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Designing Bushfire Protection Measures

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Bush Fire Assessment Report

in relation to the proposed construction, operation and maintenance of a Battery Energy Storage System (BESS) at:

Lot 3 DP 1018958, Lot 4 DP 1016725, Lot 3 DP1181412, Lot 3 DP 1226927 and Lot 4 DP 1226927
1 Main Street Wallerawang

(project site)

Contents

Contents 2

Executive Summary 6

Compliance Summary 7

List of Abbreviations 8

1. Introduction 9

2. Purpose of this Report 9

3. Location 10

4. Bush Fire Prone Land Map 11

4.1 Vegetation Category 1 11

4.2 Vegetation Category 2 11

4.3 Vegetation Category 3 11

5. Property Description 13

5.1 Zoning 13

5.2 Biodiversity Values 15

5.3 The Proposal 15

6. Site Assessment 16

7. Bush Fire Attack Assessment 16

7.1 Determine Vegetation Formations 16

7.2 The effective slope 20

7.3 Fire Weather 23

7.4 Determination of APZs 24

7.5 Proposed Class 5 – 8 buildings 24

7.6 Proposed Class 10b structures 25

8. Objectives of PBP Chapter 1 27

9. Objectives of PBP Chapter 8 29

10. Risk of Fire with Large Scale Battery Systems....33
11. Construction Requirements....33
12. Recommendations....34
13. Summary....37
14. References....39
15. Legislation....40
Appendix 1 – Operational Footprint Plan....41
Appendix 2 – Construction Plan....42
Appendix 3 – Photos of Site and Surrounds....43
Appendix 4 – PBP Turning Head Requirements....52

Document Tracking

Item	Detail
Project Name	Bush Fire Assessment Report, proposed construction, operation and maintenance of a Battery Energy Storage System (BESS)
Project Address	Lot 3 DP 1018958, Lot 4 DP 1016725, Lot 3 DP1181412, Lot 3 DP 1226927 and Lot 4 DP 1226927 1 Main Street Wallerawang
Client Name	ARCADIS Design & Consulting
Project Number	21/0264
Plan Reference	Operational Footprint Plans by Arcadis Design and Consulting Dated 18/06/2021
Prepared by	Warwick Fear
Approved by	Catherine Gorrie
BAL	N/A as AS3959-2018 is not a set of deemed to satisfy provisions for this non-residential development

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It should be borne in mind that the measures recommended in this report cannot guarantee that a building will survive a bushfire event on every occasion. This is due to the degree of vegetation management, the unpredictable behaviour of bushfires and extreme weather conditions. As such, the author is not liable to any person for any damage or loss whatsoever which has occurred or may occur in relation to the person taking action or not taking action based on the recommendations of this report.

NOTE: This bush fire assessment shall remain valid for 12 months from the date of issue.

Executive Summary

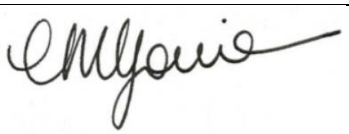
Bushfire Consulting Services was commissioned by ARCADIS Design & Consulting to provide a bush fire assessment for the proposed construction, operation and maintenance of a Battery Energy Storage System (BESS) at Lot 3 DP 1018958, Lot 4 DP 1016725, Lot 3 DP1181412, Lot 3 DP 1226927 and Lot 4 DP 1226927, 1 Main Street Wallerawang. The project site is mapped as designated bush fire prone land by Lithgow Council and is located within 100 metres of bush fire prone (hazardous) vegetation.

The proposal is a form of "other non-residential" development and, as such, this report makes recommendations in accordance with the aim and objectives of Chapter 1 and 8 of the NSW RFS document '*Planning for Bush Fire Protection*' (PBP) (NSWRFS 2019). The recommendations address these objectives including:

- afford buildings and their occupants protection from exposure to a bush fire
- provide for a defendable space to be located around buildings
- provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings
- ensure that appropriate operational access and egress for emergency service personnel and occupants is available
- provide for ongoing management and maintenance of Bush Fire Protection Measures (BPMs)
- ensure that utility services are adequate to meet the needs of firefighters
- Provide safe access to/from the public road system for firefighters providing property protection during a bush fire and for occupant egress for evacuation
- Provide suitable emergency and evacuation (and relocation) arrangements for occupants of the development
- Provide adequate services of water for the protection of buildings during and after the passage of bush fire, and to locate gas and electricity so as not to contribute to the risk of fire to a building
- Provide for the storage of hazardous materials away from the hazard wherever possible

Where all recommendations are implemented, the report concludes that the proposal can comply with the aim and objectives of PBP.

Compliance Summary

This Assessment has been Certified by: Catherine Gorrie BPAD-Level 3 Accredited Practitioner FPAA Cert No: BPAD20751	
Does this development comply with the aim and objectives of PBP?	Yes
Is referral to the NSW Rural Fire Service (RFS) required?	Yes

List of Abbreviations

APZ	Asset Protection Zone
AS3959	Australian Standard 3959 – 2018, *Construction of Buildings in Bushfire Prone Areas*
BAL	Bushfire Attack Level
BPAD	Bushfire Planning and Design (Accreditation Scheme)
BPMs	Bushfire Protection Measures
BPLM	Bushfire Prone Land Map
Council	Lithgow Council
CDC	Complying Development Certificate
DA	Development Application
DEM	Digital Elevation Model
EP&A Act	*Environmental Planning and Assessment Act – 1979*
FDI	Fire Danger Index
FPAA	Fire Protection Association of Australia
IPA	Inner Protection Area
kW/m^2	Kilowatts per metre squared
LiDAR	Light Detection and Ranging
LPMA	Land & Property Management Authority
NCC	National Construction Code
OPA	Outer Protection Area
PBP	*Planning for Bush Fire Protection 2019*
RF Act	*Rural Fires Act – 1997*
RFS	NSW Rural Fire Service
SEPP	State Environmental Planning Policy
SIX	Spatial Information Exchange
SWS	Static Water Supply

1. Introduction

This report has been commissioned by ARCADIS Design & Consulting to provide a bush fire assessment for the proposed construction, operation and maintenance of a Battery Energy Storage System (BESS) at Lot 3 DP 1018958, Lot 4 DP 1016725, Lot 3 DP1181412, Lot 3 DP 1226927 and Lot 4 DP 1226927, 1 Main Street Wallerawang.

The subject property is "bushfire prone land" as per the local Council bushfire prone land map (Figure 4) as defined by section 10.3 (s10.3) of the *Environmental Planning & Assessment Act* (EP&A) 1979 and therefore the requirements stipulated by legislation apply to any new development on the site.

Planning for Bush Fire Protection 2019 (Chapter 8) describes this type of development as "other non-residential development" and therefore the aim and objectives of Chapter 1 and 8 of PBP are applicable.

The bush fire assessment and recommendations are derived from the Rural Fire Service document *Planning for Bush Fire Protection 2019*.

2. Purpose of this Report

The purpose of this report is to provide the owners, the Consent Authority, the Certifier and the Rural Fire Service with a description of the proposed development as well as the vegetation type, slope and any other factors influencing the likely bushfire behaviour, sufficient to show that the development will be protected from the likely bushfire threat as outlined in current legislation.

This assessment includes an analysis of the hazard, threat and subsequent risk to the development and provides recommendations that satisfy the aim and objectives of Planning for Bush Fire Protection.

3. Location

The project site (the site) is located and known as Lot 3 DP 1018958, Lot 4 DP 1016725, Lot 3 DP1181412, Lot 3 DP 1226927 and Lot 4 DP 1226927, 1 Main Street Wallerawang. The site is a part of the greater Greenspot 2845 Activity Hub located within the lands of the decommissioned Wallerawang Power Station. The property is part of the Lithgow local government area.

Figure 1. Location Map. Source: Arcadis (2021a)

4. Bush Fire Prone Land Map

Bush fire prone land maps are created by local Councils at the request and direction of the NSW RFS. The NSW RFS offers guidance to Councils for map creation via the document 'Guide for Bushfire Prone Land Mapping' (2015). Per the Guide:

4.1 Vegetation Category 1

Vegetation Category 1 is considered to be the highest risk for bush fire. It is represented as red on the bush fire prone land map and will be given a 100m buffer. This vegetation category has the highest combustibility and likelihood of forming fully developed fires including heavy ember production. Vegetation Category 1 consists of areas of forest, woodlands, heaths (tall and short), forested wetlands and timber plantations.

