Battery cell thermal hazard
4.	Lithium-ion battery	Battery cell equipment failure
5.	Lithium-ion battery	Battery cell operational hazard
6.	Lithium-ion Battery	Battery cell chemical hazard
7.	Lithium-ion Battery	Explosion hazard
8.	Lithium-ion battery	Release and dispersion of flammable and toxic gases
9.	Lithium-ion battery	Exposure to Electromagnetic Field
10.	Lithium-ion Battery	Dropping of battery cell(s) during installation
11.	Lithium-ion Battery	Malicious damage to BESS
12.	Transformer	Transformer arcing / fire / explosion
13.	Transformer	Loss of containment (oil)
14.	Transformer	Live contact with transformer
15.	Adjacent substation	Electrical and/or fire hazards at substation
16.	Adjacent HV BESS site	Battery fire
17.	Switchgear	Loss of containment (sulphur hexafluoride [SF <sub>6</sub> ]).
18.	Switchgear	Outdoor switchgear failure (Arc Flash)
19.	Switchgear	Outdoor switchgear failure (Equipment failure)
20.	Natural Hazard	Grass or scrub fire Stray ember induced fire
21.	Natural Hazard	Extreme temperature/humidity
22.	Natural Hazard	Seismic events
23.	Natural Hazard	Flooding
24.	Natural Hazard	Extreme wind
25.	Natural hazard	Ambient weather (lightning)
26.	Natural Hazard	Subsidence
27.	Other	Loss of containment (contaminated water)

No.	Source	Hazard
28.	Other	Exposure to contaminated land
29.	Other	Vehicle collision / congestion
30.	Other	Loss of containment (waste / fuel)
31.	Other	Loss of containment (e.g. refrigerant)
32.	Other	Exposure to high voltages

## 5.2 Risk Analysis

In this study, risk is defined as the likelihood of a specified undesired event occurring within a specified period or in specified circumstances. It may be either a frequency (the number of specified events occurring in a unit of time) or a probability (the probability of a specified event following a prior event), depending on the circumstances.

The matrices set out in Table 5-2, Table 5-3, and Table 5-4 are part of Aurecon's management framework and were used to complete a qualitative risk assessment of the identified hazards. Consistent with standard risk assessment methodology, the risk rating for a given hazard is a product of the likelihood and consequence of its occurrence.

As such, the potential consequence for each identified hazard carried forward due to posing significant off-site risk was first assessed (Table 5-2), followed by an assessment of their estimated likelihood of occurrence (Table 5-3). Finally, the overall current risk rating was then calculated by using likelihood and consequence as inputs (Table 5-4).

Table 5-2: Hazard Consequence Assessment Matrix

Consequence	People	Property	Environment	Community
<b>A – Catastrophic</b>	Single or multiple fatality	Virtual complete loss of plant, system and / or neighbouring property	Permanent / irreversible widespread ecological damage not able to be remediated	Outrage by a sizeable community or many communities. Riots.
<b>B – Major</b>	Disabling injury or illness i.e., amputation and/or permanent loss of bodily function, or any kind of permanent health impact	Extensive damage to plant, system and / or neighbouring property	Extensive ecological damage, lengthy remediation process	Community/NGO legal actions. Pickets, demonstrations.
<b>C – Moderate</b>	Any Lost Time Incident (LTI), i.e., an illness or injury resulting in one or more consecutive days or shifts off work	Significant damage to plant, system and / or neighbouring property	Substantial ecological damage but able to be remediated	Persistent formal community complaints. Formal complaints to politicians or comparable representatives.
<b>D – Minor</b>	A medical treatment case (MTC) / or restricted work case (RWC)	Moderate damage to plant, system and / or neighbouring property	Localised ecological damage, easily remediated	Formal complaints from local Community.
<b>E – Incidental</b>	First Aid case, or an injury or illness not requiring treatment	Minor damage to plant, system and / or neighbouring property	Negligible ecological damage, may not require remediation	No Informal community complaints &/or negative comments / views.

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**Table 5-3: Hazard Likelihood Assessment Matrix**

Likelihood	Descriptor	Likelihood	Industry Incidences
<b>5 – Almost Certain</b>	The threat is expected to be realised.	90% < Likelihood ≤ 100%	Common incident
<b>4 – Likely</b>	The threat is likely to be realised.	5% < Likelihood ≤ 90%	Several incidents nationally
<b>3 – Possible</b>	The threat may be realised.	1% < Likelihood ≤ 5%	One or a few incidents nationally
<b>2 – Unlikely</b>	The threat is not expected to be realised.	0.1% < Likelihood ≤ 1%	No known national incidents. One or a few incidents in comparable international operating regimes.
<b>1 – Rare</b>	The threat may be realised in reasonably foreseeable but exceptional circumstances.	0% < Likelihood ≤ 0.1%	No known incidents in comparable international operating regimes.

**Table 5-4: Risk Rating Matrix**

		Likelihood				
		1 – Rare	2 – Unlikely	3 – Possible	4 – Likely	5 – Almost Certain
Consequence	A - Catastrophic	High	Critical	Critical	Critical	Critical
	B – Major	High	High	Critical	Critical	Critical
	C – Moderate	Medium	Medium	High	High	Critical
	D – Minor	Low	Low	Medium	High	High
	E – Incidental	Low	Low	Low	Medium	Medium

The risk rating presented in the table above is a conservative iteration of the risk rating matrix presented in AS/NZS 5139:2019 – *Electrical Installations – Safety of battery systems for use with power conversion equipment*.

### 5.3 Risk Register

The identified hazards, events, applicable infrastructure and the relationships with causes, consequences and controls are summarised in the risk register as a preliminary Risk Management Plan (refer to Appendix B).

The risk assessment has shown that, whilst there is potential for major consequences, implementing risk controls will make these consequences unlikely, particularly for any hazards with off-site effects. The recommended technical and management safeguards set out in Section 6 are intended to reduce the residual risk so that no identified hazards pose a significant risk.

### 5.4 Other risk factors considered

A review of other risk factors was also carried out to identify any hazards. This included the assessment of natural hazards.

The natural hazards relevant to the facility have been included in the Appendix B. These include extreme ambient temperatures, bushfires, seismic activity, flooding, wind, subsidence, and lightning.

Natural hazards have the potential to cause a loss of control (e.g. flooding resulting in control malfunctions) or containment (e.g. seismic activity can damage storage tanks). These hazards will be mitigated by ensuring the design meets the requirements of recognised standards.

It was noted that the project would not involve:

- Storage or transport of incompatible materials (i.e., hazardous and non-hazardous). Hazardous materials will be stored in dedicated areas and storage protocols in accordance with standard and guidelines will be followed.
- Generation of hazardous waste.
- Possible generation of dusts within confined areas.
- Type of activities involving hazardous materials with the potential to cause significant off-site impacts (i.e. multiple fatalities outside the site boundary).
- Incompatible, reactive, or unstable materials and process conditions that could lead to uncontrolled reaction or decomposition.
- Storage or processing operations involving high (or extremely low) temperature and/or pressures.
- Hazardous materials and processes with known past incidents (or near misses) that resulted in significant off-site impacts at BESS facilities.

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## 6 Task 3: BESS Recommendations

There are several Australian and international standards which govern the best practice design and installation of the facility. The following recommended technical safeguards are expected to reduce the residual risk such that no identified hazards pose a significant risk.

### 6.1 General Recommendations

General recommendations for risk reduction due to dangerous goods on site include:

- A licence issued to the occupier of the site by the Environment Protection Authority under Section 44 of the *Environment Protection Act 2017*, is required for significant modifications of the facility and should be obtained.
- A licence issued to the occupier of the site by WorkSafe Victoria under the *Dangerous Goods Act 1985*, is required for manifest quantities.
- A Risk Management Plan must be developed for the facility in consultation with CFA prior to development commencing.
- An Emergency Plan should be prepared for the site and provided to CFA as per the requirements of Regulation 53 of the *Dangerous Goods (Storage and Handling) Regulations 2022* [7].
- Under Clause 53.10-1 of the Victoria Planning Provisions [2], an application for a BESS (classified as Utility installation under the Planning Scheme) must be referred to the Environment Protection Authority (EPA) as there is no specific land use threshold distance provided in the planning scheme. This referral, required under Section 55 of Planning and Environment Act 1987 [4], ensures that the EPA reviews the potential environmental impacts of the proposed use and provides recommendations or conditions for mitigating any adverse effects.
- Buildings should be designed to relevant applicable codes for the range of natural hazards listed in Appendix B. Appendix B: Risk

### 6.2 BESS (Lithium-ion battery) Recommendations

#### 6.2.1 General BESS system design

Given that fire and thermal runaway are the primary hazards associated with these systems, managing operating temperature is the primary consideration in the design and installation of lithium-ion battery systems. Recommendations below contribute to this objective for the protection of both on-site and off-site assets, access, and design of safeguarding:

- BESS and auxiliary infrastructure should be surrounded by fencing, locked gates and other security measures as necessary and compliant with relevant standards (also including access control to HV areas).
- The BESS and auxiliary infrastructure should be designed to incorporate redundant safety and protective systems wherever necessary, such that no single point of failure will result in a significant hazard event.
- The BESS should be designed to operate between temperature extremes, with allowance for higher maximum temperatures of approximately 1.5 to 2° C to account for the likely effects of global warming.
- BESS site and infrastructure design should consider wind action and lightning protection.
- Facility design should incorporate arc flash hazard controls.
- For lithium-ion batteries specifically, the following recommendations are proposed:
  - BESS is to be designed, manufactured and installed to Australian or prevailing international standards and in particular:

- IEC 62485-5: Safety requirements for secondary batteries and battery installations – Part 5: Safe operation of stationary lithium-ion batteries.
- IEC 62933 Electrical energy storage (EES) systems, Part 5-1: Safety considerations for grid-integrated EES systems – General specification
- IEC 62933 Electrical energy storage (EES) systems, Part 5-2: Safety requirements for grid-integrated EES systems – Electrochemical-based systems.
- AS/NZS 5139: Electrical installations – Safety of battery systems for use with power conversion equipment.
- AS 4681: The Storage and Handling of Class 9 (miscellaneous) Dangerous Goods and Articles.
- Electronic safety-related systems should be installed at both a hardware and software level, designed to applicable standards, to allow for safe isolation of electrical energy in the event of a failure.
- The design of the BESS units should include a detection and prevention system for overtemperature, cell overpressure, coolant leaks, and other potential issues.
- BESS site is to be equipped with a fire, smoke and flammable gas leak monitoring system.
- BESS units will be installed outdoors. Appropriate ingress protection is required for the battery enclosures.
- Appropriate HVAC/cooling systems should be designed and installed to keep the lithium-ion BESS within a safe operating temperature range.

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### 6.2.2 Lithium-ion Batteries

The primary reference standards are *IEC 62619 Safety Requirements for Secondary Lithium Cells and Batteries, for use In Industrial Applications* and *IEC 62485-5: Safety requirements for secondary batteries and battery installations – Part 5: Safe operation of stationary lithium-ion batteries* [26].

These standards outline safety and protection measures for lithium-ion batteries, addressing the major hazards identified in this assessment. They provide requirements for the installation, operation, maintenance, and end-of-life management of lithium-ion batteries in BESS. Contractors and suppliers must adhere to these standards for the installation, operation, maintenance, and disposal of BESS components.

Further requirements to be followed are outlined in the CFA Design Guidelines and Model Requirements for Renewable Energy Facilities [6] to mitigate the thermal and fire hazards associated with BESS facilities.

- Design of the Lithium-Ion BESS should consist of modular, insulated battery cells and the container should be kept free of extraneous and combustible materials to mitigate the risk of fire or thermal overload spreading to multiple battery cells. These units need to account for adequate separation to prevent fire propagation considering the findings from the 2021 Victorian Big Battery fire incident where fire propagation to the roof of the adjacent BESS sub-unit occurred.
- Wiring must be closed, and cables for battery energy storage systems must be buried, except where required to be above-ground for grid connection.
- Appropriate cooling systems should be designed and installed to keep the Lithium-Ion BESS within a safe operating temperature range to prevent the potential release of toxic or combustible gases.
- A fire protection system should be designed and installed to mitigate the consequences of a fire or thermal runaway hazard event. A Lithium-Ion battery fire presents multiple hazards including fire damage to buildings and personnel, gas release, chemical damage and reactions, and hazardous material contamination.
- Containers/infrastructure for BESS must be clear of vegetation, including grass, for at least ten (10) metres on all sides. CFA requires non-combustible mulch such as crushed rock or mineral earth within this 10 m area.
- Containers/infrastructure for BESS must be located so as to be directly accessible to emergency responders through provision of a suitable access road. The Project's access road requirements shall be assessed during detailed design through appropriate consultation.

- Where appropriate, containers and infrastructure for BESS must be provided with appropriate spill containment (bundling or otherwise) that includes provision for management of firewater runoff.

### 6.2.3 Separation Distances

Additional safeguarding includes designing to Australian Standards and industry best practice to minimise the risk of fire through inherently safe design such as on-site separation of BESS units (i.e., obtaining vendor test results of the battery enclosures for fire propagation is recommended).

Recommendations for separation distances are as follows:

- Safe separation distances and limited access to the existing substation and switchyard should be maintained for construction, installation, and commissioning works.
- The design of BESS and auxiliary infrastructure should consider:
  - Surface Water and Groundwater Assessment to determine special flood considerations
  - Provision for water retention facility
- The layout should be developed to accommodate the anticipated number of BESS enclosures and the necessary separation distances to mitigate the spread of fires. The BESS installation will also adhere to fire and safety codes and standards such as NFPA 855, UL 9540, and UL 9540A.
- The separation of the buildings, including switch rooms, control room and workshop shall be in accordance with AS 2067:2016: *Substations and high voltage installations exceeding 1 kV a.c.* and the National Construction Code. Additional discussion on the separation from the transformers is noted within Section 7.3 of this report.
- Lithium-ion batteries are considered DGs while in storage and not connected to the grid. *AS/NZS 4681 The Storage and Handling of Class 9 (miscellaneous) Dangerous Goods and Articles* outlines requirements for Class 9 DGs (i.e., lithium-ion batteries and battery enclosures) which should be followed while battery enclosures are on-site and not connected to the grid. Additionally, contract specifications should, therefore, require that batteries intended on being operational and connected as soon as practicable following delivery.

As the final dimensions of the enclosures and associated clearances may vary depending on the selected supplier and product type and the final detailed design, the supplier appointed will be required to finalise the detailed design in accordance with the above design considerations for the appropriate management and minimisation of fire risk. The battery enclosure supplier will advise the safe separation demonstrated by tests within battery enclosures to prevent fire propagation should an incident occur involving the battery cells. These separation distances should also align with CFA separation requirements, including:

- Ensuring separation distances account for radiant heat flux (output) as an ignition source between adjacent battery containers/enclosures and between BESS and other related battery infrastructure, buildings, the site boundary, and vegetation.
- A fire break around the BESS and related infrastructure, of a width of no less than 10 m or greater where determined in the Risk Management Plan.

