TransGrid

EnergyConnect (NSW – Western Section)

Technical paper 10

Bushfire impact assessment

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Technical paper 10 – Bushfire impact assessment

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Glossary

Term/Acronym	Description
Campaign fire	A fire normally of a size and/or complexity that requires substantial firefighting resources, and possibly several days or weeks to suppress
Commonwealth	Reference to Commonwealth as an entity such as Commonwealth Government or Commonwealth land
DPIE	(NSW) Department of Planning Industry and Environment
EIS	Environmental Impact Statement
EnergyConnect	EnergyConnect is a proposed new electricity interconnector between Wagga Wagga in New South Wales and Robertstown in South Australia, with an added connection into north-west Victoria. EnergyConnect is a joint project between TransGrid and ElectraNet, who operate the transmission networks in New South Wales (NSW) and South Australia (SA), respectively.
EP&A Act	*(NSW) Environmental Planning and Assessment Act 1997*
NEM	National Electricity Market
NSW	New South Wales
(the) proponent	The proposal is proposed to be undertaken by NSW Electricity Networks Operations Pty Ltd as a trustee for NSW Electricity Operations Trust (referred to as TransGrid). TransGrid is the operator and manager of the main high voltage (HV) transmission network in NSW and the Australian Capital Territory (ACT) and is the Authorised Network Operator (ANO) for the purpose of an electricity transmission or distribution network under the provisions of the *Electricity Network Assets (Authorised Transactions) Act 2015.*
(the) proposal	The proposal is known as 'EnergyConnect (NSW – Western Section)' The proposal would involve the following key features: > construction of new high voltage transmission lines and associated infrastructure between the SA/NSW border near Chowilla and the existing Buronga substation > an upgrade to the existing transmission line between the Buronga substation and the NSW/Victoria border at Monak, near Red Cliffs, and the decommissioning of the 220kV single circuit transmission line (known as Line 0X1) > a significant expansion and upgrade of the existing Buronga substation from an operating capacity of 220kV to 330kV > establishment and upgrade of access tracks, as required > a minor realignment of the existing 0X2 220kV transmission line, in proximity to the Darling River > other ancillary works required to facilitate the construction of the proposal e.g. laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps. The description of the proposal as presented in the EIS is indicative and based on the current level of design. The proposal would continue to be refined during detailed design.

Term/Acronym	Description
proposal study area	The study area for this EIS, which comprises a one kilometre wide corridor between the SA/NSW border near Chowilla and Buronga and a 200 metres wide corridor between Buronga and the NSW/Victoria border at Monak, near Red Cliffs. Encompasses the disturbance area and a buffer zone which has been applied to identify the constraints nearby to the proposal which may or may not be indirectly impacted by the proposal.
RFA	*Rural Fires Act 1997*
SEARs	Secretary Environmental Assessment Requirements
SSI	State Significant Infrastructure
Transmission line easement	An area surrounding and including the transmission lines, which is a legal 'right of way' and allows for ongoing access and maintenance of the lines and will be acquired from landholders. The easement width would be up to 80 metres wide.

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1. Introduction

1.1 Overview of Energy Connect

TransGrid (electricity transmission operator in New South Wales (NSW)) and ElectraNet (electricity transmission operator in South Australia (SA)) are seeking regulatory and environmental planning approval for the construction and operation of a new High Voltage (HV) interconnector between NSW and SA, with an added connection to north-west Victoria. Collectively, the proposed interconnector is known as EnergyConnect.

EnergyConnect comprises several components or 'sections' (shown on Figure 1-1). The NSW – Western Section (referred to as 'the proposal') is the subject of this technical paper.

EnergyConnect aims to secure increased electricity transmission between SA, NSW and Victoria, while facilitating the longer-term transition of the energy sector across the National Electricity Market (NEM) to low emission energy sources.

EnergyConnect has been identified as a priority transmission project in the NSW Transmission Infrastructure Strategy (Department of Planning and Environment, 2018), linking the SA and NSW energy markets and would assist in transporting energy from the South-West Renewable Energy Zone to major demand centres.