4.2 Vegetation Category 2

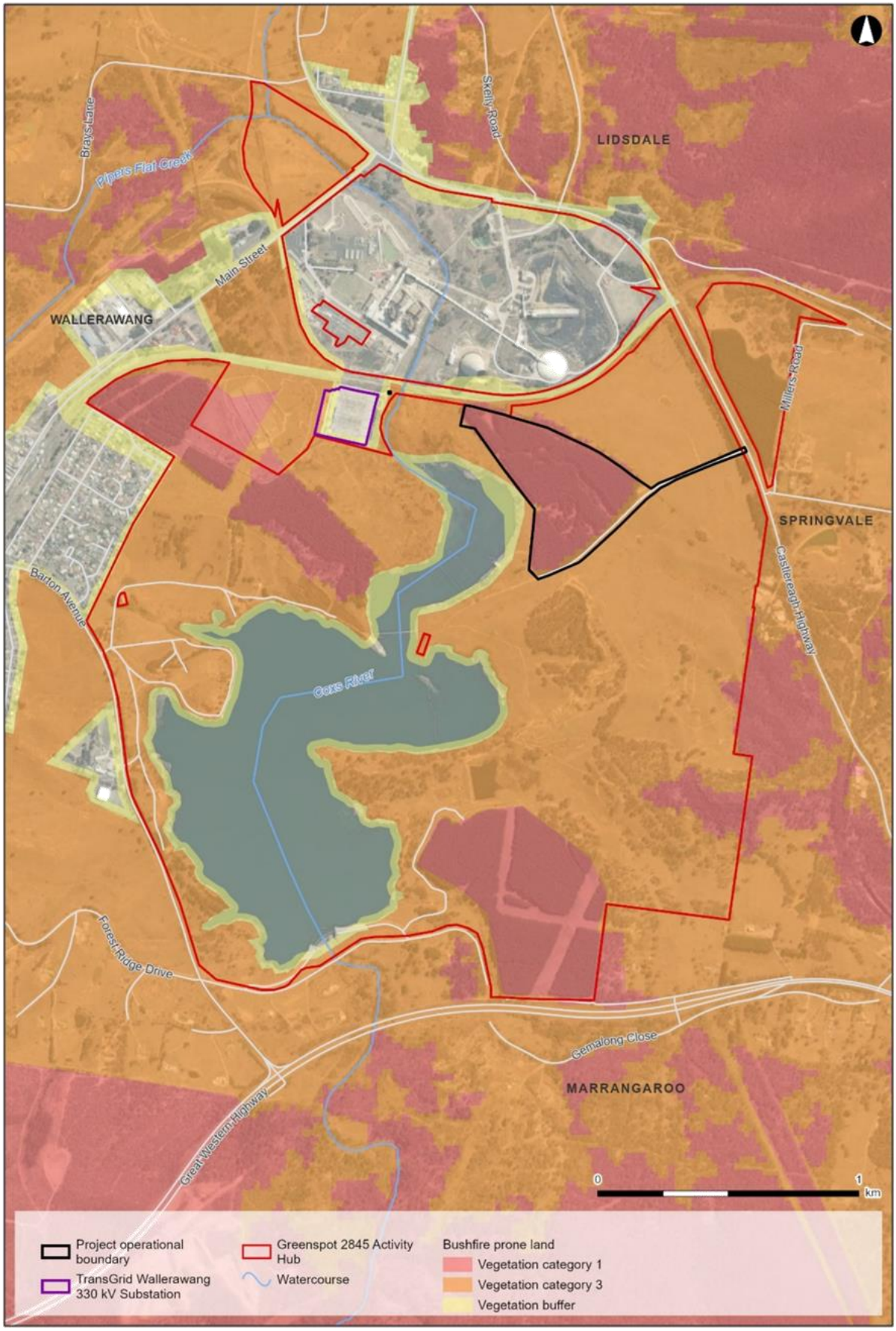
Category 2 vegetation typically consists of Rainforests and other lower risk vegetation parcels such as isolated remnant areas of vegetation and urban reserves. The 30m and 100m vegetation buffers indicated above are typically shown as pale yellow on Bush Fire prone Land Map.

4.3 Vegetation Category 3

Vegetation Category 3 is considered to be medium bush fire risk vegetation. It is higher in bush fire risk than Category 2 (and the excluded areas) but lower than Category 1. It is represented as dark orange on a Bush Fire Prone Land map and will be given a 30 metre buffer. This category consists of:

› Grasslands, freshwater wetlands, semi-arid woodlands, alpine complex and arid shrublands.

Figure 3. Bushfire Prone Land Map. Source: Arcadis (2021b)



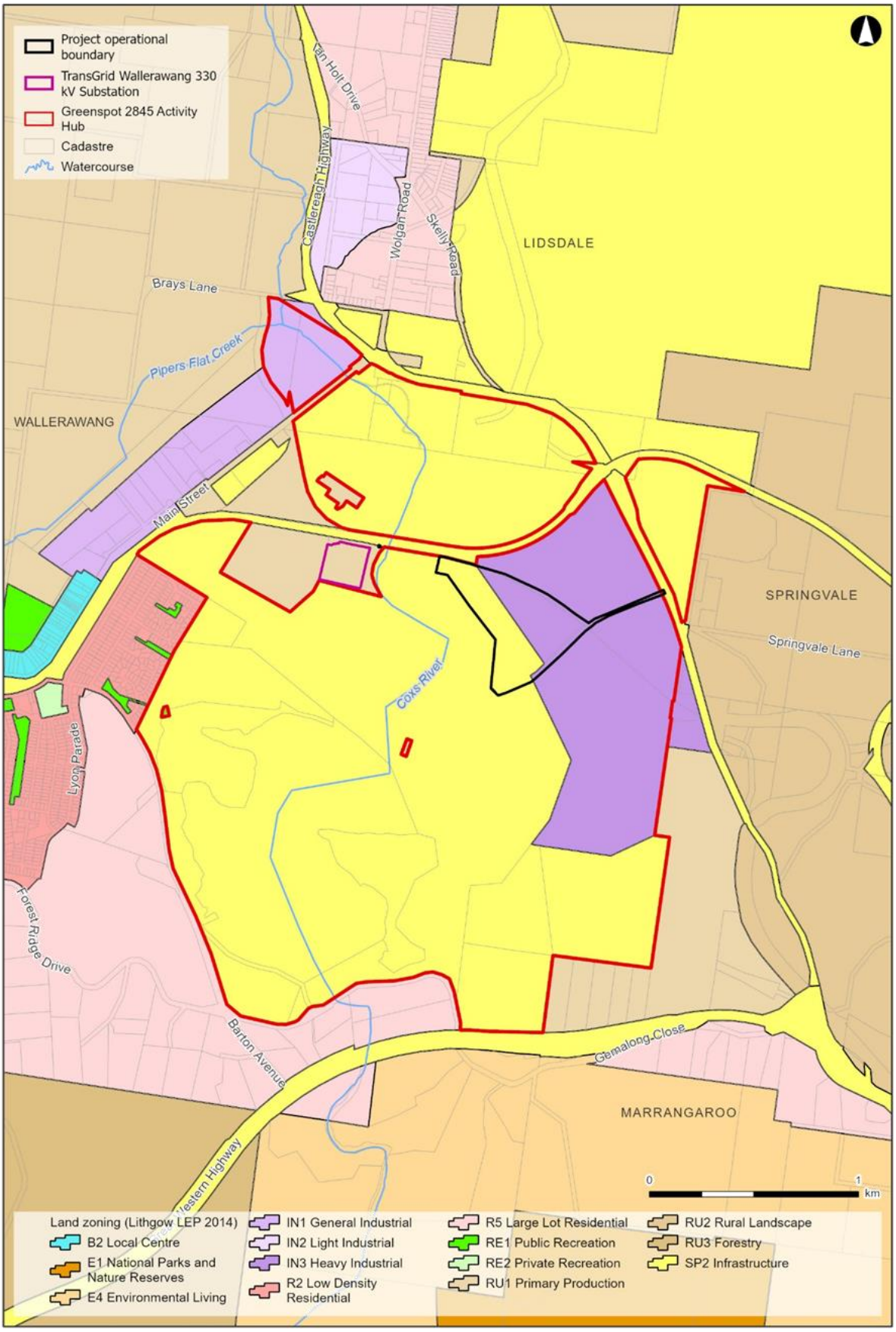
5. Property Description

The project site is comprised of Lot 3 DP 1018958, Lot 4 DP 1016725, Lot 3 DP1181412, Lot 3 DP 1226927 and Lot 4 DP 1226927, 1 Main Street Wallerawang, covering approximately 208 ha in area (Figure 2). It is bounded by the Main Western Railway line and private allotments to the approximate north, the Castlereagh Highway to the approximate east, and private allotments to the approximate south and west. It currently contains a number of residual buildings and structures associated with the former Wallerawang Power Station. The site of the proposed BESS facility is approximately 10 ha in area and is located on land which is subject to a Pine Plantation Deed that is to be harvested by NSW Forestry.