## 6.3 Transformer and Switchgear Recommendations

AS 2067:2016: *Substations and high voltage installations exceeding 1 kV a.c.* outlines the risks and safety measures for primary hazards presented by transformer which includes live contact, arc flashing, and fire and explosions.

The BESS (including transformers) should be designed in line with, and comply with, this standard. All transformers should have separation distances away from other transformers, control rooms and office complexes that meet or exceed the required distances in the standard. Details of the requirements for this standard are listed below:

- Protection against live contact of a transformer is generally achieved with the following mitigation measures:

- protection by enclosure
- protection by barrier
- protection by obstacle
- protection by placing out of reach.
- Protection against arc faults between transformers and other equipment or people is generally achieved with the following mitigation measures:
  - Protection against operating error through:
    - load break switches
    - short-circuit rated fault-making switches
    - interlocking device
    - non-interchangeable key locks.
  - Operating aisles as short, high, and wide as possible
  - Solid covers as an enclosure or protective barrier
  - Equipment tested to withstand internal arc fault
  - Arc protection to be directed away from operating personnel and vented outside the building if necessary
  - Use of current limiting devices
  - Very short tripping time; achievable by instantaneous relays or by devices sensitive to pressure, light or heat
  - Operating of the plant from a safe distance
  - Prevention of re-energisation by use of manually resettable devices which detect internal equipment faults, and which incorporate pressure relief and provide external indication.
- To mitigate the risks associated with transformer fire, the following steps should be followed:
  - Minimise the risk of a fire starting:
    - The transformer specification should consider insulation levels, operating temperatures, cooling systems, protection systems, operation (including the effect of prolonged overloading) and maintenance practices.
  - Minimise the risk of transformer failure developing into an oil fire:
    - Consideration should be given to insulating liquid type, tank strength, low explosion risk bushings, and pressure relief.
  - Minimise the impact of a transformer fire on the environment, other assets, and humans.
- If a transformer failure has developed into a transformer fire, the following control measures should be in place to minimise the damage resulting from the fire.
  - Minimise risk of loss of life and injury to humans by:
    - providing adequate clearance around transformers, particularly those with sound enclosures
    - providing adequate access for firefighting equipment
    - providing adequate egress routes.
- Minimise the risk of the fire spreading or causing damage to adjacent transformers, control building, structures and other items of plant and equipment. Fire damage can be minimised by:
  - providing passive protection systems in the form of adequate separation distances, fire barriers, construction buildings of fire resisting materials

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- providing active suppression systems such as deluge, water mist, or gas flooding.
- Minimise contamination and damage to the environment by provision of oil containment systems and bunding.

Additionally, to eliminate the risk of a transformer oil fire, the use of a dry-type transformer is recommended.

## 6.4 Natural Hazards Recommendations

It is expected that no natural hazards will impact the BESS and therefore pose a significant off-site risk following appropriate controls being implemented.

Table 6-1: Natural hazards description and recommendations

Hazard	Description
Bushfires	The Project is located within a bushfire prone area. Refer to Section 7 for further information and recommendations.
Extreme temperatures	The temperature data in Yarragon (as recorded at Morwell Latrobe Valley Airport weather station: 085280) from 1995 – 2024 were as follows: annual maxima and minima were 46.3°C in February 2009 and -4.8°C in July 2017, respectively .  The BESS should be designed to operate beyond these temperature extremes, with allowance for higher maximum temperatures of approximately 1.5 to 2°C to account for the likely effects of global warming.
Seismic activity	According to the National Seismic Hazard Assessment 2018, there is a 10% chance that the peak ground acceleration of 0.06-0.08m/s <sup>2</sup> (moderate shaking and very light damage) will be exceeded at least once in a 50-year period. Therefore, the risk of seismic activity is assumed to be minimal.
Flooding	The BESS and auxiliary infrastructure should be located outside the extent of the 1% AEP flood event or designed to be above the 1% AEP flood level.
Excessive wind	Yarragon is located within the A5 Wind Region as per Figure 3.1 of AS/NZS 1170.2:2021 . The BESS should be designed in accordance with AS/NZS 1170.2:2021: Structural design actions – Part 2: Wind actions.
Lightning	The average annual ground lightning flash density in Yarragon VIC is around 0.5-1 km <sup>2</sup> yr <sup>-1</sup> . Notwithstanding, a lightning study for the proposed site should be conducted with the lightning mitigation measures implemented in the design.
Subsidence	The North Yarragon BESS is not located within any mining subsidence areas.

## 6.5 Safety Management System Recommendations

The following recommendations relate to Safety Management Systems which should be implemented to ensure safe operations of the Project.

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### 6.5.1 Construction Phase Recommendations

The construction contractor is to prepare an adequate safety management system and documentation for the Project construction phase (e.g., various management plans, emergency plans, traffic management plans, procedure for removal of contaminated land and remediation as required).

The BESS should be tested to ensure safe function under the guidance of IEC 62619: *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium cells and batteries, for use in industrial applications.*

Further recommendations include:

- Waste management plans for construction and operation of the Project are to be developed.

- Provisions are to be in place for identification and removal of any contaminated land during construction.
- Housekeeping procedures are to be developed for construction and operation.

### 6.5.2 Commissioning Phase Recommendations

The following recommendations should be implemented prior to the commencement of commissioning of the Project:

- Site Acceptance Testing (SAT) conducted at the site to confirm the BESS can be integrated and operated within the infrastructure
- Emergency Response Plan to be prepared as per the CFA guidelines prior to commissioning:
  - Safe operating conditions for temperature
  - Details of the electrical safety hazards
  - Details of the effects of fire on the battery energy storage system
  - The shut-down procedures if the batteries are involved in fire
  - A plan for partial and full decommissioning of the BESS in the event of an emergency incident that renders the facility inoperable or unsafe, prior to its anticipated end-of-life
  - A Fire Management Plan to minimise fire risks
  - An Emergency Information Book within the Emergency Information (Manifest) Container; including the following:
    - The safe operating conditions (e.g. temperature) of the BESS
    - The details of any emissions or toxic gases, including during a fire,
    - All dangerous goods stored on-site must have a current Safety Data Sheet (SDS).
    - Other manifest requirements as listed in the *Dangerous Goods (Storage and Handling) Regulations 2022* [7]

An audit system should also be developed to ensure regular review and update of the emergency response plan.

### 6.5.3 Operations Phase Recommendations

The following safety management plans should specifically address the BESS and be in place prior to commencement of the Project's operation:

- Work Health and Safety Management Plan, compliant with AS 5577: 2013 Electricity network safety management systems.
- Asset Management Plans and assurance activities (e.g. audits, monitoring and control testing). A comprehensive and regular program of maintenance and inspections, covering the BESS and related infrastructure (i.e., transformers, HVAC, civil structures) to ensure the system is serviced and maintained as per the manufacturer's requirements, including measures to vet contractor appointments to ensure batteries are designed and installed to appropriate standards.
- Development and implementation of plant operating and maintenance procedures.
- Pest control/management is to be implemented.
- Adequate safeguards are to be implemented for hazards related to working in proximity to a HV substation.

An audit system should also be developed to ensure regular review and update of the safety management plans.

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## 6.6 Applicable Standards

The standards and codes applicable to the identified hazards to be applied to the design of the Project are listed below:

- *AS 1530.4 Methods for fire tests on building materials, components, and structures, Part 4: Fire-resistance tests for elements of construction.*
- *AS 1554.1 Structural steel welding, Part 1: Welding of steel structures*
- *AS 1603 Automatic fire detection and alarm systems*
- *AS 1670 Fire detection, warning, control and intercom systems*
- *AS 1725.1 Chain link fabric fencing, Part 1: Security fences and gates – General requirements*
- *AS 1768 Lightning protection*
- *AS 1940 The storage and handling of flammable and combustible liquids*
- *AS 2067 Substations and high voltage installations exceeding 1 kV a.c.*
- *AS 2374.1 Power transformers Part 1: General*
- *AS 3000 Electrical installations (known as the Australian / New Zealand Wiring Rules)*
- *AS 3008 Electrical installations – Selection of cables*
- *AS 3011.2 Electrical installations - Secondary batteries installed in buildings, Part 2: Sealed cells*
- *AS 3786 Smoke alarms using scattered light, transmitted light or ionization*
- *AS 4086.1 Secondary batteries for use with stand-alone power systems, Part 1: General requirements (where applicable)*
- *AS 4417 Regulatory compliance mark for electrical and electronic equipment*
- *AS 4428 Fire detection, warning, control and intercom systems - Control and indicating equipment*
- *AS 4681 The Storage and Handling of Class 9 (miscellaneous) dangerous goods and articles*
- *AS 5139 Electrical Installations – Safety of battery systems for use with power conversion equipment*
- *AS / IEC 60076 Power Transformers*
- *AS 60529 Degrees of protection provided by enclosures (IP Code)*
- *AS 61439 (Series)- Low-voltage switchgear and control gear assemblies*
- *AS 61558.1 Safety of Power Transformers, Power Supplies, Reactors and Similar Products, Part 1: General requirements and tests*
- *AS / IEC 62271-200 High-voltage switchgear and controlgear, Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*
- *IEC 63056 Safety requirements for secondary lithium cells and batteries for use in electrical energy storage systems*
- *NFPA (Fire) 855 Standard for the Installation of Stationary Energy Storage Systems*
- *UL 1642 Lithium Batteries*
- *UL 1741 Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources*
- *UL 9540 Energy Storage Systems and Equipment*
- *UL 9540A ANSI/CAN/UL Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems.*
- *NFPA (Fire) 70 National Electrical Code*

# 7 Bushfire Hazard Assessment

## 7.1 Assessment of the planning scheme requirements

The following sections provide a tailored response to requirements set out in Section 2.2.2 of the CFA guidelines and Clause 13.02 of the Victoria Planning Provisions based on the Project description in Section 2.1.

### 7.1.1 Victoria Planning Provisions

Clause 13.02-1S (Bushfire planning) outlines the State’s objectives in managing bushfire risk to life and property through appropriate hazard identification and strategic planning. Clause 13.02 (Bushfire) includes strategies for bushfire hazard identification and applies to all development in a designated Bushfire Prone Area (BPA), Bushfire Management Overlay (BMO) or any development that may create a bushfire hazard. The CFA Guidelines also require appropriate consideration of Clause 13.02-1S. Table 7-1 below and subsequent sections provide responses to each of the strategies within Clause 13.02-1S.

**Table 7-1: Addressing information requirements within Clause 13.02-1S of the Victoria Planning Provisions (VPP) in relation to bushfire hazard identification**

Bushfire hazard identification and assessment strategies	Response
Applying the best available science to identify vegetation, topographic and climatic conditions that create a bushfire hazard.	A site visit was conducted on 18 January 2024 as part of the ecological site assessment and vegetation was assessed in accordance with AS 3959:2018.
Considering the best available information about bushfire hazard including the map of designated BPA prepared under the <i>Building Act 1993</i> or regulations made under that Act.	Mapping confirms that the Project Area is <u>within</u> a BPA (Figure 5) and fire history maps have been sourced from DEECA.
Applying the BMO to areas where the extent of vegetation can create an extreme bushfire hazard.	Mapping confirms that the south-western corner of the Project Area is <u>within</u> the BMO (Figure 5).
Considering and assessing the bushfire hazard on the basis of: <ul style="list-style-type: none"> <li>■ Landscape conditions - meaning conditions in the landscape within 20 kilometres (and potentially up to 75 kilometres) of a site;</li> <li>■ Local conditions - meaning conditions in the area within approximately 1 kilometre of a site;</li> <li>■ Neighbourhood conditions - meaning conditions in the area within 400 metres of a site; and</li> <li>■ The site for the development.</li> </ul>	A description of the Project Area and the surrounding landscapes are provided below. <ul style="list-style-type: none"> <li>■ Landscape conditions (refer to the Sections directly below this table)</li> <li>■ Local conditions (refer to Sections directly below this table)</li> <li>■ Neighbourhood conditions (refer to Section 6.1.1.2)</li> <li>■ The site for development (refer to Section 8.1.2 and 8.1.3)</li> </ul> <p><b>Note:</b> CFA requirements on landscape and site bushfire hazard assessment have been used in providing a response to these conditions.</p>

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Bushfire hazard identification and assessment strategies	Response
<p>Consulting with emergency management agencies and the relevant fire authority early in the process to receive their recommendations and implement appropriate bushfire protection measures.</p> <p style="text-align: center;"><b>ADVERTISED PLAN</b></p>	<p>This assessment provides the basis for initial consultation with CFA. This plan will be provided to CFA prior to initial consultation. Ongoing consultation will then occur with CFA during the planning application and in developing documentation prior to commissioning of the facility. The Project team have met with the CFA team relevant to the planning permit application proposal (17 April 2025). Attendees were Matt Allen (State Infrastructure and Dangerous Goods Unit Leader at CFA) and Jennifer Blyth (Senior Specialist Risk Advisor).</p>
<p>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.</p>	<p>This assessment identifies the bushfire risks within the Project Area and surrounding landscape and includes bushfire protection measures that should be employed in the site layout and design (Appendix A: Gap Analysis against CFA Guidelines).</p>
<p>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.</p>	<p>The Project Area is considered to have a low bushfire risk and contains suitable access and egress options (refer to Section 8.1.2).</p> <p>The facility can also incorporate fire protection measures through design, construction, and operation (Appendix A: Gap Analysis against CFA Guidelines).</p>

## Landscape condition and bushfire hazards

The broader landscape surrounding the Project Area comprises cleared farmland with paddocks that are occasionally separated by planted tree lines. There are some forested areas present, mainly along the riparian corridors and where patches of remnant vegetation has been retained in the mostly cleared landscape. The Project Area is considered to exhibit mostly low-risk environmental attributes as per the CFA Guidelines, including:

- Primarily grassland
- The surrounding landscape is generally flat with some undulation
- The majority of the site is covered in sown pasture paddocks used for grazing by livestock interspersed with small, isolated patches and strips of vegetation
- No Land Subject to Inundation Overlay (LSIO) applies.

However, it is noted that there are some environmental attributes that indicate risk of bushfire affecting the Project Area, including:

- Continuous vegetation along the riparian corridors within 1-10 km surrounding the Project Area
- To the east of the proposed BESS site are steeper gradients with slopes of 5-10 degrees
- A BMO associated with a patch of vegetation along the waterways to the south affects the south-western corner of the Project Area.

The nearby township of Yarragon (located approximately 6 km south of the site) is considered to have a low-risk under the Municipal Fire Management Plan (Baw Baw Shire Council 2021) and the Gippsland Bushfire Management Strategy 2020 (DELWP 2020).