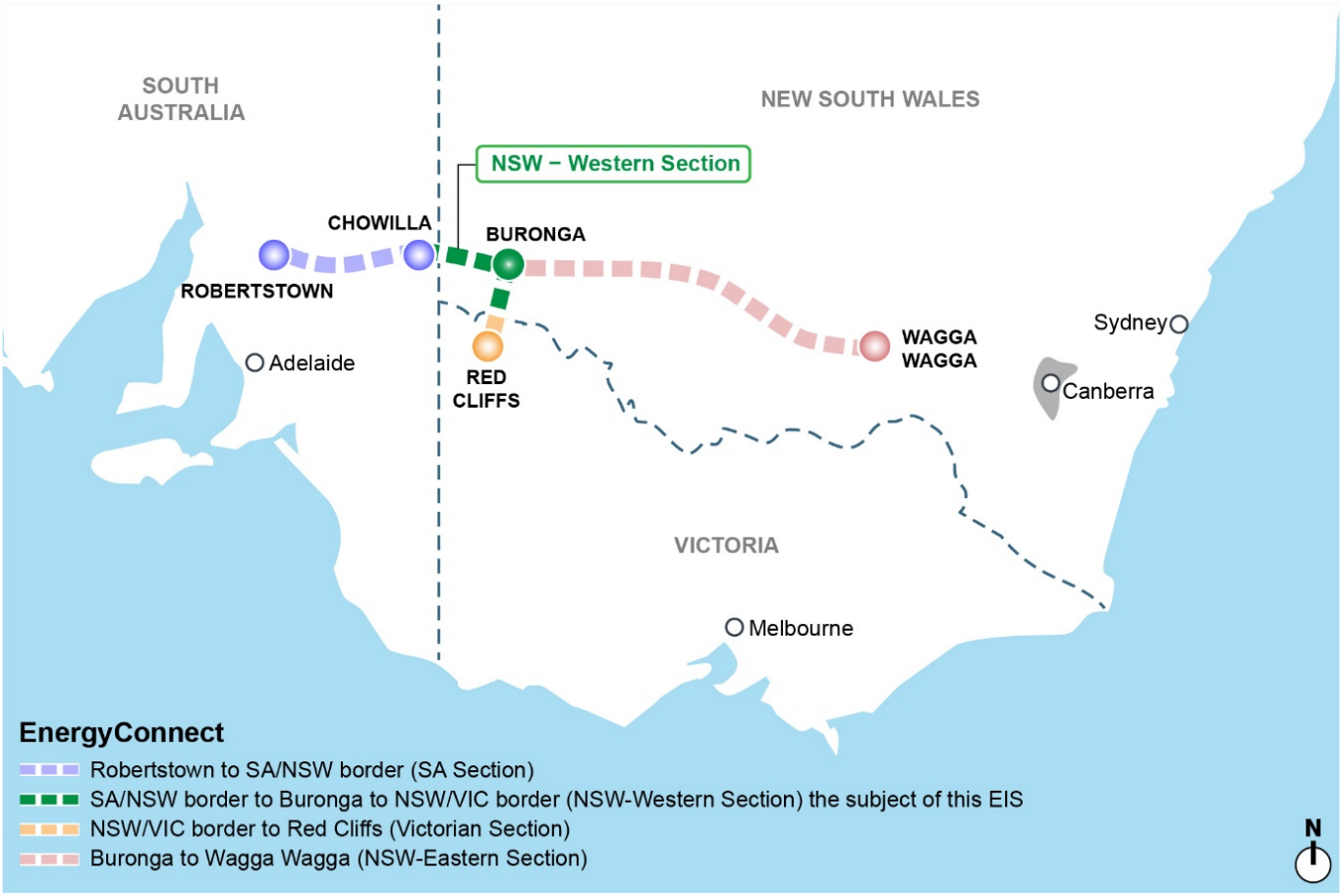

Figure 1-1 Overview of EnergyConnect

1.2 The proposal

TransGrid is seeking approval under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* (the EP&A Act) to construct and operate the proposal. The proposal has been declared as Critical State Significant Infrastructure under Section 5.13 of the EP&A Act.

The proposal was also declared a controlled action on 26 June 2020 and requires a separate approval under the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999*. The proposal is subject to the bilateral assessment process that has been established between the Australian and NSW governments.

The proposal is located in western NSW within the Wentworth local government area (LGA), approximately 800 kilometres west of Sydney at its nearest extent. The proposal spans between the SA/NSW border near Chowilla and Buronga and the NSW/VIC border at Monak, near Red Cliffs. It traverses around 160 kilometres in total.