5.1 Zoning

The land is zoned IN3 - Heavy Industrial, SP2 – Infrastructure and RU1 - Primary Production under Lithgow Local Environmental Plan 2014. Adjacent lands to the approximate east are zoned similarly. Adjacent lands to the approximate north are zoned SP2 – Infrastructure, adjacent lands to the approximate south are zoned SP2 – Infrastructure and R5 – Large Lot Residential, and adjacent lands to the approximate west are zoned SP2 – Infrastructure and R2 – Low Density Residential (Figure 4).

Figure 4. Zoning Map. Source: Arcadis (2021c)



5.2 Biodiversity Values

A search of the NSW Office of Heritage and Environment and Heritage's Biodiversity Values Map (NSW Government 2021c) has been carried out and has not revealed any high biodiversity values on the land.

5.3 The Proposal

The proposal is for the construction, operation and maintenance of a Battery Energy Storage System (BESS). The proposal includes the construction of the BESS, a new office building and carpark, a new switchyard and a 20000 L water tank, together comprising the BESS Facility. A new 330 kV transmission corridor and associated infrastructure is proposed to the west of the BESS Facility to connect the BESS to the electricity grid via the existing TransGrid 330 kV substation. In terms of the National Construction Code (NCC), the classification of the proposed buildings include a Class 5 office, a Class 7a carpark and a Class 10b water tank. The BESS, switchyard and transmission line components are considered to be NCC Class 10b.

The NCC itself is a uniform set of technical provisions for the design, construction and performance of buildings and plumbing and drainage systems throughout Australia (NSW Government 2021d). It is published and maintained by the Australian Building Codes Board, on behalf of and in collaboration with the Australian Government and each State and Territory Government.

The NCC is made up of the:

- Building Code of Australia (BCA), being Volumes One and Two (given effect through the *Environmental Planning and Assessment Act 1979*)
- Plumbing Code of Australia, being Volume Three (given effect through the *Plumbing and Drainage Act 2011*).

At the time of writing, detailed plans for the proposed buildings and structures were not available. It was also not known whether the proposed 330 kV transmission line corridor would contain aerial or underground conductors. This report is therefore based upon the proposed operational footprint plan shown in Appendix 1 and assumes that any electrical conductors will be aerial.

6. Site Assessment

Bushfire Consulting Services Pty Ltd attended the site on 26 March 2021. The assessment relates to the new development shown in the operational footprint plans (reference Appendix 1 below). The NSW Spatial Services mapping website has also been used as a reference (NSW Government 2021a), and '*Ocean Shores to Desert Dunes*' by David Keith (Keith 2004), in determining the vegetation type.

7. Bush Fire Attack Assessment

7.1 Determine Vegetation Formations

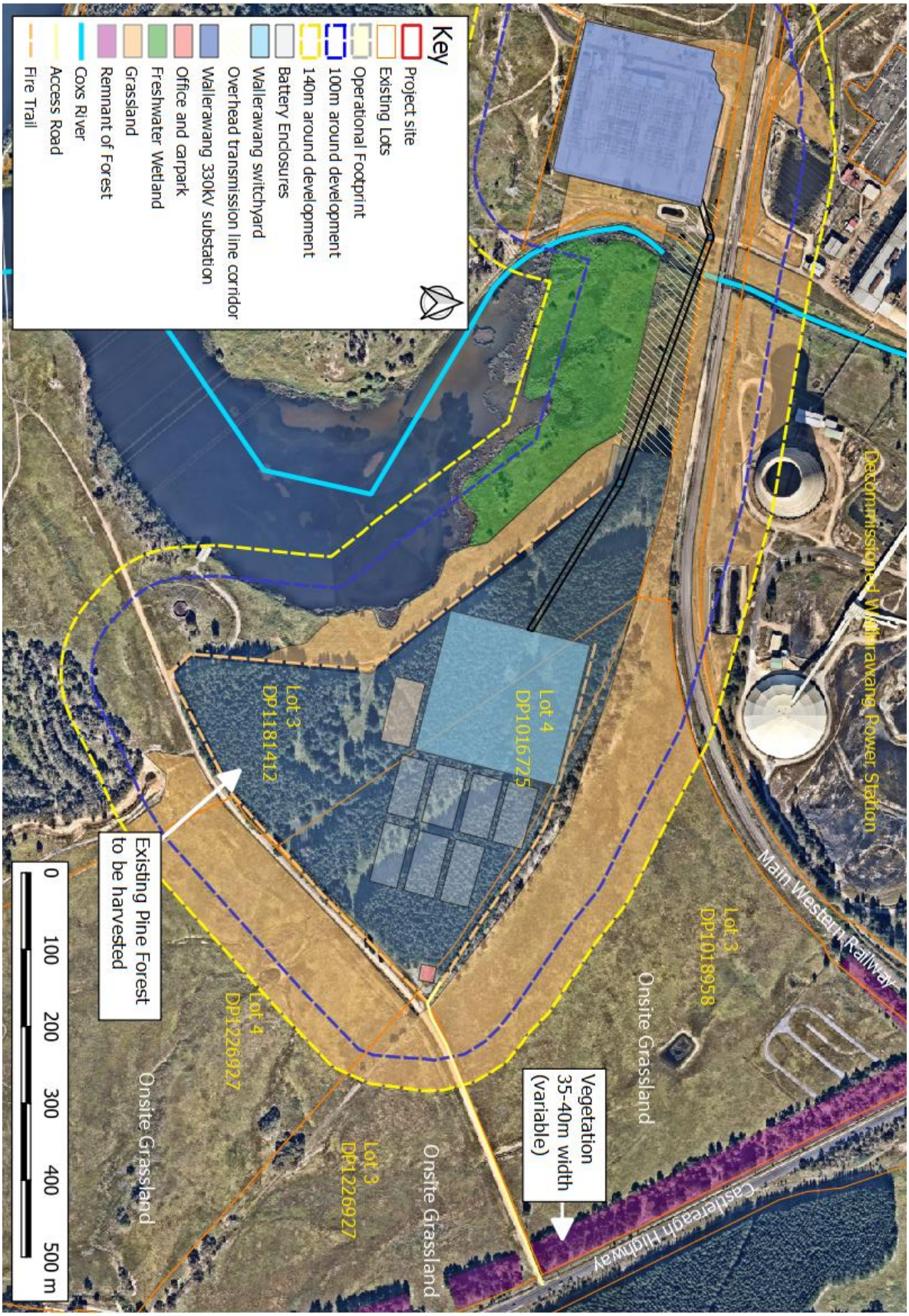
The hazardous vegetation formations for each aspect of the development within 140m of the proposed assets have been identified according to Keith (2004). The bushfire threat emanates from bushland located to the north, east, south and west of the proposal. This includes vegetation predominantly within the boundaries of the Project Site, with some hazard vegetation existing on the northern side of the Main Western Railway Line.

At the time of site inspection, the proposed site of the BESS Facility and the eastern section of the proposed 330 kV transmission line corridor represented a pine forest. It is understood that the forest is subject to a Pine Plantation Deed and is to be harvested by NSW Forestry in its entirety. The ground is then to be subject to tree stump and residual vegetation removal for the development of the Facility. It is therefore considered that the area of the existing pine forest will not represent hazard vegetation for the purposes of the proposal.

Based on a site inspection and determination of vegetation formation using the Keith (2004) Identification Key, the primary bushland vegetation having the potential to affect the subject buildings within the BESS facility is most representative of Grassland in all directions. An area of Freshwater Wetlands surrounding the Cox's River exists at distances greater than 100m to the west of the BESS facility, located within and to the south of the proposed 330 kV transmission line corridor.