No recent bushfires have occurred within the immediate landscape surrounding the Project Area (Figure 5) since 1970 (DEECA 2023). The closest and most recent bushfire occurred in a similar landscape approximately 7km to the north-east in 2014, which was a small fire contained to a few properties. All historic substantial fires occurred >10 km from the site within areas containing significant patches of vegetation (state and regional parks and conservation reserves), and many of these records are from the 2009-2010 Black Saturday bushfires, which was considered one of Australia's worst bushfire disasters, and burnt a

significant portion of the state. The landowner of the site reported that ember attacks occurred in the area during the Black Saturday bushfires. A number of planned burns have also occurred in the West Gippsland area for fire prevention purposes, the closest of which is approximately 9 km to the north in Sweetwater Creek Nature Conservation Reserve.

Based on the condition of the landscape and limited patches of vegetation, extreme bushfire behaviour is considered unlikely. However, there is potential risk from spot fires in the event of bushfires from the north and increased risk from patches of woodland/forest along riparian areas. The broader landscape type is Type One [15] and the closest known core area of vegetation (not grassland or low threat vegetation) is the Sweetwater Creek Nature Conservation Reserve, approximately 9 km to the north. There are minimal large patches of forest in the surrounding area, with grassed paddocks the predominant vegetation in the region. The site also has ready access and egress to safe areas around Yarragon that would provide safety in the event of a fire.

The primary landscape bushfire risk to the Project Area is from grassfire due to the minimal amount of treed or scrub vegetation in the landscape which has been cleared for farming. Particularly from the prevailing bushfire directions of the north-west and south-west [15], there is some treed or scrub vegetation which may cause a spot fire risk, but this is not considered to pose a significant fire risk. Grasslands occur immediately around the Project Area in all directions. Overall, there are only minor bushfire hazards present in the surrounding landscape.

A landscape bushfire hazard assessment in accordance with CFA guidelines has been developed and is provided below in Figure 6.

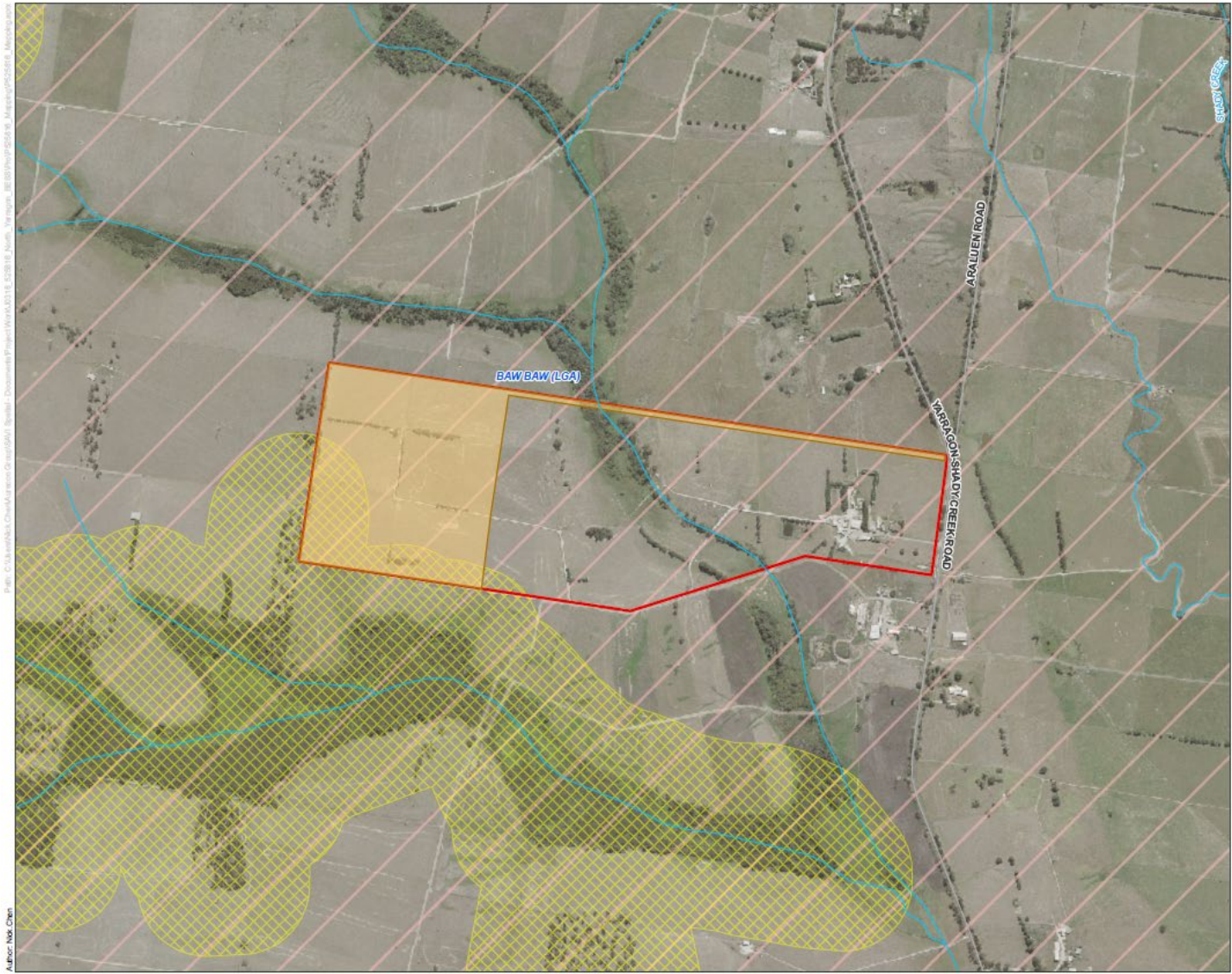
### **Local and neighbourhood conditions bushfire hazards**

The local and neighbourhood conditions surrounding the Project Area are similar and therefore can be considered by one assessment. The Project Area is bordered in all directions by farmland with scattered dwellings and outbuildings. One major road, Yarragon-Shady Creek Road, occurs along the eastern boundary. Approximately 6 km to the south is the small township of Yarragon, with the major towns of Warragul and Trafalgar occurring approximately 10 km to the west and 9 km to the south-east, respectively. There are scattered patches of remnant riparian vegetation along creeklines and unnamed tributaries within surrounding farmland, as well as rows of planted windbreaks. However, these are dispersed and mostly disconnected so present a reduced bushfire hazard.

Overall, the surrounding local and neighbourhood conditions are considered a low bushfire risk and extreme bushfire behaviour is considered unlikely, although there is potential for grassfires to occur from human-induced factors or spot-fires from forested areas to the north.

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- Legend**
- Road
  - Watercourse
  - Project area
  - Property boundary
  - Local government area
  - BMO - Bushfire Management Overlay
  - Bushfire Prone Area (BPA)

**Notes:**

**Basemap:** Vicmap, Esri, TomTom, Garmin, FAD, NOAA, USGS, Esri Community Maps Contributors, Vicmap, © OpenStreetMap, Microsoft, Esri, TomTom, Garmin, METI, NASA, USGS

**Other data:** DEECA, Aurecon

Date: 6/05/2025      Version: 2

**North Yarragon BESS**

**Figure 5: Locations of BMO and BPA**

**Figure 5. Locations of BMO and BPA**

# ADVERTISED PLAN

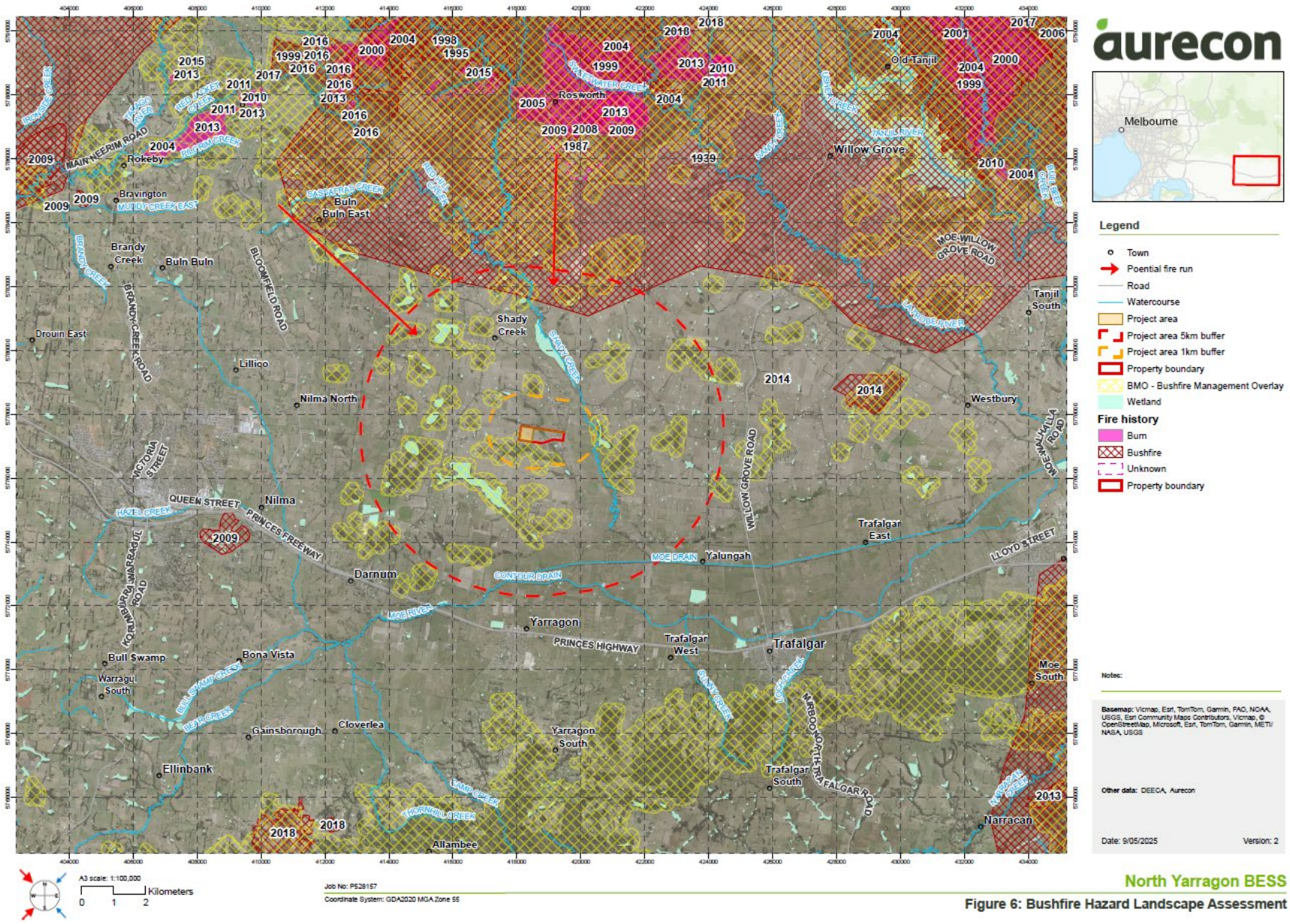


Figure 6: Site bushfire hazard assessment

## 7.1.2 Site for development

### Site description

The Study Area is used for livestock grazing and therefore the majority of the Study Area is highly disturbed and modified agricultural land (Photo 1). The majority of this land is grazed by cattle so is kept to a minimal fuel level. A tributary of Shady Creek runs through the north-east of the Study Area (Photo 2), which is flanked by riparian vegetation comprising of smooth-bark gums and a moderately-dense understorey of shrubs and grasses (Photo 3). Rows of planted trees as well as scattered remnant trees are spread throughout the Study Area.

Adjacent to the riparian woodland vegetation along the unnamed tributary of Shady Creek there were patches of wet heathland vegetation within the waterlogged soil mainly comprising of scattered rushes and sedge species up to 1 m high (Photo 4). Closed scrub vegetation occurred around the heathland with >30% foliage cover and shrubs up to 5 m high (Photo 5). The western side of the Study Area comprised predominantly of pasture grasses and planted vegetation used as windbreaks between paddocks (Photo 6). A transmission line also runs through the paddocks east to west in the north-western corner of the Project Boundary (Photo 7). The majority of the Study Area is generally flat with some minor undulation, however, the section just east of the proposed BESS site occurs on a slope of 5-10 degrees (Photo 8).

More detailed vegetation descriptions in accordance with the *AS 3959:2018* vegetation classifications can be found in Section 7.1.3.

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Photo 1. Agricultural land throughout the Study Area



Photo 2. Unnamed tributary



Photo 3. Riparian vegetation

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Photo 4. Wet heathland vegetation



Photo 5. Closed scrub vegetation



Photo 6. Planted tree rows as windbreaks



Photo 7. Transmission lines

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Photo 8. Slight slope east of the BESS site

## Existing access

The Project Area is accessible from one road, Yarragon-Shady Creek Road. Yarragon-Shady Creek Road is a two-lane bitumen road that runs north-south along the eastern boundary. The road is accessible from the south from the Princes Highway and the north from Old Sale Road.

Two access points are proposed off of Yarragon-Shady Creek Road. The main access point will be in the top north-eastern corner of the Property Boundary, and the alternate fire access point will be from the existing access to the property, approximately 180 m south of the main access point. Having access points only on the eastern side of the site is considered a restriction, however, these points have been located as far apart as practicable.

### 7.1.3 Site bushfire assessment

Using *AS3959:2018*, classified vegetation within and adjacent to the Project Area comprises grassland, woodland, forest and scrub. Grassland (Figure 7) includes the unmanaged pasture grasses surrounding the BESS site and within the adjacent properties (see Photo 1 in Section 7.1.2). These areas are classified as sown pasture. All grassland within the BESS site will be managed in a minimal fuel condition and has therefore been excluded from the BAL assessment.

Woodland (Figure 8) includes the three patches of remnant trees and sections of two planted tree rows that intersect these remnant trees, to the west of the BESS site (Photos 9 & 10). The two planted tree rows were included in the remnant tree woodland patches as they occur within 20 m of classified vegetation (the remnant woodlands) and therefore, cannot be excluded under Clause 2.2.3.2 (f). Due to the mature age of the vegetation, it can be classified as woodland (Category 05 as per *AS3959:2018*). Due to the current poor soils and surrounding land use, vegetation is unlikely to reach forest canopy densities and heights.

The remaining section of the northern planted tree row adjacent to woodland Plot 2 forms part of the unmanaged grassland patch, as it occurs outside of the property boundary and therefore cannot be removed or managed. It does not continue as a woodland patch because it is a planted windbreak <20 m in width, so

doesn't fit the woodland classification. All planted tree rows within the BESS site are proposed to be removed.



Photo 9. Woodland patch 1



Photo 10. Woodland patch 2

Forest (Figure 9) includes the patch of riparian vegetation that occurs adjacent to the unnamed tributary of Shady Creek, which runs along the northern boundary of the property and through the centre of the Study Area (Photos 11 & 12). The vegetation in this patch conforms to the Ecological Vegetation Class (EVC) Swampy Riparian Woodland, which matches the description of open forest (Category 03 as per AS3959:2018), comprising of trees to 30 m high and 30-70% foliage cover typically dominated by Eucalypts, Melaleuca or Callistemon.