1.2.1 Key proposal features

The key components of the proposal include:

- a new 330 kilovolt (kV) double circuit transmission line and associated infrastructure, extending around 135 kilometres between the SA/NSW border near Chowilla and the existing Buronga substation
- an upgrade of the existing 24 kilometre long 220kV single circuit transmission line between the Buronga substation and the NSW/VIC border at Monak (near Red Cliffs, Victoria) to a 220kV double circuit transmission line, and the decommissioning of the 220kV single circuit transmission line (known as Line 0X1)
- a significant upgrade and expansion of the existing Buronga substation to a combined operating voltage 220kV/330kV
- new and/or upgrade of access tracks as required
- a minor realignment of the existing 0X2 220kV transmission line, in proximity to the Darling River
- ancillary works required to facilitate the construction of the proposal (e.g. laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps).

An overview of the proposal is provided in Figure 1-1. The final alignment and easement of the transmission line would be confirmed during detailed design and would be located within the transmission line corridor as shown in Figure 1-2.

Subject to approval, construction of the proposal would commence in mid-2021. The construction of the transmission lines would take approximately 18 months. The Buronga substation upgrade and expansion would be delivered in two components and would be initially operational by the end of 2022, with site decommissioning and rehabilitation to be completed by mid-2024. The final construction program would be confirmed during detailed design.

The proposal is further described in Chapter 5 and Chapter 6 of the Environmental Impact Statement (EIS).

1.2.2 Proposal need

The proposal is required to complete the missing transmission link between the SA and NSW transmission networks. The upgrade to the existing transmission line between Buronga and Red Cliffs would also enhance the capacity of the network to provide electricity between NSW and Victoria.

This connection would relieve system constraints and allow for NSW, SA and Victorian consumers to benefit from significant amounts of low-cost, large-scale solar generation in south-west NSW. The proposal is an essential component of EnergyConnect.