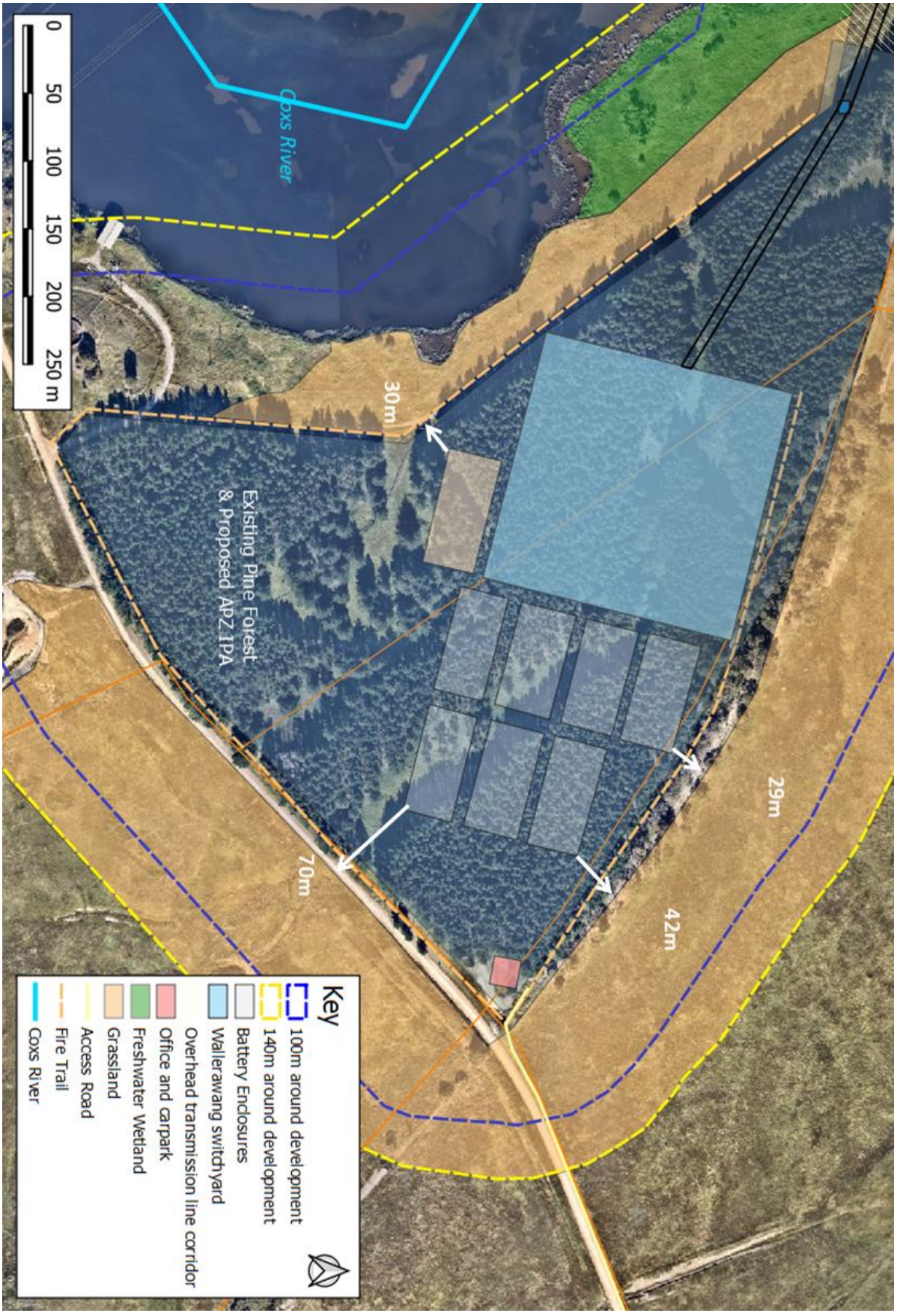
A remnant area of vegetation, approximately 35-40m in width and variable, exists along the east boundary of Lot 3 in DP1018958 and Lot 3 in DP1226927 adjacent to the Castlereagh Highway. Per PBP section A1.11.1, remnant vegetation is a parcel of vegetation with a size of less than 1 Ha or a shape that provides a potential fire run not exceeding 50m that could threaten buildings. These remnants are considered a low hazard and any Asset Protection Zone (APZ) setbacks and building construction standards for these may be the same as for Rainforests. This vegetation is of little significance to the BESS Facility as it lies approximately 300m (>100m) to the east, however the proposed main entrance and primary access road to the Facility pass through this area. Figures 5 and 6 below illustrate the hazard vegetation as it relates to the proposal.

Figure 5. Hazardous vegetation affecting the proposal operational footprint. Source: NearMap (2021) with overlays by BFCS P/L. Aerial Photography date: 14/01/2021



Vegetation was assessed to a distance of 140m from the proposal

Figure 6. Hazardous vegetation affecting the proposed BESS facility. Source: NearMap (2021) with overlays by BFCS P/L. Aerial Photography date: 14/01/2021



7.2 The effective slope

The slope of the land under the classified vegetation has a direct influence on the rate of fire spread, the intensity of the fire and the level of radiant heat flux. The effective slope of the land from the new building for a distance of 100m is derived from a site assessment combined with the most detailed contour data available. The slope is then categorised into one of following classes, relative to the location of the hazard:

all upslope vegetation (considered 0 degrees)

>0 to 5 degrees downslope vegetation

>5 degrees to 10 degrees downslope vegetation

>10 degrees to 15 degrees downslope vegetation, and

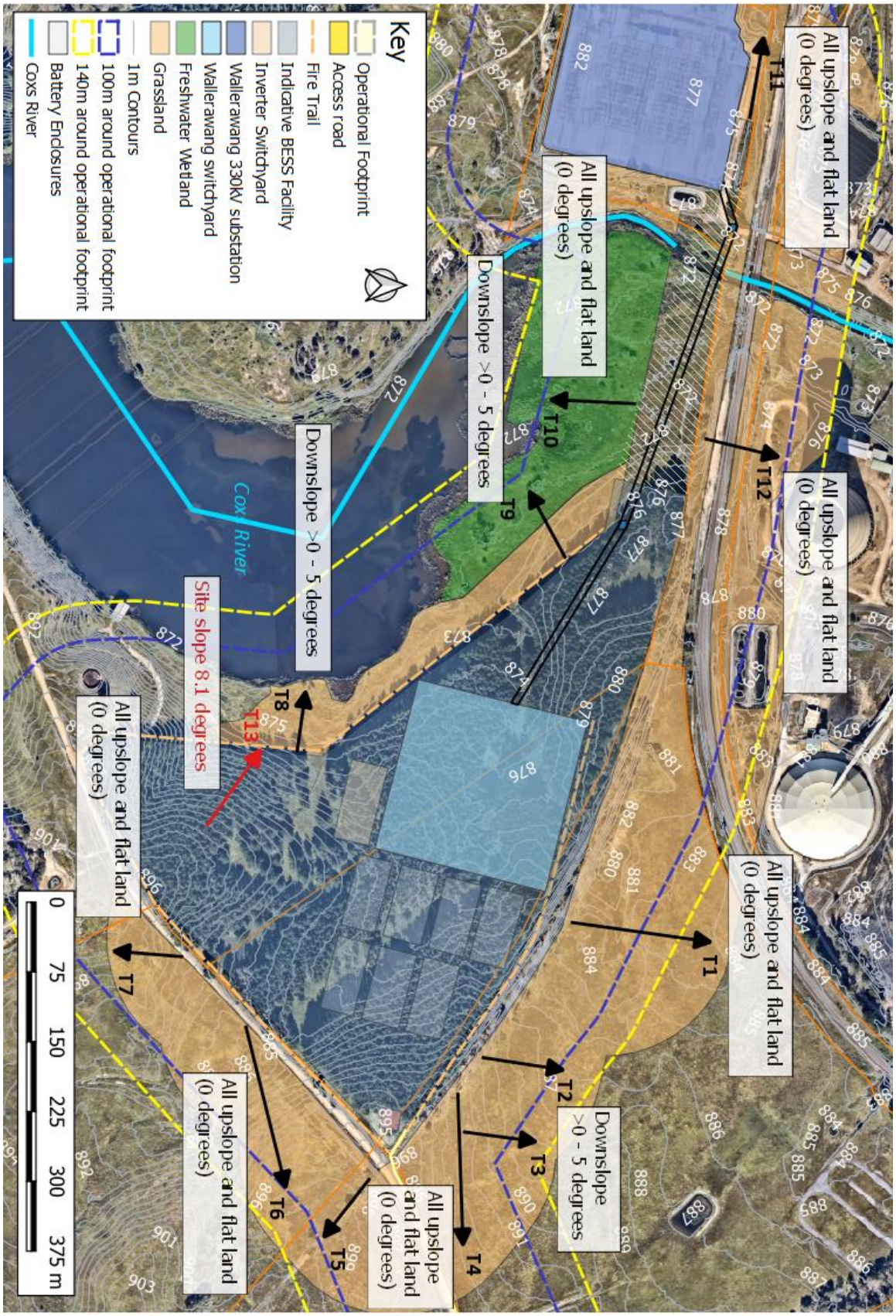
>15 degrees to 20 degrees downslope vegetation.

1m DEM data is sourced from NSW Spatial Services which is captured using LiDAR and has a horizontal accuracy of 0.3m and vertical accuracy of 0.8m at 95%.

The effective slope influences the rate of fire spread, the intensity of the fire and the level of radiant heat flux on an asset. For example, fires tend to race more quickly up a vegetated slope than down a vegetated slope. As a result, this influences the size of the required APZ to mitigate the threat. Minimum PBP APZ requirements are designed to ensure that buildings will not be expected to experience radiant heat flux levels of greater than 29 kW/m^2. Radiant heat levels greater than $29kW/m^2$ are taken to be indicative of potential flame contact, which would not meet the general aim and objectives of PBP.