Photo 11. Forest patch image 1



Photo 12. Forest patch image 2 (background)

Scrub (Figure 10) includes the patch of vegetation adjacent to the western side of the forest patch that occurs through the centre of the Study Area (Photos 13 & 14). The vegetation within this patch conforms to the EVC Swamp Scrub, which matches the description of closed scrub (13), comprising >30% foliage cover

with shrubs >2 m high, and may be dominated by *Banksia*, *Melaleuca* or *Leptospermum* with heights up to 6 m.



Photo 13. Scrub patch image 1



Photo 14. Scrub patch image 2

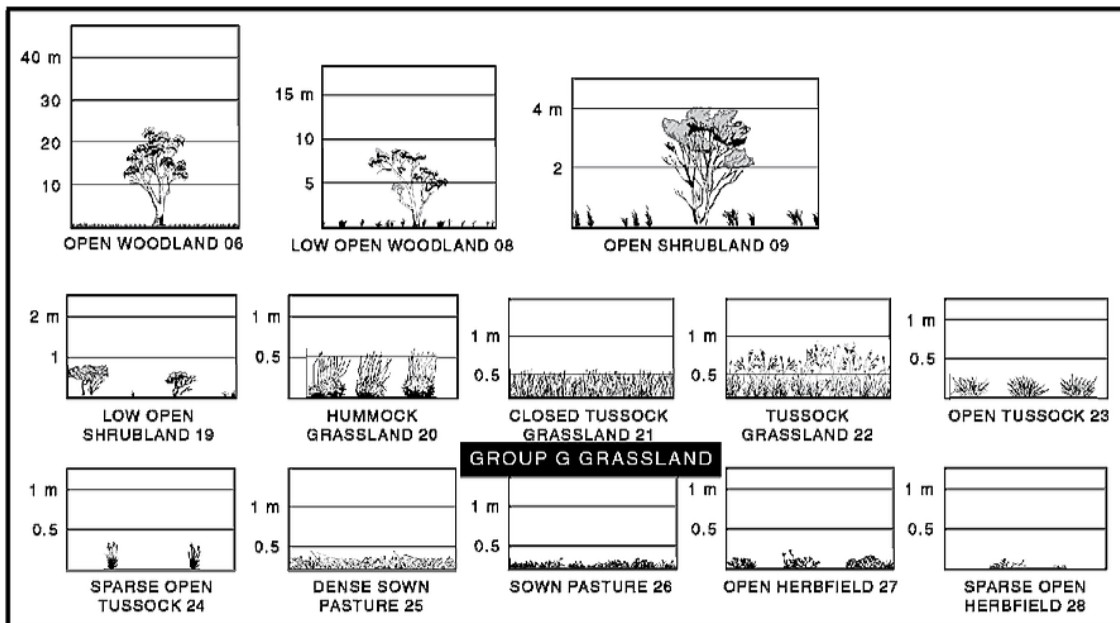


Figure 7: Classification of vegetation: Grassland (Standards Australia, 2018)

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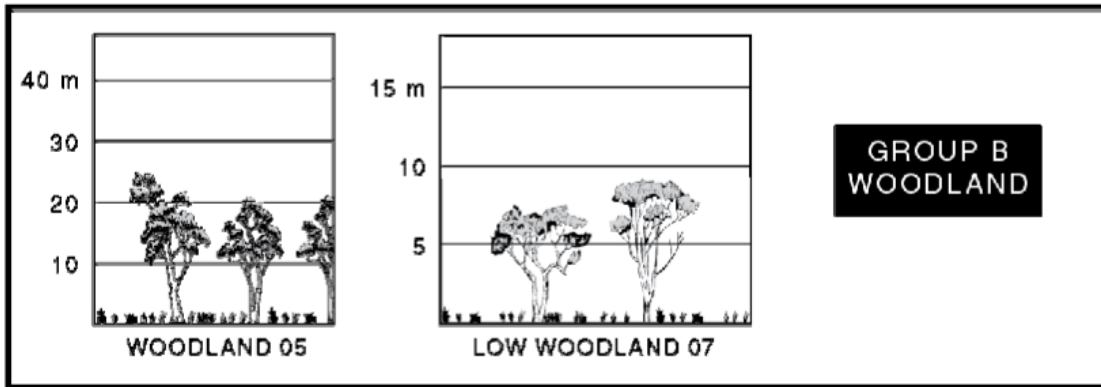


Figure 8: Classification of vegetation: Woodland (Standards Australia, 2018)

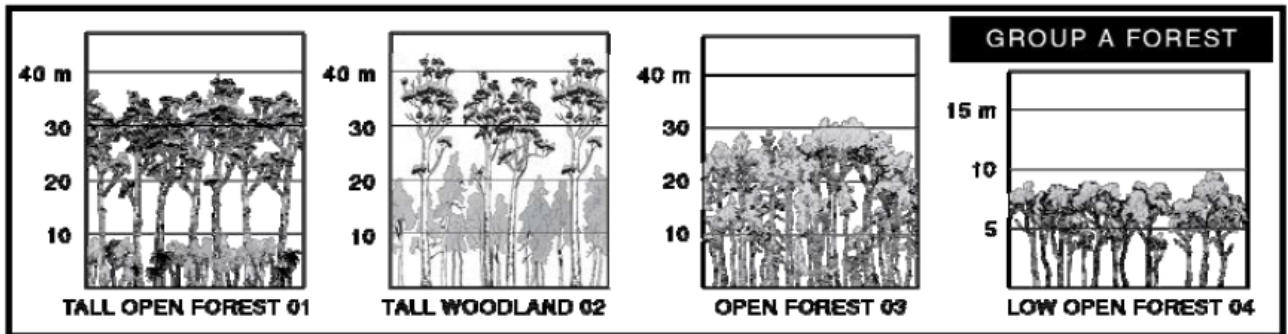


Figure 9: Classification of vegetation: Forest (Standards Australia, 2018)

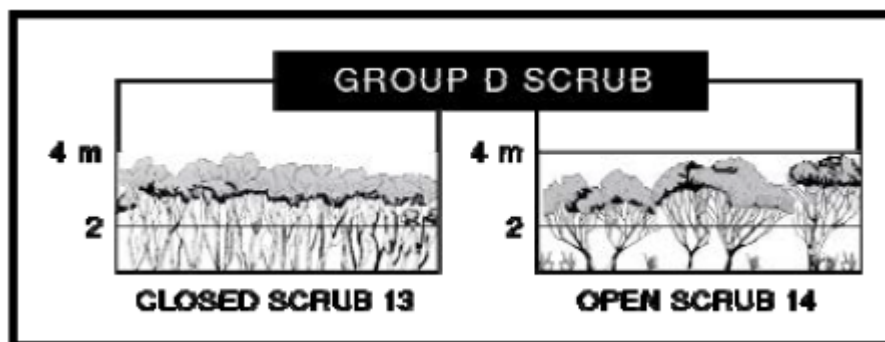


Figure 10: Classification of vegetation: Scrub (Standards Australia, 2018)

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The Project is proposing to remove all the planted tree rows within the BESS site. The planted tree rows and woodland vegetation along the western edge of the Project Area and towards the south-west are proposed to be retained, as these are located outside of the Property Boundary.

The BAL contours surrounding the BESS site are provided in Figure 11.

## 7.2 Addressing risk to the BESS from the landscape (bushfire/grassfire)

### 7.2.1 Overall bushfire/grassfire risk

Due to the modified nature of the site and the surrounding landscape, the overall potential bushfire risk is considered low.

Potential bushfire hazards in and around the Project Area is largely limited to grassland associated with agriculture. There is potential risk of spot fires sparking from bushfires in forested areas to the north or from human-induced factors. The scattered patches of woodland, scrub and riparian vegetation may increase the risk of fires within the landscape. While this is considered unlikely to occur, it has done so in the past during extreme bushfire events like the Black Saturday bushfires. Despite this increased risk, grass fires that may spread through or from the surrounding agricultural properties would have to cross multiple fuel breaks, such

as roads and waterways. Additionally, the level of grass is also often low with limited vegetation hazard present as the adjoining agricultural lands are cropped and actively grazed.

The small and narrow strips of planted woodland vegetation and forest/scrub vegetation are not likely to support an extended fire run towards the site due to their sparse nature, limited connectivity and the presence of adjoining roads. They are of insufficient dimensions to enable a fire to burn at maximum intensity directly towards the BESS.

The slope across the majority of the Project Area is noted as flat. The vegetation around the site does not pose a substantial bushfire risk to the Project Area.

While the overall bushfire/grassfire risk to or from the Project is relatively low, the measures adopted from the CFA Guidelines outlined in the following section will:

- further reduce the likelihood of a fire starting at the BESS
- mitigate and manage the risk to life and property in the event of a fire entering or spreading from the BESS.

Overall, no significant bushfire hazards are identified within the Project Area.

## 7.2.2 Addressing bushfire risks to the BESS

Table 7-2 provides a description of control measures to address bushfire/grassfire risk to the proposed BESS facility.

Table 7-2: Summary of measures to manage fire risk

Consideration	Project design response
Location	<p>The facility is located in a low-risk environment to reduce the risk of external fire impacting the facility. The site is currently undeveloped and is used for farming practices. The immediate surrounds are generally low bushfire risk, with the site consisting of grassed paddocks with strips of amenity planting and scattered patches of forest/woodland/scrub vegetation. The site is easily accessible via Yarragon-Shady Creek Road. The site is within a BPA and BMO.</p> <p>The site environment meets the attributes described in Section 4.1 of the CFA Guidelines, namely:</p> <ul style="list-style-type: none"> <li>■ primarily grassland</li> <li>■ generally flat topography, some undulation may be present</li> <li>■ slopes are less than 5 degrees</li> <li>■ good road access with multiple routes available to and from the Project site</li> <li>■ no LSIO applies.</li> </ul>
Design	<p>The structures, equipment, and buildings installed within the BESS facility will meet the construction requirements for BAL-19 rated buildings. These items predominantly feature metal exterior surfaces. Examples include steel-clad buildings with corrugated steel roofing, metal electrical cabinets, inverters and battery units housed within modified shipping-container structures, metal perimeter fencing, light poles, and lightning masts. Substation equipment including transformers, circuit breakers, busbars, and harmonic filters also have metal external surfaces and are therefore inherently resistant to ember attack.</p> <p>Exposed ground surfaces within the facility will either be single size aggregate, concrete, bitumen, or crushed gravel, all of which are non-combustible.</p> <p>The BESS units installed at the facility will be rated to at least Ingress Protection level IP55. This rating indicates that while the enclosure is not entirely dust-tight, any dust ingress is restricted to levels that do not compromise the unit's normal or safe operation. The battery cooling system operates on a closed-loop design, with external fans functioning solely for heat exchange and not permitting outside air to enter the battery enclosure. With this design, the likelihood of ember ingress into the BESS units is considered negligible.</p> <p>All modern BESS units have thermal insulation (commonly glass fiber insulation) to resist external heat. Some manufacturers have tested to ASTM-E119 (Building Fire Test Method) and achieved an external temperature withstand rating of up to 1050 degrees celsius over</p>

Consideration	Project design response
	<p>2 hours. Some BESS suppliers use inherently self-extinguishing materials (e.g. RTM material with UL94-VO) for battery pack covers.</p> <p>During the BESS procurement phase for the project, resistance to external fire and ember attack would be stated performance criteria and suppliers would be required to provide technical information and test reports to prove their products are robust enough to be shortlisted or selected.</p>
Layout	A 20 m wide firebreak around the perimeter of the site, with access track, will be incorporated into the site layout.
Administration, permits and training	<p>Fire risk management is to be implemented by adhering to any conditions during the Fire Danger Period. Conditions include remaining on designated tracks for driving and restricted smoking areas. Appropriate permits (such as hot work permit) to be obtained if required.</p> <p>Site personnel to be equipped with first aid and fire mitigation training including CFA's training modules for bushfire safety.</p> <p>An Emergency Management Plan should be prepared as per the CFA guidelines. (An Emergency Management Plan can take the form of a Bushfire Emergency Management Plan as long as bushfire controls are included).</p>
Emergency vehicle access	<p>Primary access and a secondary access will be provided via Yarragon-Shady Creek Road.</p> <p>A perimeter access road around the battery storage area and substation will be included within the 20 m firebreak.</p> <p>Access roads will be constructed as per CFA guidelines, including for construction type, width and grade.</p>
Firefighting water supply	The site is proposed to include two 310 kL water tanks and a hydrant ring main equipped with three fire hydrants to protect the facility.
Firebreaks	<p>A 20 m wide firebreak around the perimeter of the site, including internal access roads, will be incorporated into the site layout.</p> <p>Firebreaks will be maintained to be free of vegetation and other flammable materials.</p>
Landscape	<p>The Project Area has limited vegetation, primarily consisting of grassland. To address visual amenity concerns raised by nearby residents, a 10 m wide vegetation screen is proposed (Figure 2). This screening will consider vegetation with fire-retardant properties in accordance with CFA planting guidelines and will be positioned at a safe distance from the facility.</p> <p>Additionally, fire breaks have been expanded to a minimum of 20 m to accommodate the screening vegetation.</p>
Vegetation and fuel management	<p>The grass on site will be maintained at or below 100 mm during Fire Danger Period.</p> <p>All vehicles will be equipped with appropriate firefighting equipment.</p>

### 7.3 Bushfire Attack Level Assessment

All vegetation within 100 m of the site was classified in accordance with Clause 2.2.3 of AS3959:2018. Each distinguishable vegetation plot with the potential to determine the BAL is summarised in Table 7-3 below.

Table 7-3. Vegetation classifications

Plot no.	Vegetation Type	Location	Average Vegetation Height (m)	Foliage Cover (%)	Fuel Loading (t/ha)	Effective Slope (degrees)
1	Forest Type A	NNE	10	30-70	25-35	-5-10 downslope
2	Woodland Type B	W	10	10-30	15-25	1-5 upslope

3	Woodland Type B	W	10	10-30	15-25	1-5 upslope
4	Woodland Type B	SW	10	10-30	15-25	1-5 upslope
5	Scrub Type D	E	3	>30	25	-1-5 downslope
6	Grassland Type G	N, E, S, W	0.3	Overstorey <10%	4.5	1-5 upslope
7	Woodland Type B	S	10	10-30	25-25	-1-5 downslope

All remaining areas within 100 m of the site that do not comprise classified vegetation are classified as 'exclusions – low threat vegetation and non-vegetated areas' as outlined in Clause 2.2.2.3 of AS3959:2018. These areas comprised of rows of planted vegetation used as windbreaks, and grassland proposed to be managed to the minimal fuel condition (considered excluded under Clause 2.2.2.3 (f) of AS3959:2018) (Photos 13-15).