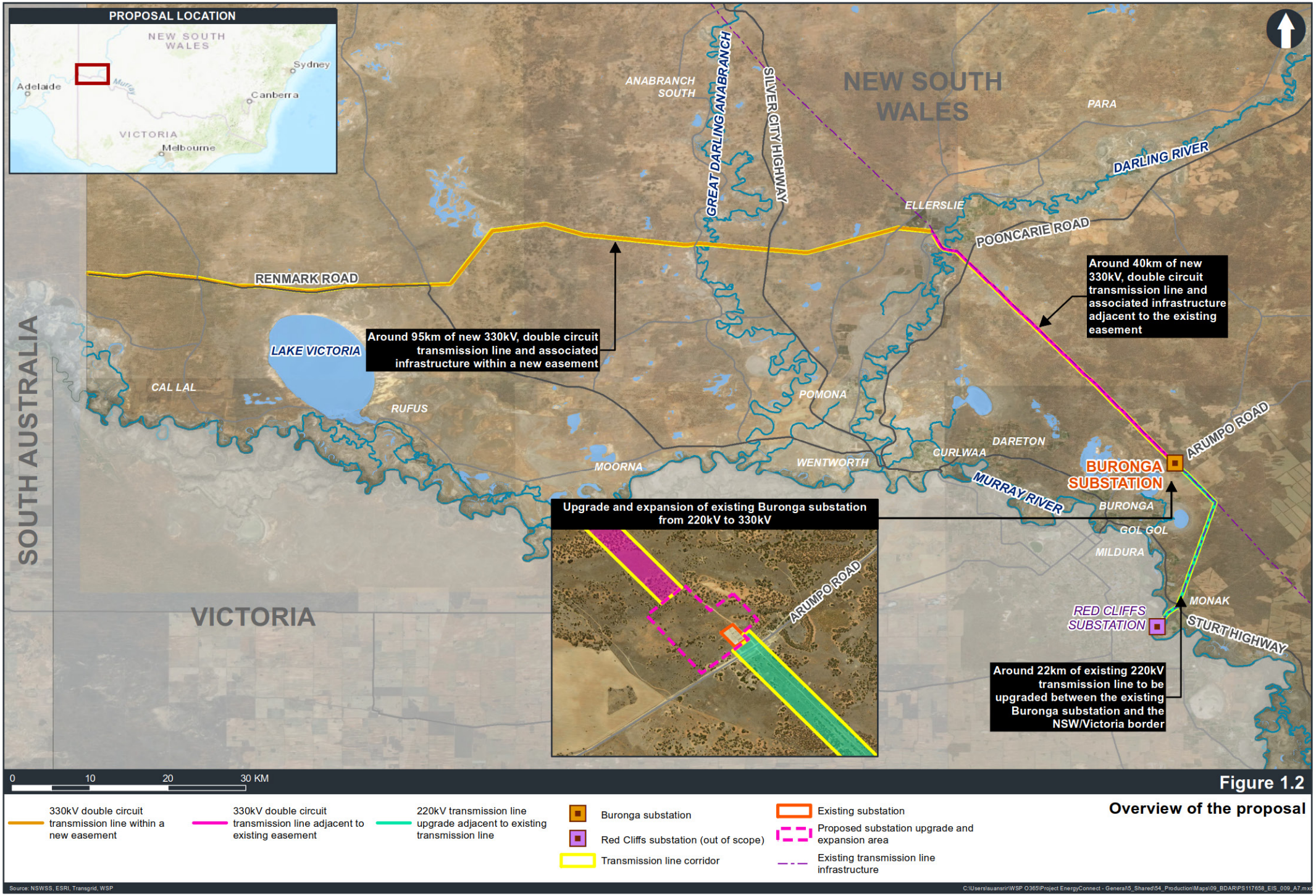

Figure 1.2

Overview of the proposal

1.3 Purpose of this technical report

This technical paper is one of a number of technical papers that form part of the EIS for the proposal. The NSW Department of Planning, Industry and Environment (DPIE) has provided the Secretary's Environmental Assessment Requirements (SEARs) for the EIS. The purpose of this technical paper is to identify and assess the potential impacts of the proposal in relation to bushfire risk. It responds directly to the SEARs (refer to Section 1.3.1).

Australian Bushfire Protection Planners Pty Limited has been commissioned by WSP on behalf of TransGrid to prepare this Bushfire Risk Assessment (BFRA) for the proposal.

The objectives of the BFRA are to:

> provide an assessment of the bushfire risk during the construction and operation of the proposal
> detail the bushfire risk mitigation strategies for the proposal
> provide recommendations on the provision of measures which, when applied, mitigates the threat of bushfire to and from the proposal and/or surrounding areas during the construction and operation phase.

1.3.1 Secretary's Environmental Assessment Requirements

The SEARs specific to this assessment and where these aspects are addressed in this technical report are outlined in Table 1-1.

Table 1-1 Secretary's Environmental Assessment Requirements – Hazards

Reference	Secretary's Environmental Assessment Requirements	Section of report where requirement addressed
Key Issues – Hazards	An assessment of the risks to public safety, paying particular attention to bushfire risks, emergency egress and evacuation.	Chapters 4 and 5 assess bushfire risks associated with the proposal. All other matters are addressed in Chapter 19 (Hazards and risk) of the EIS.

1.4 Structure of this report

The structure and content of this report is as follows:

> *Chapter 1 – Introduction:* Outlines the background and need for the proposal, and the purpose of this report
> *Chapter 2 – Legislative and policy context:* Provides an outline of the key legislative requirements and policy guidelines relating to bushfire risk for the proposal
> *Chapter 3 – Proposal context:* Describes the proposal location and existing infrastructure within and surrounding the proposal study area
> *Chapter 4 – Bushfire risk assessment*, which includes:
  – a desktop assessment of the existing environment within and surrounding the proposal study area including the fire history, bushfire ignition sources, topography, climate and weather, and vegetation
  – an examination of the factors influencing bushfire risk, including the two elements of risk – likelihood which is described as the chances of a bushfire occurring, and consequence, the impact of the bushfire when it occurs
  – an assessment of the potential bushfire risk to the proposal
  – an examination of the bushfire risk created by the construction and operation of the proposal
> *Chapter 5 – Mitigation measures:* Outlines the proposed mitigation measures for the proposal, including bushfire protection measures to be implemented to manage and reduce the level of bushfire risk
> *Chapter 6 – References*: Identifies the key reports and documents used to generate this report.

1.5 Report terminology

The following terms are discussed throughout the report and are defined as:

- **Proposal study area** – the proposal, including transmission line corridor, Buronga substation upgrade and expansion, access tracks, and the main construction compounds and accommodation camps at Buronga and Anabranch South, would be contained within the proposal study area. The proposal study area comprises of a one kilometre wide corridor between the SA/NSW border near Chowilla and Buronga and a 200 metre wide corridor between Buronga and the NSW/Victoria border at Monak, near Red Cliffs, and is used in the environmental assessment to provide a broader understanding of the constraints and conditions of the locality.
- **Transmission line corridor** – the corridor in which the final easement and transmission line is expected to be contained within. It would consist of a 200 metre wide corridor along the transmission line component of the proposal. Transmission line construction activities would be contained within this area, but some access tracks may extend beyond this corridor.

1.6 Limitations

There are no limitations associated with the preparation of this technical report.