The effective slope has been estimated manually on site over a distance of 100m from the proposed development where accessible, under the classified vegetation community constituting the hazard. The slope was found to be consistent with the topographical information from NSW Spatial Services LiDAR data (Figure 7).

Figure 7. Slope Diagram. Source: NearMap (2021) and LiDAR (NSW Government 2021a) with overlays by BFCS P/L: Aerial Photography Date: 14/01/2021



1m contours. Transect numbers are indicated (see Table 1 below)

Table 1. Slope Analysis

Transect number	Slope calculation	Direction from proposal element	PBP Slope Description
T1	*((884 - 883)/147) x 1/tan = 0.4°upslope*	North of Wallerawang switching yard	All upslope and flat land (0°)
T2	*((890 - 886)/91) x 1/tan = 3.1° downslope*	North of BESS	Downslope >0 - 5°
T3	*((892 - 888)/78) x 1/tan = 2.9° downslope*	Northeast of carpark and offices	Downslope >0 - 5°
T4	*((893 - 892)/174) x 1/tan = 0.3° upslope*	East of BESS (1)	All upslope and flat land (0°)
T5	*((900 - 898)/75) x 1/tan = 1.5° upslope*	Southeast of carpark and offices	All upslope and flat land (0°)
T6	*((898 - 887)/129) x 1/tan = 4.9° upslope*	East of BESS (2)	All upslope and flat land (0°)
T7	*((896 - 891)/70) x 1/tan = 4.1° upslope*	South of BESS	All upslope and flat land (0°)
T8	*((875 - 872)/70) x 1/tan = 2.5° downslope*	West of BESS	Downslope >0 - 5°
T9	*((876 - 872)/84) x 1/tan = 2.7° downslope*	West of 330 kV transmission line corridor	Downslope >0 - 5°
T10	*((872 - 872)/123) x 1/tan = 0° (approximately level)*	South of 330 kV transmission line corridor	All upslope and flat land (0°)
T11	*((878 - 875)/96) x 1/tan = 1.8° upslope*	West of connection to TransGrid 330 kV substation	All upslope and flat land (0°)
T12	*((876 - 873)/80) x 1/tan = 2.1° upslope*	North of 330 kV transmission line corridor	All upslope and flat land (0°)
T13	*((890 - 876)/98) x 1/tan = 8.1° (downslope to NW)*	Site slope (greatest) under proposed APZ	8.1° *(downslope to NW, <18°)*

7.3 Fire Weather

The development is located in the Lithgow Council area, a part of the Central Ranges Region, which has a Forest Fire Danger Index (FFDI) of 80.

The McArthur Forest Fire Danger Index (FFDI) is essentially a score from 0 to 100 that measures the relative degree of danger of fire in Australian Forests, based upon climate conditions. The FFDI is calculated using the parameters of air temperature, relative humidity, average wind speed and the Keech-Byram Drought Index, available from the Bureau of Meteorology. For example, an FFDI of 100+ represents 'Catastrophic' conditions, whereas an FFDI of 80 represents 'Extreme' (lower than Catastrophic) conditions.

PBP typically assigns worst-case FFDIs to a region based upon 1 in 50 year climate events that have been determined from historical data. Where FFDI 80 is assigned to a region this is realistically the expected worst-case scenario from a climate perspective. If a region has an FFDI of 80 then this means that the potential threat to buildings and occupants is less than if the worst-case FFDI was 100. As a result, the separation distances between assets and hazard for a given predicted radiant heat level (eg. 29 kW/m^2) in an FFDI 80 region may be less than for a region with FFDI 100. This is because the fire intensity, rate of spread etc of fires burning under the different worst-case conditions will also vary.

For calculation of the relative danger afforded by Grassland vegetation the Grassland Fire Danger Index (GFDI) is used. The GFDI is calculated a little differently to the FFDI and requires inputs including air temperature, relative humidity, wind speed, and the degree of fuel curing (as this will vary typically according to season).

PBP section 7.9 indicates that where Grassland APZ requirements are provided in PBP Appendix 1 Tables (such as Table A1.12.3), the distances are based upon the GFDI.

7.4 Determination of APZs

An Asset Protection Zone (APZ) is a fuel-reduced area surrounding a built asset or structure. An APZ provides a buffer zone between a bush fire hazard and an asset and an area of reduced bush fire fuel that allows suppression of fire. It also provides an area from which backburning or hazard reduction can be conducted and allows emergency services access as well as providing a relatively safe area for firefighters and occupants to defend a property.

7.5 Proposed Class 5 – 8 buildings

For buildings with occupants, potential building footprints should not be exposed to radiant heat levels exceeding 29kW/m^2, in order to meet PBP requirements. Where radiant heat levels of ≤29kW/m^2 can be demonstrated it is anticipated that the building will not be subject to flame contact during a bush fire. Bush fire fuels should be minimised within an APZ. This is so that the vegetation within the planned zone does not provide a path for the transfer of fire to the asset either from the ground level or through the tree canopy.

An IPA should provide a tree canopy cover of less than 15% and should be located greater than 2 metres from any part of the roofline of a building. Garden beds or flammable shrubs are not to be located under trees and should be no closer than 10m from an exposed window or door. Trees should have lower limbs removed up to a height of 2m above the ground. PBP has minimum specifications for APZs to be established around buildings to be managed as an Inner Protection Area (IPA). The specifications are based upon residential development but are broadly applicable to other habitable buildings that will have occupants, such as Class 5 offices.

To identify the appropriate APZ to avoid flame contact, the relevant FFDI (80), vegetation formation and effective slope are matched using Table A1.12.3 of PBP (below).

Table A1.12.3 of PBP – (Adapted from) Minimum distances for APZs – FFDI 80 areas (≤29kW/m², 1090K). Applicable to proposed Class 5 office

Aspect	Vegetation Classification	Slope Under Classified Vegetation	APZ required	APZ recommended
Northeast	Grassland	Downslope >0 - 5°	11m	20m
Southeast	Grassland	All upslope and flat land (0°)	10m	20m
Southwest	N/A	N/A	N/A	N/A
Northwest	N/A	N/A	N/A	N/A

In this instance the required minimum APZ is 11m to the northeast and 10m to the southeast of the proposed office building. It is recommended that an APZ of 20m be implemented to further reduce potential radiant heat levels.

7.6 Proposed Class 10b structures

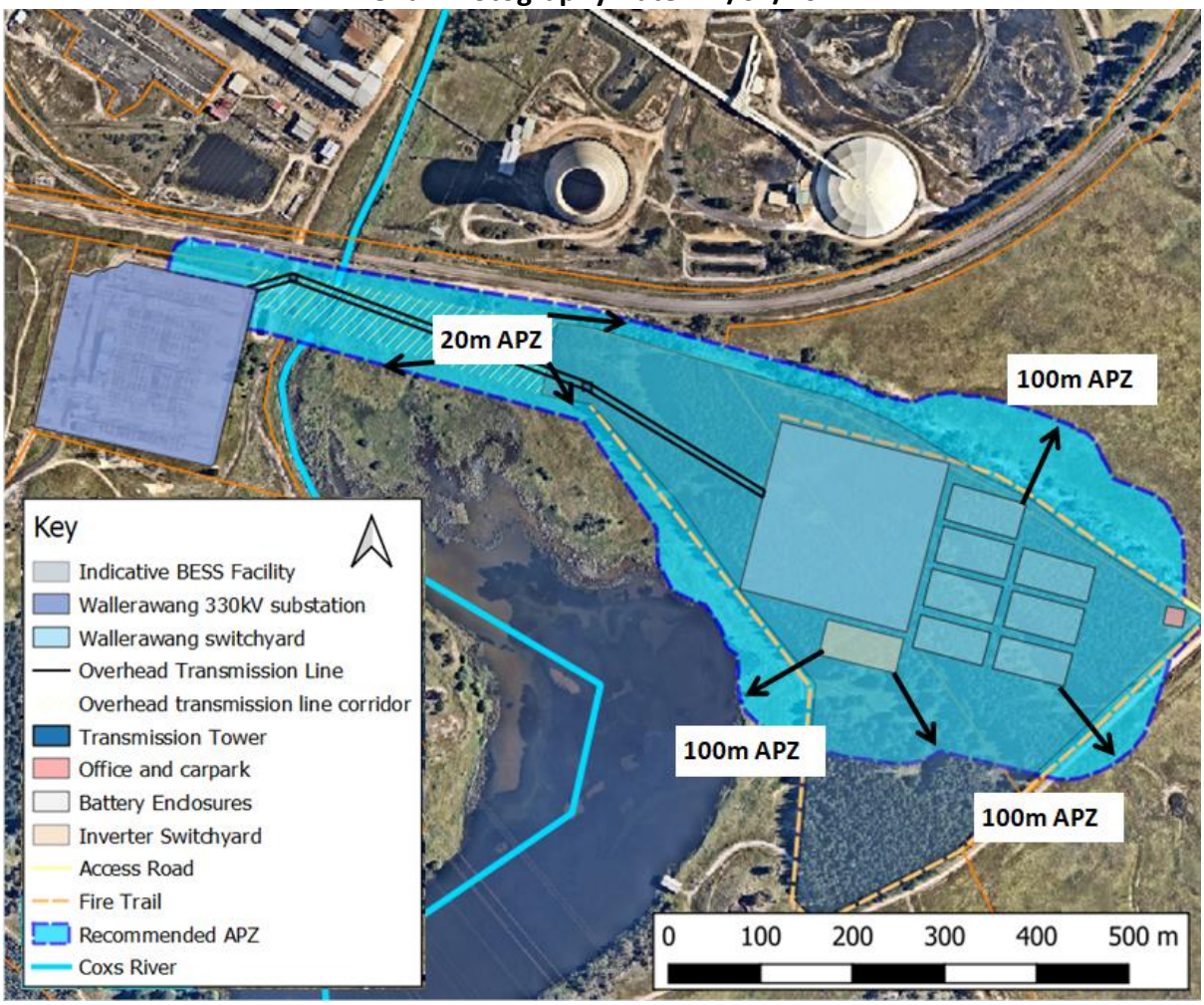
It is considered that the proposed BESS, the proposed Wallerawang switchyard, the proposed water tank and the infrastructure associated with the proposed 330 kV transmission line corridor may be classified as Class 10b under the NCC. It has been assumed that electrical conductors within the transmission corridor will be aerial and will require support above ground by pylons.