Site inputs used for BAL calculation include:

- **FDI:** 100
- **Classified Vegetation:** Class G Grassland
- **Slope Class/Topography:** All upslopes and flat land (0 degrees)

**Note:** the BAL contours have been mapped with reference to the current design. This includes the assumption that all buildings will be located behind the proposed 20 m Asset Protection Zone (APZ).

Based on the above parameters, BAL contours displaying estimated radiant heat levels is presented in Figure 11. The BESS and associated infrastructure primarily falls into a **BAL-12.5** or lower under AS 3959:2018 due to the proposed 20 m Asset Protection Zone creating a buffer between the buildings and the unmanaged grassland. A small portion of the western half of the BESS yard falls within BAL-19, as it is located less than 33 m from woodland vegetation. Moving the BESS slightly east (>33 m from the woodland vegetation) will ensure that all infrastructure remains within a BAL-12.5 rating.

Annual vegetation management requirements for the APZ and the associated buildings (such as removal of vegetation from the surrounds, roofs and gutters) should be in accordance with Table 6 of Clause 53.02-5 (see Section 7 below) and CFA Guidelines *Landscaping for Bushfire – Garden Design and Plant Selection* (CFA, 2022).

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Photo 15. Row of planted vegetation classified as excludable under Clause 2.2.3.2 (f) of AS3959:2018



Photo 16. Row of planted vegetation classified as excludable under Clause 2.2.3.2 (f) of AS3959:2018



Photo 17. Grassland managed in a minimal fuel condition classified as excludable under Clause 2.2.3.2 (f) of AS3959:2018

## 7.4 Bushfire management recommendations

As outlined in Section 6.2.2, a 20 m fire break around the BESS and associated infrastructure is to be implemented as part of the Project's detailed design which is in line with Section 4.2.5 of the CFA Guidelines (Fire Detection and Suppression Equipment). Additionally, in order to reduce the bushfire risk further it is recommended that the following defensible space requirements from Table 6 of 53.02-4.2 are adhered to for the duration of each fire season in perpetuity:

- Grass must be short cropped (<100 mm in height) 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 m of a building, flammable objects must not be located close to the vulnerable parts of the building.
- Plants greater than 10 cm in height must not be placed within 3 m 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 m<sup>2</sup> in area and must be separated by at least 5 metres.
- Trees must not overhang or touch any elements of the building.
- The canopy of trees must be separated by at least 5 m from other tree canopies.
- There must be a clearance of at least 2 m between the lowest tree branches and ground level.

Additionally, vegetation management should also be undertaken in accordance with the CFA guidelines *Landscaping for Bushfire – Garden Design and Plant Selection* (CFA, 2022).

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**aurecon**



### Legend

- Watercourse
- Property boundary
- Project Infrastructure Boundary
- BMO - Bushfire Management Overlay
- BAL Radiant Heat (kW/sqm)**
- Flame Zone
- BAL 40
- BAL 29
- BAL 19
- BAL 12.5
- Vegetation Type**
- Forest
- Grassland
- Scrub
- Woodland
- Layout Design**
- Transmission Line 220kV
- Alternate Fire Access Route
- HV Cabling 220kV
- Storm Water Detention Basin
- Water Tanks
- Substation Area
- Terminal Station
- Temporary Facilities
- Battery Yard
- O&M Buildings / Storage & Parking
- New Transmission Tower 220kV
- Transmission Tower 220kV
- Asset Protection Zone
- BESandPCS
- Internal Infrastructure Components

Notes:

Basemap: Sources Esri, TomTom, Garmin, FAO, NOAA, USGS, OpenStreetMap contributors, and the GIS User Community. We request attribution as Commonwealth of Australia (Bureau of Meteorology) 2022. © Commonwealth of Australia (Geoscience Australia) 2021. This product is released under the Creative Commons Attribution 4.0 International License. <http://creativecommons.org/licenses/by/4.0/legalcode>

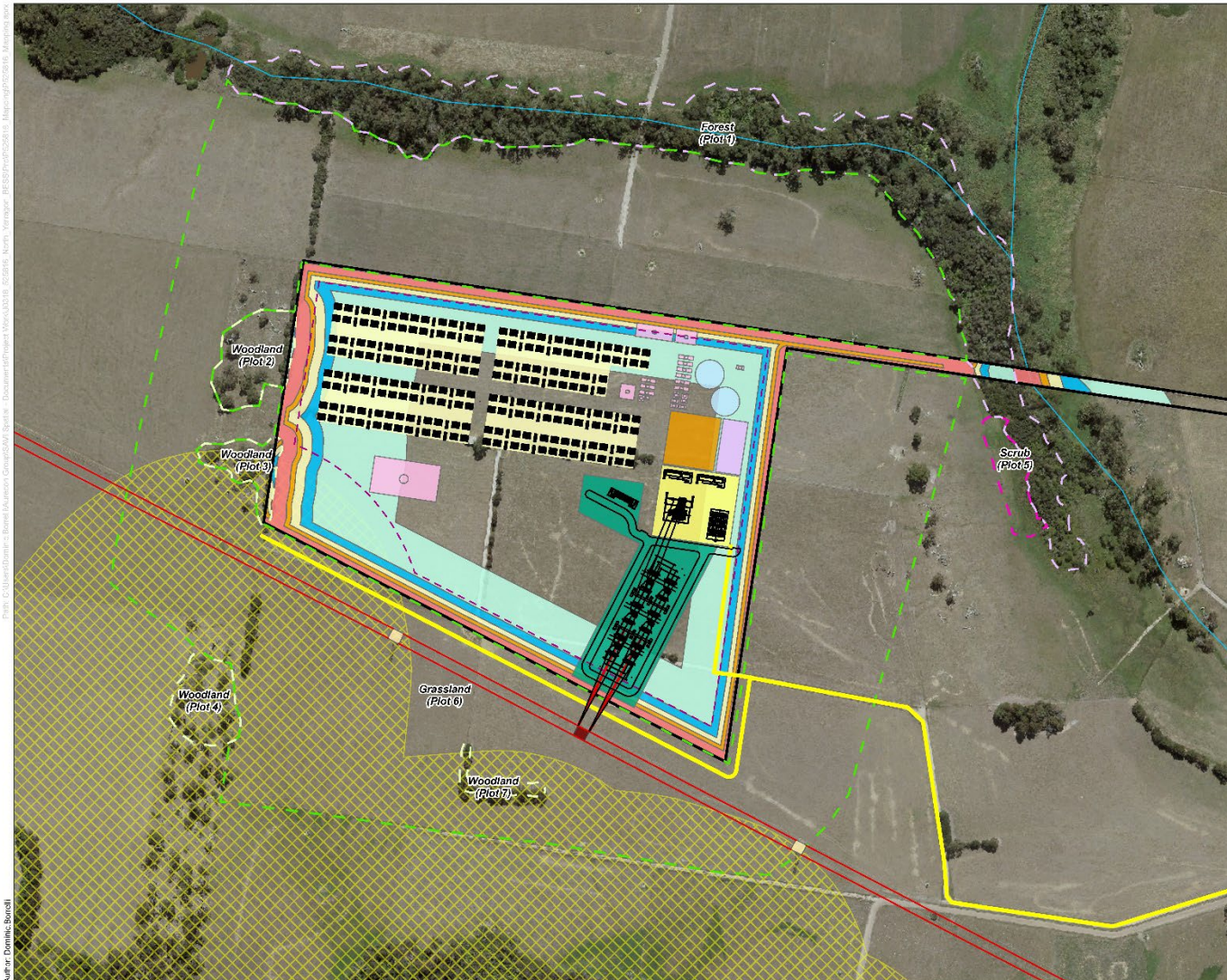
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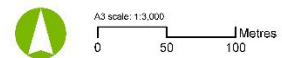
Version: 7

### North Yarragon BESS

Figure 7: Bushfire Attack Level (BAL)



Author: Dominic Borelli



Job No: P529157  
Coordinate System: GDA2020 MGA Zone 55

Figure 11. BAL mapping

## 8 Conclusion

The dangerous goods screening process concluded that the storage quantities of lithium-ion batteries and transformer oil on the site would exceed placarding, manifest, and fire protection quantities.

The dangerous goods screening assessment concluded:

- As the placard quantity thresholds for Class 9 as set out by Schedule 2 of the *Dangerous Goods (Storage and Handling) Regulations 2022* have been exceeded, placards are required. They should be displayed at every entrance for road vehicles and at the entrance of the buildings and rooms that store the batteries.
- As the manifest quantity thresholds for Class 9 as set out by Schedule 2 of the *Dangerous Goods (Storage and Handling) Regulations 2022*, are exceeded, a manifest of all chemicals should be prepared and sent to WorkSafe Victoria. In addition, an updated emergency plan shall be prepared for the facility and provided to the Victorian Country Fire Authority for written advice.
- As the fire protection quantity thresholds for Class 9 as set out by Schedule 2 of the *Dangerous Goods (Storage and Handling) Regulations 2022*, are exceeded, written advice from the emergency services authority (i.e. CFA) shall be sought in relation to the design of the fire protection system for the premises. Further to this the CFA guidelines state that following a review of the Risk Management Plan the CFA may request the preparation of a Fire Safety Study to be conducted for BESS facilities where the design, capacity, complexity, location, or proposed operations necessitate an enhanced, detailed analysis of requirements for fire and explosion safety systems.

A hazard identification and analysis was conducted. The process identified thirty-two (32) hazards associated with the Project, of which twenty-four (24) potential hazards had potentially significant off-site risks. All identified hazards can be controlled through appropriate technical management recommendations which reduce the residual risk so far as is reasonably practicable and make it unlikely that significant off-site risk is posed.

The hazard and risk assessment recommends key technical and safety recommendations regarding the:

- Layout and design of the BESS systems
- Lithium-ion battery design
- Transformers and switchgear design and
- Site Layout including the separation distances required to prevent escalation of potential consequences.

The assessment recommends that a safety management system is implemented that includes the following safeguards prior to the commencement of construction, commissioning or operation of the Project.

- Comprehensive, documented installation and operating procedures, with a regular audit/review system.
- Comprehensive, documented inspection and maintenance procedures with a regular audit/review system.
- Work Health and Safety Management Plan.
- Emergency Response Plan and Emergency Planning Program.
- Asset Management Plans and assurance activities.

Further study and planning will be undertaken as per CFA guidelines in the detailed design phase. This Hazard and Risk assessment also includes elements of the Risk Management Plan that will be developed as the project progresses and will support this future work.

The Bushfire Hazard Assessment found that the broader landscape surrounding the Project Area comprises largely of cleared farmland with paddocks that are occasionally separated by planted tree lines and riparian corridors, with no dense forested areas present nearby. The Project Area is considered to exhibit low-risk environmental attributes as per the CFA Guidelines. The primary landscape bushfire risk to the Project Area is from grassfire due to the potential for spot fires to occur within the treed or scrub vegetation in the landscape from potential bushfires in the north. Consequently, based on the condition of the landscape and

limited patches of vegetation, extreme bushfire behaviour is considered unlikely. The site also has ready access and egress to safe areas around Yarragon that would provide safety in the event of a fire.

In accordance with Method 1 of AS3959:2018, the BAL rating for the site is BAL-12.5 or lower under AS 3959:2018 due to the proposed 20 m Asset Protection Zone creating a buffer between the buildings and the unmanaged grassland.

It is recommended that the proposed 20 m APZ is adhered to for the duration of each fire season in perpetuity. Additionally, vegetation management should also be undertaken in accordance with the CFA guidelines *Landscaping for Bushfire – Garden Design and Plant Selection* (CFA, 2022).

This assessment concludes that, provided the proposed BESS development is designed, constructed, and operated in accordance with the specified mitigations, controls and CFA guidelines, it poses a low residual risk.

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# Appendix A: CFA Guideline Model Requirements

An analysis (Table 10-1) was conducted against the CFA guideline checklist (within Appendix A of the CFA Design Guidelines and Model Requirements: Renewable Energy Facilities V4 [6]) to identify what actions need to be considered to ensure the Project is able to satisfy all CFA requirements

Table 10-1: CFA Guideline Checklist Gap Analysis

CFA Section	Guideline Requirement	Project Assessment
Section 2: Consultation	<p><u>Consulting with CFA</u></p> <p>Early consultation with CFA's Specialist Risk and Fire Safety Unit, before developing a planning permit application?</p>	<p>The project team have met with the CFA relevant to the planning permit application proposal (17 April 2025). Attendees were Matt Allen (State Infrastructure and Dangerous Goods Unit Leader at Country Fire Authority (CFA)) and Jennifer Blyth (Senior Specialist Risk Advisor).</p> <p>However, CFA engagement will continue to be undertaken during the next phase of the project, in line with planning permit requirements. The Hazard and Risk Assessment identifies key fire risks and mitigation measures, which can inform discussions with CFA's Specialist Risk and Fire Safety Unit at a later stage.</p>
Section 3: Fire Risk Management	<p><u>Risk Management</u></p> <p>A Risk Management Plan must be developed for the facility, in consultation with CFA, before development starts</p>	<p>As per CFA guidelines a preliminary Risk Management Plan is provided in Appendix B. It builds upon the Hazard and Risk Assessment and will be completed during detailed design.</p>
Section 4: Facility Location	<p><u>Landscape Risk to Facility</u></p> <p>An assessment against policy contained in Victoria Planning Provisions (VPP) Clause 13.02-1S (Bushfire Planning) that considers:</p> <ul style="list-style-type: none"> <li>a) The impact of any ignitions arising from the infrastructure on nearby communities, infrastructure and assets.</li> <li>b) The impact of bushfire on the infrastructure (e.g. ember attack, radiant heat impact, flame contact).</li> </ul>	<p>Due to the modified nature of the site and the surrounding landscape, the overall potential bushfire risk is considered low. Potential bushfire hazards in and around the Project Area is largely limited to grassland associated with agriculture. The risk is of grass fires in the landscape are reduced as any grass fires that may spread through or from the surrounding agricultural properties would have to cross multiple fuel breaks, such as roads and waterways. The level of grass is also often low with limited vegetation hazards present as the adjoining agricultural lands are cropped and actively grazed.</p> <p>The small and narrow strips of planted woodland vegetation and forest/scrub vegetation will not support an extended fire run towards the site due to their sparse nature, limited connectivity and the presence of adjoining roads. They are of insufficient dimensions to enable a fire to burn at maximum intensity directly towards the BESS.</p> <p>The slope across the majority of the Project Area is noted as flat. The vegetation around the site does not pose a substantial bushfire risk to the Project Area. While the overall bushfire/grassfire risk to or from the Project is relatively low, the measures adopted from the CFA Guidelines (Table 8-2) will further reduce the likelihood of a fire starting at the BESS and mitigate and manage the risk to life and property in the event of a fire entering or spreading from the BESS.</p> <p>Overall, no significant bushfire hazards are identified within the Project Area.</p>
	<p><u>Facility Risk to Landscape</u></p> <p>As assessment of the fire risk from the proposed facility to the landscape.</p>	<p>There is minimal off-site risk after mitigations (See Appendix B: Risk ) and the Project Area and surrounding land is classified as Farming Zone.</p> <p>The facility is not expected to lead to a significant increase in risk to adjacent land.</p> <p>Additionally, the site will be designed to comply with NFPA 855 which outlines battery separation, containment, fire detection and suppression systems, and explosion control system requirements. The BESS will be equipped with a BMS.</p>

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CFA Section	Guideline Requirement	Project Assessment
Section 4: Facility Design	<p><u>Emergency Vehicle Access</u></p> <ul style="list-style-type: none"> <li>a) Construction of a minimum four (4) metre perimeter road within the perimeter fire break.</li> <li>b) Roads must be of all-weather construction and capable of accommodating a vehicle of fifteen (15) tonnes (e.g. no compacted earth).</li> <li>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 trucks.</li> <li>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.</li> <li>e) Dips in the road should have no more than a 1 in 8 (12.5% or 7.1°) entry and exit angle.</li> <li>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</li> <li>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.</li> <li>h) The provision of at least two (2) but preferably more access points to each part of the facility</li> </ul>	<p>The model requirements (i.e. accessible fire service infrastructure and safe evacuation points) from Section 4.2.1 (Emergency Vehicle (Fire Truck) Access) of the CFA guidelines will be incorporated into final design and layout of the facility.</p> <p>In addition to the standard access gate, an additional alternative fire access route to access the BESS is also included through the fenced terminal station area in the current design of the facility.</p>
	<p><u>Additional Requirements for Battery Energy Storage Systems</u></p> <p>The provision of at least two access points into each section where battery energy storage systems are located.</p>	<p>It is confirmed that there are at least two access points into each section where BESS are located.</p>
	<p><u>Firefighting Water Supply</u></p> <ul style="list-style-type: none"> <li>a) Water access points must be clearly identifiable and unobstructed to ensure efficient access.</li> <li>b) Static water storage tank installations must comply with AS 2419.1-2021: Fire hydrant installations – System design, installation and commissioning.</li> <li>c) The static water storage tank(s) must be an aboveground water tank constructed of concrete or steel.</li> <li>d) The static water storage tank(s) must be capable of being completely refilled automatically or manually within 24 hours.</li> <li>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.</li> <li>f) The hard-suction point must be provided with a 150mm full bore isolation valve equipped with a Storz connection, sized to comply with the required suction hydraulic performance.</li> <li>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.</li> <li>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.</li> <li>i) The road access and hardstand must be kept clear at all times.</li> <li>j) The hard-suction point must be protected from mechanical damage where necessary.</li> <li>k) Where the access road has one entrance, an eight (8) metre radius turning circle must be provided at the tank.</li> <li>l) An external water level indicator must be provided to the tank and be visible from the hardstand area.</li> <li>m) Signage indicating 'FIRE WATER' and the tank capacity must be fixed to each tank.</li> <li>n) Signage must be provided at each vehicle entrance to the facility, indicating the direction to the nearest static water tank(s).</li> </ul>	<p>The fire water system is yet to be designed. Water supply volume required is to be determined during detailed design. A ring main fire water supply and locate fire hydrants should be installed together with a fire water pump house as per NFPA 855 and CFA requirements. The final design will incorporate the model requirements from Section 4.2.2 of CFA (Firefighting Water Supply) including fire hydrant model requirements.</p>

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CFA Section	Guideline Requirement	Project Assessment
	<p><u>Additional Requirements for Battery Energy Storage Systems - Centralised BESS</u></p> <p>a) Where reticulated water is available, the provision of a fire hydrant system that meets the requirements of AS 2419.1-2021: Fire hydrant installations, Clause 3.9: Open Yard Protection, and Table 2.2.5(D): Number of Fire Hydrants Required to Flow Simultaneously - Open Yards.</p> <p style="text-align: center;"><b>OR</b></p> <p>b) Where no reticulated water is available, provision of a fire water supply in static storage tanks, where:</p> <ol style="list-style-type: none"> <li>i. The fire water supply must be of a quantity no less than 288,000 L or as per the provisions for Open Yard Protection of AS 2419.1-2021: Fire hydrant installations, flowing for a period of no less than four hours at 20 L/s, whichever is the greater.</li> <li>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).</li> <li>iii. Fire hydrants must be provided and located so that every part of the battery energy storage system is within reach of a 10 m hose stream issuing from a nozzle at the end of a 60 m length of hose connected to a fire hydrant outlet.</li> <li>iv. The fire water supply must be located at vehicle entrances to the facility, at least 10 m from any infrastructure (electrical substations, inverters, battery energy storage systems, buildings).</li> <li>v. The fire water supply must be reasonably adjacent to the battery energy storage system and shall be accessible without undue danger in an emergency. (Eg., Fire water tanks are to be located closer to the site entrance than the battery energy storage system).</li> <li>vi. The fire water supply must comply with AS 2419.1-2021: Fire hydrant installations, Section 5: Water storage tanks.</li> </ol>	<p>The final fire water system is yet to be designed. Two 310,000 L water tanks are proposed. Water supply volume required is to be determined during detailed design. Potential to install a ring main fire water supply and locate fire hydrants as per NFPA 855 and CFA requirements. The final design will incorporate the model requirements from Section 4.2.2 of CFA (Firefighting Water Supply) and any additional requirements for BESS.</p>
	<p><u>Fire Detection and Suppression Equipment</u></p> <ol style="list-style-type: none"> <li>a) For on-site buildings and structures, according to the requirements of the National Construction Code.</li> <li>b) For storages of dangerous goods, according to the requirements of any Australian Standards for the storage and handling of dangerous goods.</li> <li>c) For electrical installations, a minimum of two suitable fire extinguishers must be provided within 3 m – 20 m of each PCU.</li> <li>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.</li> </ol>	<p>The fire detection and suppression system are yet to be designed; however, the final design will align with the model requirements outlined in Section 4.2.3 of the CFA Guidelines (Fire Detection and Suppression Equipment).</p> <p>Fire hazards may arise during construction and commissioning. These risks will be mitigated through the implementation of appropriate de-energising and isolation systems as part of the detailed design phase, ensuring compliance with NFPA 855.</p> <p>Additionally, the site will be designed in accordance with NFPA 855, which specifies requirements for battery separation, containment, fire detection and suppression, and explosion control systems. The BESS will be equipped with a Battery Management System (BMS) to monitor and manage operational risks. Additionally, findings from the FSS will be integrated into the final design to enhance overall fire protection measures.</p>
	<p><u>Fire Breaks</u></p> <p>The provision of fire breaks:</p> <ol style="list-style-type: none"> <li>a) Around the perimeter of the facility, commencing from the boundary of the facility or from the vegetation screening inside the property boundary. (N/A for wind energy facilities.)</li> <li>b) Around the perimeter of control rooms, electricity compounds, substations and all other buildings on-site.</li> <li>c) Of a width of at least 10m.</li> </ol>	<p>A minimum 20 m fire break is to be implemented as part of the Project's detailed design in line with Section 4.2.5 of the CFA Guidelines (Fire Detection and Suppression Equipment). Refer to Section 7.2.2</p>
	<p><u>Additional Requirements for Battery Energy Storage Systems</u></p> <p>The provision of a fire break around battery energy storage systems and related infrastructure</p>	<p>A minimum 20 m fire break around the battery energy storage system and related infrastructure is to be implemented as part of the Projects detailed design in line with Section 4.2.5 of the CFA Guidelines (Fire Detection and Suppression Equipment). Refer to Section 7.2.2. A 20 m Asset Protection Zone is proposed in the latest design.</p>
	<p><u>Design Specific to Facility Type - Requirements for Battery Energy Storage Systems</u></p> <ol style="list-style-type: none"> <li>1. Facility design that incorporates: <ol style="list-style-type: none"> <li>a) A separation distance that prevents fire spread between battery containers/enclosures and other site elements.</li> <li>b) A fire break around the battery energy storage system and related infrastructure, of a width of no less than 10 m.</li> </ol> </li> </ol>	<p>The final design will incorporate the model requirements for a BESS facility type from Section 4.2.6.3 of the CFA Guidelines (Battery Energy Storage Systems). Refer to Section 7.2</p>

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CFA Section	Guideline Requirement	Project Assessment
	<p>c) A layout of site infrastructure that:</p> <ol style="list-style-type: none"> <li>i. Considers the safety of emergency responders.</li> <li>ii. Minimises the potential for grassfire and/or bushfire to impact the battery energy storage system.</li> <li>iii. Minimises the potential for fires in battery containers/enclosures to impact on-site and off-site infrastructure.</li> </ol> <p>3. Battery energy storage systems must be:</p> <ol style="list-style-type: none"> <li>a) Located so as to be reasonably adjacent to a site vehicle entrance (suitable for emergency vehicles).</li> <li>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.)</li> <li>c) Provided with in-built fire and gas detection systems.</li> <li>d) Provided with explosion prevention via sensing and venting, or explosion mitigation through deflagration panels.</li> <li>e) Provided with suitable ember protection.</li> <li>f) Provided with suitable access roads for emergency services vehicles.</li> <li>g) Installed on a non-combustible surfaces.</li> <li>h) Provided with suitable ventilation.</li> <li>i) Provided with suitable impact protection.</li> <li>j) Provided with enclosed wiring and buried cabling, except where required to be above-ground for grid connection.</li> <li>k) Provided with spill containment that includes provision for management of fire water runoff.</li> </ol>	
Section 5: Facility Construction and Commissioning	<p><u>Emergency Plan</u></p> <p>An Emergency Plan must be developed for the construction and commissioning phase of the facility.</p>	Will be developed per CFA guidelines during detailed design.
Section 6: Facility Operation	<p><u>Fire Management Plan</u></p> <p>A Fire Management Plan must be developed for the facility, in consultation with CFA, before development starts.</p>	Will be developed per CFA guidelines during detailed design.
	<p><u>Bushfire and Grassfire</u></p> <p>If your facility is at-risk of bushfire, prevention and preparedness activities must be detailed in the Fire Management Plan.</p>	As the site has been identified as at-risk of bushfire (due to its presence in a BPA), this must include prevention and preparedness activities as per Section 6.2.1 Bushfire and Grassfire Risk of the CFA Guidelines. The Fire Management Plan will also need to be regularly reviewed and updated, in accordance with Section 6.3 of the CFA Guidelines.
	<p><u>Vegetation Management</u></p> <p>Facility operators must undertake the following measures during the Fire Danger Period:</p> <ol style="list-style-type: none"> <li>a) Grass must be maintained at or below 100 mm in height during the declared Fire Danger Period.</li> <li>b) Long grass and/or deep leaf litter must not be present in areas where heavy equipment will be working, during construction or operation.</li> <li>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 <a href="http://www.cfa.vic.gov.au">www.cfa.vic.gov.au</a>).</li> </ol>	<p>It is important that vegetation and fuel is managed effectively to reduce both the risk of fire entering the facility, as well as minimise the consequences of fire. Given that the BESS site is within a BPA, it is a priority to allow for fire risks to be managed for the duration of the operational life of the facility.</p> <p>The current site is predominately grassed paddocks. Therefore, the primary management action is to maintain grass height during the fire danger period. Throughout the year, long grass should also be reduced where possible, particularly if there is long grass in and adjacent to work areas that will utilise heavy equipment or machinery.</p> <p>Additionally, during the fire danger period, restrictions should be adhered to, and it is recommended that vehicles, particularly maintenance vehicles and machinery, carry a fire-extinguisher.</p>
	<p><u>Arc Flash Hazard Management</u></p> <p>Where required, appropriate demarcation of arc boundaries to at least 10m from PCU arc flash outlet flaps (blow-out panels) must be provided.</p>	The facility design has not yet incorporated arc flash hazard controls. The final design will incorporate appropriate demarcation of arc boundaries, ensuring at least 10 m from PCU arc flash outlet flaps (blow-out panels). Signage, barriers, and mitigation measures will be implemented during the detailed design phase to reduce personnel exposure and ensure compliance with applicable safety standards.
	<p><u>Facility and System Monitoring</u></p> <p>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</p>	The site will be designed to comply with NFPA 855 which outlines battery separation, containment, fire detection and suppression systems and explosion control system requirements. The BESS will be equipped with a BMS.

CFA Section	Guideline Requirement	Project Assessment
	<p><u>Maintenance</u></p> <p>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</p>	<p>Maintenance to be conducted to meet Australian standards and manufacturers requirements. Any work that may create an ignition source will be under 'hot work' permits.</p>
<p>Section 7: Emergency Planning</p>	<p><u>Emergency Plan (Operational)</u></p> <p>An Emergency Plan must be developed for the operational phase, specific to the facility, in consultation with CFA, before development starts.</p>	<p>Will be developed per CFA guidelines during detailed design.</p>
<p>Section 8. Provision of Emergency Information</p>	<p><u>Developing an Emergency Information Book</u></p> <p>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.</p>	<p>Will be developed per CFA guidelines during detailed design.</p>

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Appendix B: Risk Management Plan (preliminary)

Table 10-2: BESS preliminary Risk Management Plan

No.	Source	Hazard	Cause(s)	Consequence(s)	Does the Hazard Pose a Potential Off-site Significant Risk?	Current Risk			Proposed Controls – Technical / Design	Proposed Controls – Safety Management	Residual Risk			Does the Hazard Pose a Potential Off-site Significant Risk with proposed controls in place?
						Likelihood	Consequence	Risk Rating			Likelihood	Consequence	Risk Rating	
1.	Lithium-ion Battery	Arcing or short-circuit	<ul style="list-style-type: none"> <li>Cable or equipment fault</li> <li>Cable thermal failure</li> <li>Dust ingress</li> </ul>	<ul style="list-style-type: none"> <li>Electrocution resulting in injury or fatality</li> </ul>	Unlikely (in terms of electrical shock hazard affecting public)	-	-	-	-	-	-	-	-	-
2.	Lithium-ion Battery	Battery cell fire hazard	<ul style="list-style-type: none"> <li>Equipment fault and ignition of combustible materials used in the storage system</li> <li>BESS module arc flash</li> <li>Installation error – reverse polarity connection</li> <li>Dust ingress</li> </ul>	<ul style="list-style-type: none"> <li>Personnel injury due to burns or smoke/chemical inhalation.</li> <li>Damage/ destruction of battery cell.</li> <li>Overheating/ electrical fault potentially leading to thermal runaway.</li> </ul>	Potential	C – Possible	4 – Major	High	<ul style="list-style-type: none"> <li>HVAC systems Australian Standards compliant</li> <li>Battery enclosures will be located outdoors</li> <li>Battery enclosure includes a thermal management system that provides active cooling and heating to the internal Battery enclosure components.</li> <li>Battery systems modular and compartmentalised to minimise damage.</li> <li>Battery enclosures minimum distancing applied</li> <li>Adequate spacing of battery modules.</li> <li>Batteries and associated balance of plant certified and designed to Australian Standards</li> <li>Electronic safety-related systems should be installed at both a hardware and software level, designed to applicable standards, to allow for safe isolation of electrical energy in the event of a failure</li> <li>BESS design location with sufficient distance from other infrastructure.</li> <li>Emergency shutdown incorporated into BESS design</li> <li>Containers/infrastructure for BESS located to be directly accessible to emergency responders</li> </ul>	<ul style="list-style-type: none"> <li>HVAC systems correctly installed and maintained</li> <li>Safety system maintenance, testing and inspections</li> <li>Safety Management Plans</li> <li>Trained operators/maintainers</li> <li>Plant operating and maintenance procedure</li> <li>Remote isolation for non-manned facility</li> </ul>	E – Rare	4 – Major	Medium	Unlikely