It is proposed that a 20m IPA be established around the proposed switchyard, the 330 kV transmission corridor and any supporting pylons within the corridor. The proposed 20m APZ exceeds the requirements of the *ISSC3 Guideline for Managing Vegetation Near Power Lines* per PBP and the 10m APZ recommended by the RFS for telecommunication towers (RFS 2012).

Per PBP section 8.3.9, the BESS itself may be considered to be hazardous as it will be associated with power generating works and represents a type of hazardous or chemical storage by virtue of the batteries. Ideally, hazardous industry development should be avoided on bush fire prone land. It is therefore proposed that an IPA of at least 100m be established around the BESS, effectively meaning that no classified hazard vegetation will exist within 100m of the facility. The IPA should include the entirety of the BESS Facility site, as depicted

in the operational footprint plan (Appendix 1). As such, the BESS will only be subject to the general aim and objectives of PBP regarding relevant bush fire protection measures. The recommended APZs for the project are shown in Figure 8 below.

Figure 8. Recommended APZs. Source: NearMap (2021) with overlays by BFCS P/L: Aerial Photography Date: 14/01/2021



8. Objectives of PBP Chapter 1

Applicable to all proposed buildings and structures

Objective	Comment
Afford buildings and their occupants protection from exposure to a bush fire	Can comply. The BESS is to be separated from any hazard vegetation by at least 100m. The proposed switchyard and 330 kV transmission lines structures are to be separated from hazard vegetation by at least 20m. The proposed Class 5 office and Class 7a carpark (where a building is proposed) are to be separated from hazard vegetation by a distance of 20m. The proposed assets are non-habitable and sufficiently separated from the hazard to afford the buildings and their occupants protection from exposure to a bush fire
Provide for a defendable space to be located around buildings	A defendable space of at least 20m is proposed around all proposed buildings or structures, which meets the requirements of PBP
Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings	For the proposed Class 5 office and Class 7a carpark (where a building is proposed), the relevant FFDI (80), vegetation formation (Grassland) and effective slopes (Downslope >0 - 5° and All upslope and flat land (0°)) have been matched using Table A1.12.3 of PBP. The available separation distance between the buildings and the hazard of 20m exceeds the minimum distance for APZs of 11m to the northeast and 10m to the southeast, indicating that direct flame contact on the buildings is not anticipated, (see section 6.4.1 this document)
Ensure that appropriate operational access and	Can comply where property access meets the relevant requirements of PBP Table 7.4a and PBP Table 5.3b:

Objective	Comment
egress for emergency service personnel and occupants is available	▪ property access roads are two-wheel drive, all weather roads ▪ The capacity of road surfaces and any bridges/causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes), bridges and causeways are to clearly indicate load rating ▪ Access is available to hydrants that are provided in accordance with the relevant clauses of AS 2419.1:2005; *or* There is suitable access for a Category 1 fire appliance to within 4m of the static water supply where no reticulated supply is available ▪ There is a minimum 4m carriageway width ▪ Rural property roads have passing bays every 200m that are 20m long by 2m wide, making a minimum trafficable width of 6m, at the passing bay ▪ There is a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches ▪ Property access provides for a suitable turning area in accordance with PBP Appendix 3; (see Appendix 3 this document) ▪ Curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress ▪ The minimum distance between inner and outer curves is 6m ▪ The crossfall is not more than 10 degrees ▪ Maximum grades for sealed roads do not exceed 15 degrees and not more than 10 degrees for unsealed roads ▪ Traffic management devices are constructed to not prohibit access by emergency services vehicles ▪ All roads are through roads

Objective	Comment
	▪ Dead end roads are not recommended, but if unavoidable, are not more than 200 metres in length, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end ▪ Where applicable, hydrants are located outside of parking reserves and road carriageways to ensure accessibility to reticulated water for fire suppression ▪ Where applicable, hydrants are provided in accordance with the relevant clauses of AS 2419.1:2005
Provide for ongoing management and maintenance of BPMs	Can comply. Normal property maintenance will ensure that BPMs are maintained
Ensure that utility services are adequate to meet the needs of firefighters	Can comply. Refer to the PBP Chapter 8 objectives below

9. Objectives of PBP Chapter 8

Applicable generally to non-residential development such as industrial and commercial uses. Per PBP section 8.3.10 the provisions within PBP Chapter 7 are used as a base for the development of a package of measures.

Objective	Comment
Provide safe access to/from the public road system for firefighters providing property protection during a bush fire and for occupant egress for evacuation	Can Comply. The project site has direct access to the Castlereagh Highway, which is a public road. Internal property access roads are to comply with the relevant requirements of PBP Table 7.4a and PBP Table 5.3b (see above), with hard surfaces provided around the development sufficient for fire trucks and other emergency vehicles to enter and egress the site in a forwards direction

Objective	Comment
Provide suitable emergency and evacuation (and relocation) arrangements for occupants of the development	Can Comply. The need to formulate an emergency evacuation plan is suggested. To do so, occupants can complete a Bush Fire Safety Plan on the NSW RFS Website http://www.rfs.nsw.gov.au/ under publications / bushfire safety
Provide adequate services of water for the protection of buildings during and after the passage of bush fire, and to locate gas and electricity so as not to contribute to the risk of fire to a building	**Water supply** Can comply where the relevant requirements of PBP Table 7.4a for water supply are met. Where reticulated water is provided to the development: ▪ Fire hydrant spacing, design and sizing comply with the relevant clauses of AS 2419.1:2005 ▪ Hydrants are not located within any road carriageway ▪ Fire hydrant flows and pressures comply with the relevant clauses of AS 2419.1:2005 Where no reticulated water supply is available: ▪ A static water supply of 20000 L is to be made available for fire suppression activities, with multiple tanks as necessary to ensure that all parts of the development are situated within 70m of a tank ▪ Suitable access for a Category 1 fire appliances is available to within 4m of the static water supply ▪ A connection for firefighting purposes is to be located within the IPA or non-hazard side and away from the structure ▪ A 65mm Storz outlet with a ball valve is to be fitted to the outlet ▪ Ball valve and pipes are adequate for water flow and are metal

Objective	Comment
	▪ Supply pipes from tank to ball valve have the same bore size to ensure flow volume ▪ Underground tanks have an access hole of 200mm to allow tankers to refill direct from the tank ▪ A hardened ground surface for truck access is supplied within 4m ▪ Above-ground tanks are manufactured from concrete or metal ▪ Raised tanks have their stands constructed from non-combustible material or bush fire-resisting timber ▪ Unobstructed access can be provided at all times ▪ Underground tanks are clearly marked ▪ Tanks on the hazard side of a building are provided with adequate shielding for the protection of firefighters ▪ All exposed water pipes external to the building are metal, including any fittings ▪ Where pumps are provided, they are a minimum 5hp or 3kW petrol or diesel-powered pump, and are shielded against bush fire attack ▪ Any hose and reel for firefighting connected to the pump shall be 19mm internal diameter and any fire hose reels are constructed in accordance with AS/NZS 1221:1997, and installed in accordance with the relevant clauses of AS 2441:2005 For both reticulated and static water supplies: ▪ any new above-ground water service pipes external to the buildings are to be metal, including and up to any taps