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No.	Source	Hazard	Cause(s)	Consequence(s)	Does the Hazard Pose a Potential Off-site Significant Risk?	Current Risk			Proposed Controls – Technical / Design	Proposed Controls – Safety Management	Residual Risk			Does the Hazard Pose a Potential Off-site Significant Risk with proposed controls in place?
						Likelihood	Consequence	Risk Rating			Likelihood	Consequence	Risk Rating	
									<ul style="list-style-type: none"> <li>Thermal overtemperature detection and prevention in Battery enclosure design</li> <li>Cell overpressure detection and protection in Battery enclosure design</li> <li>Remote monitoring</li> <li>Access controls for MV areas (arc flash risk)</li> <li>Storage and handling of BESS / Li-batteries according to AS 4681.</li> <li>Fire modelling or full scale fire testing to be conducted as part of design to ensure fire radiation effects do not impact on adjacent infrastructure.</li> <li>Fire Risk Evaluation to be conducted to provide fire safety recommendation and required firefighting equipment</li> </ul>					
3.	Lithium-ion Battery	Battery cell thermal hazard	<ul style="list-style-type: none"> <li>Chemical properties of the battery materials and thermal runaway.</li> <li>Propagation of adjacent battery fire (escalation event).</li> </ul>	<ul style="list-style-type: none"> <li>Personnel injury due to burns or smoke/chemical inhalation.</li> <li>Damage/ destruction of battery cell.</li> </ul>	Potential	C – Possible	4 – Major	High	<ul style="list-style-type: none"> <li>HVAC systems Australian Standards compliant</li> <li>Battery modules chemistry is LFP (higher temperature to trigger thermal runaway)</li> <li>Battery enclosures will be located outdoors</li> <li>Battery enclosure includes a thermal management system that provides active cooling and heating to the internal Battery enclosure components</li> <li>Battery systems modular and compartmentalised to minimise damage.</li> <li>Adequate spacing of battery modules.</li> <li>Battery enclosures minimum distancing applied</li> <li>Batteries and associated balance of plant certified and designed to Australian Standards.</li> <li>Electronic safety-related systems should be installed at both a hardware and software</li> </ul>	<ul style="list-style-type: none"> <li>HVAC systems correctly installed and maintained</li> <li>Safety system maintenance, testing and inspections</li> <li>Safety Management Plans</li> <li>Trained operators/maintainers</li> <li>Plant operating and maintenance procedures</li> <li>Remote isolation for non-manned facility</li> <li>Lessons learnt from previous battery fire incidents</li> </ul>	E – Rare	4 – Major	Medium	Unlikely

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No.	Source	Hazard	Cause(s)	Consequence(s)	Does the Hazard Pose a Potential Off-site Significant Risk?	Current Risk			Proposed Controls – Technical / Design	Proposed Controls – Safety Management	Residual Risk			Does the Hazard Pose a Potential Off-site Significant Risk with proposed controls in place?
						Likelihood	Consequence	Risk Rating			Likelihood	Consequence	Risk Rating	
									level, designed to applicable standards, to allow for safe isolation of electrical energy in the event of a failure <ul style="list-style-type: none"> <li>■ BESS design location sufficient distance from other infrastructure</li> <li>■ Emergency shutdown incorporated into BESS design</li> <li>■ Containers/infrastructure for BESS located to be directly accessible to emergency responders</li> <li>■ Thermal overtemperature detection and prevention in Battery enclosure design</li> <li>■ Cell overpressure detection and protection in Battery enclosure design.</li> <li>■ Remotely accessible flammable gas monitoring to detect presence of flammable gases</li> <li>■ Access controls for MV areas (arc flash risk)</li> <li>■ Fire modelling ore full scale fire testing to be conducted as part of design to ensure fire radiation effects do not impact on adjacent infrastructure.</li> <li>■ Fire Risk Evaluation to be conducted to provide fire safety recommendation and required firefighting equipment</li> </ul>					
4.	Lithium-ion battery	Battery cell equipment failure	<ul style="list-style-type: none"> <li>■ Loss of cooling fluid/ Coolant leak from equipment attributable to design fault/error.</li> <li>■ Improper installation/commissioning.</li> <li>■ Lack of maintenance or collision or impact on the BESS.</li> </ul>	Battery overheats and thermal runaway (refer to thermal hazard)	Potential	C – Possible	4 – Major	High	<ul style="list-style-type: none"> <li>■ Installation of coolant leak alarms.</li> <li>■ Ensure all telemetry, fault monitoring and electrical safety protection devices remain active regardless of keylock switch position or system state</li> <li>■ Active monitoring and control of the pyro disconnect's power supply circuit</li> <li>■ Required clearance between Battery enclosures for maintenance access as per</li> </ul>	<ul style="list-style-type: none"> <li>■ Development and implementation of commissioning procedures in accordance with manufacturer's procedures</li> <li>■ Safety system maintenance, testing and inspections</li> <li>■ Development and implementation of safety management plans</li> </ul>	E – Rare	4 – Major	Medium	Unlikely

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No.	Source	Hazard	Cause(s)	Consequence(s)	Does the Hazard Pose a Potential Off-site Significant Risk?	Current Risk			Proposed Controls – Technical / Design	Proposed Controls – Safety Management	Residual Risk			Does the Hazard Pose a Potential Off-site Significant Risk with proposed controls in place?
						Likelihood	Consequence	Risk Rating			Likelihood	Consequence	Risk Rating	
									BESS provider recommendations	<ul style="list-style-type: none"> <li>Trained operators/maintainers</li> <li>Plant operating and maintenance procedures</li> <li>Implementation of operating plant manuals</li> </ul>				
5.	Lithium-ion battery	Battery cell operational hazard	<ul style="list-style-type: none"> <li>Control breakdown from equipment fault; design fault/error</li> <li>Discharging/charging of a unit beyond the state of charge threshold</li> <li>Improper installation/commissioning</li> <li>Lack of maintenance or collision or impact on the BESS.</li> </ul>	Battery overheats and thermal runaway (refer to thermal hazard)	Potential	C – Possible	4 – Major	High	<ul style="list-style-type: none"> <li>Ensure all telemetry, fault monitoring and electrical safety protection devices remain active regardless of keylock switch position or system state</li> <li>Active monitoring and control of the pyro disconnect's power supply circuit</li> <li>Required clearance between Battery enclosures for maintenance access as per BESS provider recommendations</li> </ul>	<ul style="list-style-type: none"> <li>Development and implementation of commissioning procedures in accordance with manufacturer's procedures</li> <li>Safety system maintenance, testing and inspections</li> <li>Development and implementation of safety management plans</li> <li>Trained operators/maintainers</li> <li>Plant operating and maintenance procedures</li> <li>Implementation of operating plant manuals</li> </ul>	E – Rare	4 – Major	Medium	Unlikely
6.	Lithium-ion Battery	Battery cell chemical hazard	Fault or failure and release of corrosive and/or toxic materials	<ul style="list-style-type: none"> <li>Personnel injury from burns or gas inhalation.</li> <li>Environmental damage.</li> </ul>	Potential (biophysical damage)	D – Unlikely	4 – Major	Medium	<ul style="list-style-type: none"> <li>Equipment designed to be compliant with applicable Australian/International Standards</li> <li>Preferably modular design</li> <li>Spill containment design</li> </ul>	<ul style="list-style-type: none"> <li>Material SDS to be consulted</li> <li>Emergency Response Plan to be developed to define actions in unlikely event of potential hazards</li> <li>Trained operators/maintainers</li> <li>Plant operating and maintenance procedures.</li> </ul>	E – Rare	4 – Major	Medium	Unlikely
7.	Lithium-ion Battery	Explosion hazard	HVAC failure (loss of cooling system) and/or overcharging of battery causing rapid expansion and confinement of gases	<ul style="list-style-type: none"> <li>Personnel injuries or fatalities.</li> <li>Damage / destruction of battery cell.</li> </ul>	Potential	D – Unlikely	5 – Catastrophic	High	<ul style="list-style-type: none"> <li>Batteries and associated balance of plant certified to relevant international standards (e.g. UL1976, UL9540)</li> <li>BESS installed outdoors with sufficient distance from infrastructure and people</li> </ul>	<ul style="list-style-type: none"> <li>HVAC systems correctly installed and maintained</li> <li>Safety system maintenance, testing and inspections</li> <li>Safety Management Plans</li> </ul>	E – Rare	5 – Catastrophic	Medium	Unlikely

# ADVERTISED PLAN

No.	Source	Hazard	Cause(s)	Consequence(s)	Does the Hazard Pose a Potential Off-site Significant Risk?	Current Risk			Proposed Controls – Technical / Design	Proposed Controls – Safety Management	Residual Risk			Does the Hazard Pose a Potential Off-site Significant Risk with proposed controls in place?
						Likelihood	Consequence	Risk Rating			Likelihood	Consequence	Risk Rating	
									<ul style="list-style-type: none"> <li>HVAC system to prevent the confinement of gases</li> <li>Electronic safety-related systems should be installed at both a hardware and software level, designed to applicable standards, to allow for safe isolation of electrical energy in the event of a failure</li> <li>Emergency shutdown incorporated into BESS design</li> <li>Containers/infrastructure for BESS located to be directly accessible to emergency responders</li> <li>Thermal overtemperature detection and prevention in Battery enclosure design.</li> <li>Cell overpressure detection and protection in Battery enclosure design</li> <li>Remote monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Trained operators/maintainers</li> <li>Plant operating and maintenance procedures</li> </ul>				
8.	Lithium-ion battery	Release and dispersion of flammable and toxic gases	<ul style="list-style-type: none"> <li>Fire arising from combustible materials used in the storage system</li> <li>Incomplete combustion of gases generated during initial battery cell thermal runaway phase</li> </ul>	<ul style="list-style-type: none"> <li>Personnel injury due to burns or smoke/chemical inhalation</li> <li>Environmental contamination (Hydrogen Fluoride contacts with water)</li> </ul>	Potential	C – Possible	5 – Catastrophic	Critical	<ul style="list-style-type: none"> <li>HVAC systems AS compliant.</li> <li>BESS installed outdoors</li> <li>Battery cooling systems</li> <li>Battery components isolated.</li> <li>Battery systems modular and compartmentalised to minimise damage.</li> <li>Adequate spacing of battery modules and heat shields</li> <li>Remote emergency shutdown and monitoring of the BESS</li> <li>Fire detection and protection/suppression included in the design of the BESS</li> <li>BESS designed in accordance with UL 9540</li> <li>Batteries and associated balance of plant certified and designed to Australian Standards</li> <li>Electronic safety-related systems should be installed at both a hardware and software</li> </ul>	<ul style="list-style-type: none"> <li>HVAC systems correctly installed and maintained</li> <li>Safety system maintenance, testing and inspections</li> <li>Development and implementation of safety management plans</li> <li>Trained operators/maintainers</li> <li>Plant operating and maintenance procedures</li> <li>Implementation of operating plant manuals (OPM)</li> <li>Develop and implement strategy for life of plant</li> <li>Pest control/management</li> </ul>	E – Rare	5 – Catastrophic	Medium	Unlikely

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No.	Source	Hazard	Cause(s)	Consequence(s)	Does the Hazard Pose a Potential Off-site Significant Risk?	Current Risk			Proposed Controls – Technical / Design	Proposed Controls – Safety Management	Residual Risk			Does the Hazard Pose a Potential Off-site Significant Risk with proposed controls in place?
						Likelihood	Consequence	Risk Rating			Likelihood	Consequence	Risk Rating	
								-	<ul style="list-style-type: none"> <li>level, designed to applicable standards, to allow for safe isolation of electrical energy in the event of a failure</li> <li>■ BESS design location sufficient distance from other infrastructure.</li> <li>■ 24-hour monitoring and installation of alarms.</li> <li>■ Access controls for HV areas (arc flash risk).</li> <li>■ Storage and handling of BESS/Li-batteries according to AS 4681</li> <li>■ Fire Risk Evaluation to be conducted to provide fire safety recommendation and required firefighting equipment</li> </ul>				-	
9.	Lithium-ion battery	Exposure to EMF	Differences in electric or magnetic fields around the BESS (transformer, powerlines)	Danger to personnel	Unlikely (affect local personnel)	-	-	-	-	-	-	-	-	-
10.	Lithium-ion Battery	Dropping of battery cell(s) during installation	Faulty equipment or procedure during battery installation	Personnel injury. Damage to battery cell.	Unlikely (anticipated impact on single unit cell)	-	-	-	-	-	-	-	-	-
11.	Lithium-ion Battery	Malicious damage to BESS	<ul style="list-style-type: none"> <li>■ Unauthorised access, few staff on-site</li> <li>■ Compromised cybersecurity system</li> </ul>	<ul style="list-style-type: none"> <li>■ Damage to battery cell and/or other infrastructure</li> <li>■ Electrolyte emission</li> <li>■ Electrocutation resulting in injury or fatality</li> <li>■ Mal-operation from external digital access of control systems.</li> </ul>	Potential	D – Unlikely	5 – Catastrophic	High	<ul style="list-style-type: none"> <li>■ BESS and auxiliary equipment to be surrounded by fencing as per AS 1725, locked gates and other security measures as necessary (e.g. CCTVs, continuous remote monitoring).</li> <li>■ Consultation with cybersecurity experts should also be conducted to implement appropriate security measures for the computer control systems</li> </ul>	<ul style="list-style-type: none"> <li>■ Regular and appropriate operations and maintenance covering inspections of the facilities</li> </ul>	E – Rare	5 – Catastrophic	Medium	Unlikely (except for unauthorised person from public)
12.	Transformer	Transformer arcing / fire / explosion	Insufficient insulating oil maintenance, equipment fault	Electrocutation resulting in injury or fatality. Damage to transformer. Ignition source for BESS fire.	Potential	D – Unlikely	5 – Catastrophic	High	<ul style="list-style-type: none"> <li>■ Transformers have been designed to AS2067</li> <li>■ Sufficient separation between transformers and the BESS, other transformers, and structure</li> </ul>	<ul style="list-style-type: none"> <li>■ Maintain transformer as per OEM recommended regime, including regular insulation and function testing</li> </ul>	E – Rare	5 – Catastrophic	Medium	Unlikely