Objective	Comment
	Local electricity supply to buildings: Can comply where the relevant requirements of PBP Table 7.4a for electricity supplies are met: ▪ Where practical, electrical transmission lines are underground, and where overhead, electrical transmission lines are proposed as follows: o Lines are installed with short pole spacing (30m), unless crossing gullies, gorges or riparian areas; and o No part of a tree is closer to a power line than the distance set out in accordance with the specifications in ISSC3 *Guideline for Managing Vegetation Near Power Lines* **Local gas supplies to buildings** Can comply where the relevant requirements of PBP Table 7.4a for gas supplies are met: ▪ reticulated or bottled gas is installed and maintained in accordance with *AS/NZS 1596:2014 - The storage and handling of LP Gas* and the requirements of relevant authorities and metal piping is used; ▪ all fixed gas cylinders are kept clear of all flammable materials to a distance of 10m and shielded on the hazard side; ▪ connections to and from gas cylinders are metal; ▪ polymer-sheathed flexible gas supply lines are not used; and ▪ above-ground gas service pipes are metal, including and up to any outlets

Objective	Comment
Provide for the storage of hazardous materials away from the hazard wherever possible	Can comply. Wherever possible, the storage of hazardous materials will be away from the hazard and shielded on the hazard side

10. Risk of Fire with Large Scale Battery Systems

The recent fire at during Moorabool battery facility in Victoria highlights that there is some risk of fire with large scale battery systems. The fire did not occur during operations but during pre-commissioning testing and Tesla (battery supplier for the Moorabool site) has previously safely installed more than 5GWh of grid scale BESS globally at more than 900 sites. The battery systems are designed to meet latest fire and safety codes and standards requirements (NFPA 855 and IFC 2018/2021), and the Moorabool fire was contained within 24 hours. Although possible, fires in BESS systems are an infrequent occurrence.

11. Construction Requirements

It has been demonstrated that the proposed Class 5 – 8 buildings are not anticipated to experience flame contact during a bushfire, meeting the aim and objectives of PBP. Consequently, per PBP section 8.3.1, the NCC does not provide for any bush fire specific performance requirements for these buildings. The general fire safety construction provisions of the NCC are taken as acceptable solutions, and AS 3959 and the NASH Standard are not considered as a set of Deemed to Satisfy provisions for this non-residential proposal. PBP is silent regarding construction requirements for the proposed Class 10b structures and they are otherwise subject only to the general aim and objectives of PBP.

12. Recommendations

The following recommendations are made for the bushfire measures for the proposed construction, operation and maintenance of a Battery Energy Storage System (BESS) at Lot 3 DP 1018958, Lot 4 DP 1016725, Lot 3 DP1181412, Lot 3 DP 1226927 and Lot 4 DP 1226927, 1 Main Street Wallerawang, and are based upon the relevant provisions of the NSW Rural Fire Service Guideline entitled *Planning for Bush Fire Protection 2019*.

1. Asset Protection Zones

At the commencement of the development, and in perpetuity:

- The curtilage surrounding the proposed BESS shall be managed as an Inner Protection Area (IPA) Asset Protection Zone (APZ) from the proposal in all directions for a distance of at least 100m and otherwise to the boundary of the proposed BESS facility footprint (as indicated in Appendix 1 this document), whichever is the greater distance.
- The curtilage surrounding the proposed Wallerawang Switchyard, the 330 kV Transmission Line Corridor and associated structures, and the office and carpark shall be managed as an Inner Protection Area (IPA) Asset Protection Zone (APZ) from the proposed buildings in all directions for a distance of at least 20m.

The APZs are to be managed as outlined in PBP 2019 Appendix 4.

2. Water Supply

Water supply is to comply with the relevant requirements of PBP Table 7.4a.

Where reticulated water is provided to the development:

- Fire hydrant spacing, design and sizing comply with the relevant clauses of AS 2419.1:2005
- Hydrants are not located within any road carriageway
- Fire hydrant flows and pressures comply with the relevant clauses of AS 2419.1:2005.

Where no reticulated water supply is available:

A static water supply of 20000 L is to be made available for fire suppression activities, with multiple tanks being provided as required, to ensure that all parts of the development are within 70m of a tank.

- Suitable access for a Category 1 fire appliances is available to within 4m of the static water supply
- A connection for firefighting purposes is to be located within the IPA or non-hazard side and away from the structure
- A 65mm Storz outlet with a ball valve is to be fitted to the outlet
- Ball valve and pipes are adequate for water flow and are metal
- Supply pipes from tank to ball valve have the same bore size to ensure flow volume
- Underground tanks have an access hole of 200mm to allow tankers to refill direct from the tank
- A hardened ground surface for truck access is supplied within 4m
- Above-ground tanks are manufactured from concrete or metal
- Raised tanks have their stands constructed from non-combustible material or bush fire-resisting timber
- Unobstructed access can be provided at all times
- Underground tanks are clearly marked
- Tanks on the hazard side of a building are provided with adequate shielding for the protection of firefighters
- All exposed water pipes external to the building are metal, including any fittings
- Where pumps are provided, they are a minimum 5hp or 3kW petrol or diesel-powered pump, and are shielded against bush fire attack
- Any hose and reel for firefighting connected to the pump shall be 19mm internal diameter and any fire hose reels are constructed in accordance with AS/NZS 1221:1997, and installed in accordance with the relevant clauses of AS 2441:2005.

For both reticulated and static water supplies:

- any new above-ground water service pipes external to the buildings are to be metal, including and up to any taps

3. Access

Access is to comply with the relevant requirements of PBP Table 7.4a and PBP Table 5.3b:

- property access roads are two-wheel drive, all weather roads

- The capacity of road surfaces and any bridges/causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes), bridges and causeways are to clearly indicate load rating
- Access is available to hydrants that are provided in accordance with the relevant clauses of AS 2419.1:2005; *or*

  There is suitable access for a Category 1 fire appliance to within 4m of the static water supply where no reticulated supply is available
- There is a minimum 4m carriageway width
- Rural property roads have passing bays every 200m that are 20m long by 2m wide, making a minimum trafficable width of 6m, at the passing bay
- There is a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches
- Property access provides for a suitable turning area in accordance with PBP Appendix 3
- Curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress
- The minimum distance between inner and outer curves is 6m
- The crossfall is not more than 10 degrees
- Maximum grades for sealed roads do not exceed 15 degrees and not more than 10 degrees for unsealed roads
- Traffic management devices are constructed to not prohibit access by emergency services vehicles
- All roads are through roads
- Dead end roads are not recommended, but if unavoidable, are not more than 200 metres in length, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end.

4. <u>Electricity and Gas Services (local supply to buildings)</u>

Electricity supply and gas services are to comply with the relevant requirements of PBP Table 7.4a.

Where practical, electrical transmission lines are underground, and where overhead, electrical transmission lines are proposed as follows:

- Lines are installed with short pole spacing (30m), unless crossing gullies, gorges or riparian areas; and
- No part of a tree is closer to a power line than the distance set out in accordance with the specifications in ISSC3 *Guideline for Managing Vegetation Near Power Lines*

Where applicable, reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 and the requirements of relevant authorities, and metal piping is used.
All fixed gas cylinders are kept clear of all flammable materials to a distance of 10m and shielded on the hazard side, connections to and from gas cylinders are metal.
Polymer-sheathed flexible gas supply lines are not used, and above-ground gas service pipes are metal, including and up to any outlets.

5. Storage of Hazardous Materials

Wherever possible, the storage of hazardous materials will be away from the hazard.

6. Emergency and Evacuation Planning

The need to formulate an emergency evacuation plan is suggested. To do so, occupants can complete a Bush Fire Safety Plan on the NSW RFS Website http://www.rfs.nsw.gov.au/ under publications / bushfire safety.

13. Summary

This report consists of a bush fire assessment for the proposed construction, operation and maintenance of a Battery Energy Storage System (BESS) at Lot 3 DP 1018958, Lot 4 DP 1016725, Lot 3 DP1181412, Lot 3 DP 1226927 and Lot 4 DP 1226927, 1 Main Street Wallerawang. The report concludes that the proposed development is on designated bushfire prone land and the legislative requirements for development in bushfire prone areas are applicable.

This report has considered all the elements of bushfire attack and finds that the development satisfies the aim and objectives of 'Planning for Bush Fire Protection' 2019, subject to implementation of the recommendations made by this report.