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No.	Source	Hazard	Cause(s)	Consequence(s)	Does the Hazard Pose a Potential Off-site Significant Risk?	Current Risk			Proposed Controls – Technical / Design	Proposed Controls – Safety Management	Residual Risk			Does the Hazard Pose a Potential Off-site Significant Risk with proposed controls in place?
						Likelihood	Consequence	Risk Rating			Likelihood	Consequence	Risk Rating	
									<ul style="list-style-type: none"> <li>Transformers are self-bundled.</li> <li>Using dry type transformer is recommended</li> <li>Fire modelling or full scale fire testing to be conducted as part of design to ensure fire radiation effects do not impact on adjacent infrastructure.</li> </ul>					
13.	Transformer	Loss of containment (oil)	<ul style="list-style-type: none"> <li>Maintenance operations (failure of pipe)</li> <li>Equipment fault</li> <li>Design fault/error</li> </ul>	Pool fire (if ignited). Personnel injury due to burns or smoke/chemical inhalation.	Unlikely (affect local personnel)	-	-	-	-	-	-	-	-	-
14.	Transformer	Live contact with transformer	Insufficient enclosure or barricading	Electrocution causing injury or fatality.	Unlikely (affect local personnel)	-	-	-	-	-	-	-	-	-
15.	Adjacent substation	Electrical and/or fire hazards at substation	Fire at substation	<ul style="list-style-type: none"> <li>Damage to infrastructure</li> <li>Personnel injury /fatality</li> <li>Impact to MV BESS</li> </ul>	Potential	D – Unlikely	5 - Catastrophic	High	<ul style="list-style-type: none"> <li>Substations and high voltage installations are to be designed to standards e.g., AS 2067</li> <li>Provisions to use cooling water on the battery enclosures when there is fire in surrounding areas</li> <li>Adequate separation from MV BESS to the substation site</li> </ul>	<ul style="list-style-type: none"> <li>Development and implementation of safety management plans.</li> </ul>	E – Rare	5 - Catastrophic	Medium	Unlikely
16.	Adjacent HV BESS site	Battery fire	Fire at HV BESS	<ul style="list-style-type: none"> <li>Damage to infrastructure</li> <li>Personnel injury/fatality</li> <li>Impact to MV BESS</li> </ul>	Potential	D – Unlikely	5 - Catastrophic	High	<ul style="list-style-type: none"> <li>HV BESS site is designed to standards</li> <li>Provisions to use cooling water on the battery enclosures when there is fire in surrounding areas</li> <li>Adequate separation from MV BESS to the HV BESS site</li> </ul>	<ul style="list-style-type: none"> <li>Development and implementation of safety management plans.</li> </ul>	E – Rare	5 - Catastrophic	Medium	Unlikely
17.	Switchgear	Loss of containment (sulphur hexafluoride [SF <sub>6</sub> ]).	Maintenance operations (failure of pipe). Equipment fault. Design fault/error.	<ul style="list-style-type: none"> <li>Release of toxic gas.</li> <li>Personnel injury.</li> </ul>	No (in terms of off-site risk)	-	-	-	-	-	-	-	-	-
18.	Switchgear	Outdoor switchgear failure	Arc-flashing induced fire	<ul style="list-style-type: none"> <li>Damage to infrastructure</li> <li>Electrocution</li> </ul>	Potential	D – Unlikely	5 - Catastrophic	High	<ul style="list-style-type: none"> <li>Adequate separation between switchgear and BESS.</li> <li>The design should comply with the Electricity Supply Act 1995</li> </ul>	<ul style="list-style-type: none"> <li>Regular maintenance and testing of switchgear functionality</li> </ul>	E – Rare	5 – Catastrophic	Medium	Unlikely

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No.	Source	Hazard	Cause(s)	Consequence(s)	Does the Hazard Pose a Potential Off-site Significant Risk?	Current Risk			Proposed Controls – Technical / Design	Proposed Controls – Safety Management	Residual Risk			Does the Hazard Pose a Potential Off-site Significant Risk with proposed controls in place?
						Likelihood	Consequence	Risk Rating			Likelihood	Consequence	Risk Rating	
				<ul style="list-style-type: none"> <li>Personnel injury/fatality</li> <li>Impact to MV BESS</li> </ul>					<ul style="list-style-type: none"> <li>and AS 62271 High-voltage switchgear and controlgear.</li> <li>AS 5139: 2019 Electrical installations - Safety of battery systems for use with power conversion equipment should be consulted for design.</li> <li>Consequence identification and analysis or full scale fire testing to ensure fire radiation effects do not impact on adjacent infrastructure.</li> </ul>					
19.	Switchgear	Outdoor switchgear failure	<ul style="list-style-type: none"> <li>Operation failure causing continued arcing</li> <li>Surge arrester failure</li> <li>Switchgear insulator failure</li> </ul>	<ul style="list-style-type: none"> <li>Damage to infrastructure</li> <li>Electrocution</li> <li>Personnel injury/fatality</li> </ul>	No (in terms of off-site risk)	-	-	-	-	-	-	-	-	-
20.	Natural Hazard	Grass or scrub fire Stray ember induced fire	<ul style="list-style-type: none"> <li>Bushfire</li> <li>Hot work</li> <li>Lightning strike</li> <li>Vandalism</li> </ul>	<ul style="list-style-type: none"> <li>Damage to BESS.</li> <li>Significant environmental damage.</li> </ul>	Potential	D – Unlikely	4 – Major	Medium	<ul style="list-style-type: none"> <li>20 m wide defensible space surrounding the BESS development footprint</li> <li>Minimum 20 kL water tank or other reticulated water source designed in accordance with the requirements of AS 2149.1 and in with CFA for fire-fighting purposes</li> <li>Remote monitoring</li> <li>BESS and auxiliary equipment to be surrounded by fencing as per AS 1725, locked gates and other security</li> <li>Lightning protection design for BESS and electrical equipment, transformers etc.</li> <li>Fire modelling or full scale fire testing to be conducted as part of design to ensure fire radiation effects do not impact on adjacent infrastructure</li> <li>Fire Safety Study during detailed design</li> <li>Fire Risk Evaluation to be conducted to provide fire</li> </ul>	<ul style="list-style-type: none"> <li>Development and implementation of safety management plans (e.g., permit to work)</li> </ul>	E – Rare	4 – Major	Medium	Unlikely

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No.	Source	Hazard	Cause(s)	Consequence(s)	Does the Hazard Pose a Potential Off-site Significant Risk?	Current Risk			Proposed Controls – Technical / Design	Proposed Controls – Safety Management	Residual Risk			Does the Hazard Pose a Potential Off-site Significant Risk with proposed controls in place?
						Likelihood	Consequence	Risk Rating			Likelihood	Consequence	Risk Rating	
									safety recommendation and required firefighting equipment					
21.	Natural Hazard	Extreme temperature/humidity	<ul style="list-style-type: none"> <li>Extreme temperatures attributable to climate change</li> <li>Fire propagation due to high winds</li> </ul>	<ul style="list-style-type: none"> <li>Personnel injury due to burns or smoke/chemical inhalation.</li> <li>Damage/ destruction of battery cell.</li> </ul>	Potential	D – Unlikely	4 – Major	Medium	<ul style="list-style-type: none"> <li>Batteries designed to operate beyond maximum temperature range with allowance for higher maximum temperatures of approximately 1.5 to 2°C to account for the likely effects of global warming.</li> <li>Wind speed to be considered in BESS design and safe separation</li> </ul>	-	E – Rare	4 – Major	Medium	Unlikely
22.	Natural Hazard	Seismic events	Failure to design the BESS to the correct earthquake loading code to account for seismic activity	Damage to battery casings, cells and other infrastructure.	Potential	D – Unlikely	4 – Major	Medium	<ul style="list-style-type: none"> <li>Monitoring of seismic information to be informed of any increase in risk</li> <li>Setback distances from falling objects (trees and powerlines)</li> <li>With regard to seismic activity, the site and proposed infrastructure will be assessed in accordance with AS 1170.4 – 2007 Structural Design Actions Part 4: Earthquake actions in Australia.</li> </ul>	<ul style="list-style-type: none"> <li>Emergency response plan</li> </ul>	E – Rare	4 – Major	Medium	Unlikely
23.	Natural Hazard	Flooding	<ul style="list-style-type: none"> <li>Drainage system failure</li> <li>Fire-fighting activity</li> <li>Failure to account for flooding during foundation construction</li> <li>Location of the site within a flood plain area.</li> </ul>	<ul style="list-style-type: none"> <li>Damage to battery casings, cells and other infrastructure.</li> <li>Environmental damage</li> </ul>	Potential	D – Unlikely	4 – Major	Medium	<ul style="list-style-type: none"> <li>Surface Water and Groundwater Assessment to be conducted to determine special flood considerations</li> <li>Provision for water retention facility</li> </ul>	<ul style="list-style-type: none"> <li>Schedule construction during dry season, account for light and heavy vehicles in heavy rain/flooding events.</li> </ul>	E – Rare	4 – Major	Medium	Unlikely
24.	Natural Hazard	Extreme wind	Failure to design the BESS to account for extreme wind or hail events	Damage to battery casings, cells and other infrastructure.	Potential	D – Unlikely	4 – Major	Medium	<ul style="list-style-type: none"> <li>The buildings within the BESS facility should be designed in accordance with AS/NZS 1170.2.2021 – Structural Design Actions – Wind Actions.</li> </ul>	-	E – Rare	4 – Major	Medium	Unlikely
25.	Natural hazard	Ambient weather (lightning)	Failure to design the BESS to the correct isokeraunic level to	<ul style="list-style-type: none"> <li>Personnel injuries due to burns or smoke/chemical</li> </ul>	Potential	D – Unlikely	4 – Major	Medium	<ul style="list-style-type: none"> <li>Conduct a lightning protection study.</li> </ul>	-	E – Rare	4 – Major	Medium	Unlikely

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No.	Source	Hazard	Cause(s)	Consequence(s)	Does the Hazard Pose a Potential Off-site Significant Risk?	Current Risk			Proposed Controls – Technical / Design	Proposed Controls – Safety Management	Residual Risk			Does the Hazard Pose a Potential Off-site Significant Risk with proposed controls in place?
						Likelihood	Consequence	Risk Rating			Likelihood	Consequence	Risk Rating	
			account for lightning strikes.	inhalation and/or fatalities. ■ Damage/ destruction of battery cell.					<ul style="list-style-type: none"> <li>Ensure no BESS equipment is located underneath powerlines.</li> <li>Implement an earthing system.</li> <li>Design the BESS facility lightning protection in accordance with AS 1768</li> </ul>					
26.	Natural Hazard	Subsidence	Underground mining	Ground instability resulting in damage to BESS units and infrastructure.	Potential	D – Unlikely	4 – Major	Medium	<ul style="list-style-type: none"> <li>Geotechnical studies.</li> <li>Other design mitigations (e.g. grouting) will be determined during detailed design if infrastructure cannot be located away from such areas</li> </ul>	-	E – Rare	4 – Major	Medium	Unlikely
27.	Other	Loss of containment (contaminated water)	<ul style="list-style-type: none"> <li>Spent fire water runoff.</li> <li>Runoff from site.</li> <li>Failure of process waste piping.</li> </ul>	Harm to the environment (flora and fauna).	Potential	C – Possible	3 – Moderate	Medium	<ul style="list-style-type: none"> <li>Installation of oily water interceptors.</li> <li>Design and Installation of containment infrastructure/impervious retention facilities, ponds and such with adequate capacity.</li> <li>Bunded transformers.</li> <li>Use of mineral oils.</li> <li>Use of synthetic insulating oils (Non-Dangerous Goods, less environmentally hazardous).</li> </ul>	<ul style="list-style-type: none"> <li>Stormwater Management Plan.</li> <li>Operations and maintenance of retention facilities/ponds.</li> <li>Continuous monitoring and alarms.</li> <li>Emergency response plan/procedure</li> </ul>	E – Rare	3 – Moderate	Low	Unlikely
28.	Other	Exposure to contaminated land	Construction activities exposing contaminated material from legacy works	Harm to personnel and the environment.	Potential	D – Unlikely	3 – Moderate	Medium	-	<ul style="list-style-type: none"> <li>Identification and testing of any contaminated land.</li> <li>Development and implementation of procedure for removal of contaminated land and remediation.</li> <li>Removal of contaminated land before construction.</li> <li>Tracking of contaminated land removal.</li> </ul>	E – Rare	3 – Moderate	Low	Unlikely
29.	Other	Vehicle collision / congestion	<ul style="list-style-type: none"> <li>Construction activities (increased heavy vehicles)</li> <li>Driver fatigue</li> </ul>	Personnel injury/fatality.	Potential	D – Unlikely	5 – Catastrophic	High	-	<ul style="list-style-type: none"> <li>Traffic Management Plan, including fatigue management.</li> </ul>	E – Rare	5 – Catastrophic	Medium	Unlikely

No.	Source	Hazard	Cause(s)	Consequence(s)	Does the Hazard Pose a Potential Off-site Significant Risk?	Current Risk			Proposed Controls – Technical / Design	Proposed Controls – Safety Management	Residual Risk			Does the Hazard Pose a Potential Off-site Significant Risk with proposed controls in place?
						Likelihood	Consequence	Risk Rating			Likelihood	Consequence	Risk Rating	
30.	Other	Loss of containment (waste / fuel)	Commissioning activities.	Harm to personnel and the environment.	Potential	D – Unlikely	3 – Moderate	Medium	<ul style="list-style-type: none"> <li>BESS and auxiliary equipment to be surrounded by fencing as per AS 1725, locked gates and other security</li> <li>Fuel storage and handling as per AS 1940</li> </ul>	<ul style="list-style-type: none"> <li>Waste Management Plan</li> <li>Construction Waste Management Plan</li> <li>Emergency response plan</li> </ul>	E – Rare	3 – Moderate	Low	Unlikely
31.	Other	Loss of containment (e.g. refrigerant)	Vandalism of battery units.	Harm to personnel and the environment.	Potential	D – Unlikely	3 – Moderate	Medium	<ul style="list-style-type: none"> <li>BESS and auxiliary equipment to be surrounded by fencing as per AS 1725, locked gates and other security</li> <li>Enclosures doors locked</li> </ul>	<ul style="list-style-type: none"> <li>Waste Management Plan</li> <li>Construction Waste Management Plan</li> </ul>	E – Rare	3 – Moderate	Low	Unlikely
32.	Other	Exposure to high voltages	Construction, installation, and commissioning activities in the vicinity of existing substation and switchyard	Electrocution causing injury or fatality.	Unlikely	-	-	-	-	-	-	-	-	-

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