Notwithstanding the precautions adopted, it should always be remembered that bushfires burn under a wide range of conditions and an element of risk, no matter how small, always remains and although the standard is designed to improve the performance of such buildings, there can be no guarantee because of the variable nature of bushfires that any one building will withstand bushfire attack on every occasion.

This report is a bush fire assessment that provides the required information to assist local Council and the Rural Fire Service in determining compliance in accordance with Planning for Bush Fire Protection. The local Council is the final consenting authority and the construction of the building must comply with the recommendations included in the Council's conditions of consent.

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14. References

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NSW RFS 2012, *Telecommunication Towers in Bush Fire Prone Areas – Community Resilience Practice Notes 1/11,* NSW Rural Fire Service, Sydney.

NSW RFS 2015, *Guide for Bushfire Prone Land Mapping – Version 5b*, NSW Rural Fire Service, Sydney.

NSW RFS 2019, *Planning for Bush Fire Protection*, NSW Rural Fire Service, Sydney.

Standards Australia 2018, *Australian Standard AS 3959-2018 'Construction of Buildings in Bushfire Prone Areas'*, SAI Global, Australia.

15. Legislation

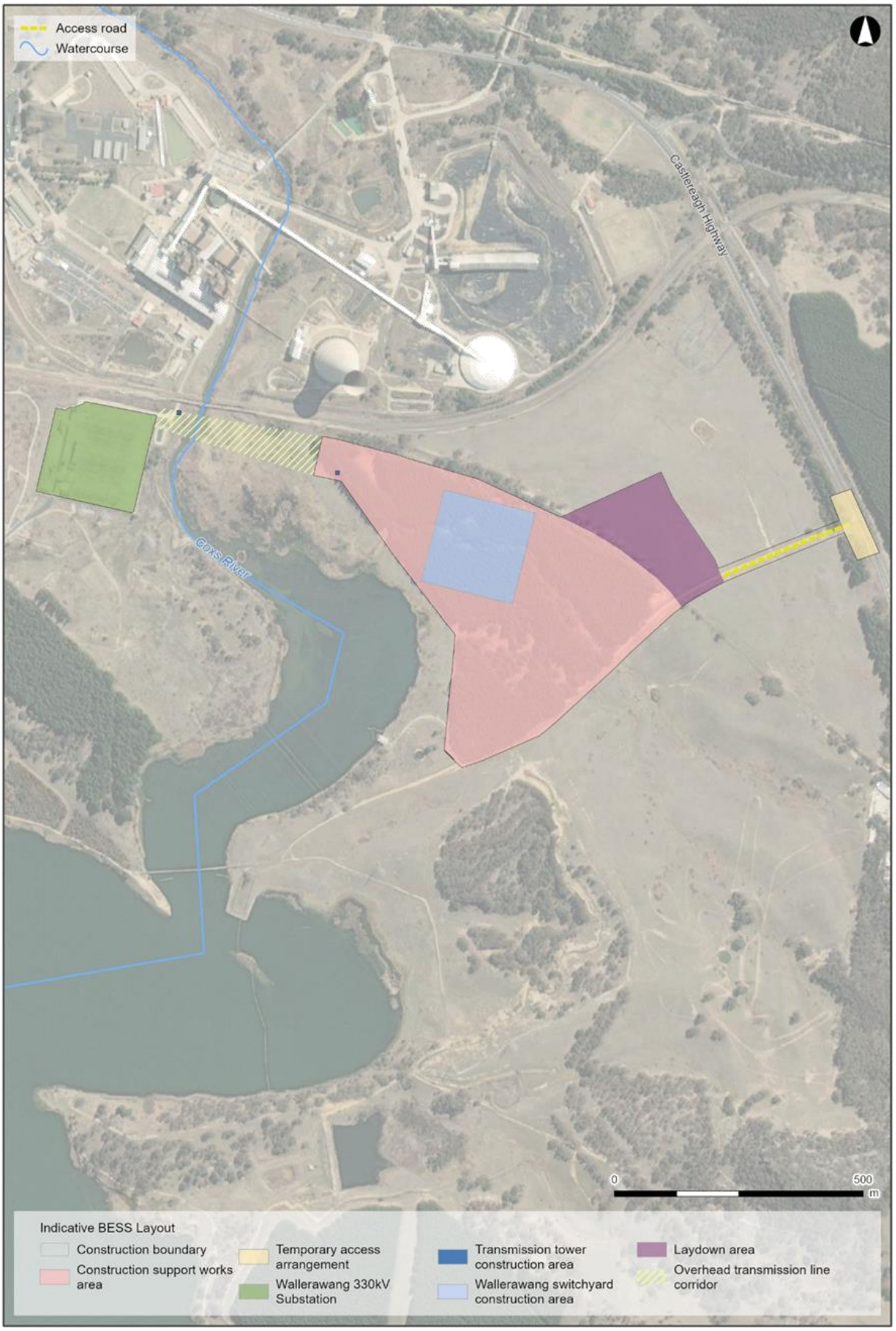
Environmental Planning & Assessment Act 1979

Rural Fires Act 1997

Rural Fires Regulation 2013

Appendix 1 – Operational Footprint Plan

Appendix 2 – Construction Plan



Appendix 3 – Photos of Site and Surrounds

Source: BFCS P/L 26/03/2021

1. *View to approximately southwest from Castlereagh Highway showing the proposed entrance site and primary access road to the Battery Energy Storage System (BESS)*

2. *View to approximately southwest showing the existing access road from Castlereagh Highway to the proposed BESS site (pine forest in background)*

3. *View to the east from the existing access road showing typical vegetation on Lot 3 in DP 1226927 and remnant Forest along Castlereagh Highway, approximately 350m east of the proposal*

4. *View to the south from the same position as photo 3 showing typical vegetation within Lot 3 in DP 1226927*

5. *View to the north from the same position as photo 3 showing typical vegetation on Lot 3 in DP 1018958*

6. *View to the northwest showing typical vegetation Lot 3 in DP 1018958 surrounding the northeast edge of the existing pine forest and the proposed BESS site on Lot 4 in DP1016725*

7. *View to the northeast showing the site of the proposed secondary access road along the southeast edge of the existing pine forest and the proposed BESS site on Lot 4 in DP1016725. Approximately 30m to the southeast of the proposal. Vegetation on Lot 4 in DP1226927 shown to the right of picture*

8. *View to the southwest from the same position as photo 7*

9. *View to the northwest from the southwest corner of the existing pine forest on Lot 3 in DP 1181412 showing the site of the proposed secondary access road and typical vegetation along the western edge of the proposal site. Lake Wallace/Cox's River to the left of picture. Approximately 200m southwest of the proposed BESS at this point*

10. *View to the west from the northwest corner of the existing pine forest showing typical vegetation within the approximate proposed 330 kV transmission line corridor from the BESS to the existing TransGrid 330 kV substation (background)*

11. View to the northwest across from the northwest corner of Lot 4 in DP 1016725 showing the Main Western Railway line and typical vegetation to the north of the proposal site. Approximately 250m to the northwest of the proposed BESS at this point

12. View to the northeast from the Lot 4 in DP 1016725 northeast boundary showing typical vegetation on Lot 3 in DP 1018958, approximately 50m north of the proposed BESS

13. View to the northwest from the same position as photo 12 showing existing vegetation along the Lot 4 in DP 1016725 northeast boundary, site of old elevated rail line

14. View to the east from the Lot 4 in DP 1016725 northeast boundary showing typical vegetation on Lot 3 in DP 1018958, approximately 40m north of the proposed BESS

15. View to the east from Lot 3 in DP 1181412 (near existing 330 kV TransGrid substation) looking toward proposed BESS site (pine forest) across Lake Wallace/Cox's River. Vegetation mix of Grassland and Freshwater Wetlands within the proposed 330 kV transmission line corridor

16. View to the southwest showing managed land surrounding the existing 330 kV TransGrid substation for connection to the proposed BESS

17. View to the northeast from position approximately 50m to the east of the existing 330 kV TransGrid substation showing typical vegetation mix within the proposed 330 kV transmission line corridor, BESS proposal site to the right of picture

18. View to northeast from a similar position to photo 17 showing Freshwater Wetlands vegetation surrounding the historical Main Western Railway viaducts crossing the northern section of Cox's River (north of Lake Wallace)

Appendix 4 – PBP Turning Head Requirements

(Adapted from PBP p.102)

A3.3 Vehicle turning head requirements

Dead ends that are longer then 200m must be provided with a turning head area that avoids multipoint turns. "No parking" signs are to be erected within the turning head.

The minimum turning radius shall be in accordance with Table A3.2. Where multipoint turning is proposed the NSW RFS will consider the following options:

Figure A3.3

Multipoint turning options.