2. Legislative and policy context

This chapter outlines the legislation and policy that are relevant when assessing bushfire risk for the proposal.

2.1 Environmental Planning and Assessment Act 1979

The proposal has been declared as Critical State significance infrastructure, and is subject to assessment under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

2.2 Rural Fires Act 1997

The *Rural Fires Act 1997* outlines the operational role of the NSW Rural Fire Service, their functions and their powers in relation to protecting the people, infrastructure and natural environment of NSW from fire related threats.

The objectives of the *Rural Fires Act 1997* are to provide:

- the prevention, mitigation and suppression of fires
- coordination of bushfire fighting and prevention
- protection of people and property from fires; and
- protection of the environment.

In relation to the management of bushfire fuels on public and private lands within NSW, sections 63(1) and 63(2) require public authorities and owners/occupiers of land to take all practicable steps to prevent the occurrence of bushfires on, and to minimize the danger of the spread of bushfires.

Under Part 5.23 of the EP&A Act, the proposal which is deemed State Significant Infrastructure, does not require authorisation for development on bushfire prone land from a bushfire authority under section 100B of the Rural Fires Act to proceed.

2.3 Planning for Bushfire Protection – 2019

The *Planning for Bushfire Protection – 2019* (NSW Rural Fire Service) document provides and explains the legal requirements, framework and protection measures needed for all types of development on bushfire prone land in NSW.

2.4 National Electricity Network Safety Code

The National Codes National Electricity Network Safety Code (NENS) 01 and 04 in conjunction with the NSW Code of Practice for Electricity Transmission and Distribution Asset Management and HB C(b) 1- 2003 '*Guidelines for Design and Maintenance of Overhead Distribution and Transmission Lines*' provide information on safety clearances from overhead transmission lines. These guidelines state that trees should be kept away from overhead lines to:

- ensure public safety
- minimise the risk of fire caused by the contact between trees and overhead lines
- reduce the number of interruptions to supply caused by trees; and
- protect the assets from damage.

When determining the amount of clearance between trees and transmission lines, consideration should be given to the:

- type of line – whether it is bare, covered or insulted overhead conductors
- conductor sag and swing
- tree movement, soundness and regrowth; and
- overhanging branches.

3. Proposal context

3.1 Proposal location and surrounding environment

The proposal is located in western NSW, approximately 800 kilometres west of Sydney and within the Wentworth Local Government Area. It will traverse around 135 kilometres, typically in an east-west alignment between the SA/NSW border and the existing Buronga 220kV substation. The proposal traverses two main bioregions, being the:

> Murray Darling Depression; and
> Darling Riverine Plains.

While each of these regions present generally distinct characteristics including landforms (typically ranging from dune fields, sand-plains and undulating plains of brown calcareous soils to lower lying floodplains confined between sand-plains and dunefield), biodiversity and climates, the proposal would typically traverse areas of rural land, and land that has been developed primarily for agricultural uses such as dryland grazing with some areas of irrigated horticulture around the Darling River. While large areas have been heavily modified and disturbed, the proposal study area also contains areas of remnant vegetation including Mallee Woodlands of mixed age, Low Open Chenopod shrub land dominated by stretches of heavily grazed and degraded to highly degraded low open chenopod of Black-bush (*Maireana pyramidata*) with a notable absence of palatable species.

The proposal study area contains no other key land uses of note, namely National Parks reserves or state forests. There are no certified aerodromes, defence or Commonwealth lands or mining tenements. There are no major population and service centres located within the corridor or proposal study area.

The townships of Wentworth and Buronga are situated along the Darling and Murray Rivers respectively and to the south of the study area. The proposal is expected to cross the Silver City Highway and a number of other local roads.

Two key waterways are present within the proposal study area, the Darling River and Great Darling Anabranch.

The proposal study area is classed as lands in bushfire prone areas.

3.2 Existing infrastructure within the proposal study area

Several sections of the proposal would be located near or parallel to existing electrical or road infrastructure (refer to Figure 1-2).

From the SA/NSW border, the proposed new transmission line would run east-west parallel to Renmark Road for approximately 36 kilometres. It would then cross a greenfield area with minimal existing infrastructure for approximately 57 kilometres before turning south-east to run parallel to the existing TransGrid ‘Line 0X2’ 220kV transmission line that connects Broken Hill to the Buronga substation for approximately 40 kilometres.

The Buronga substation is an existing 220kV substation operated by TransGrid, which is located north-east of the main town of Buronga at 993 Arumpo Road, Wentworth NSW. The existing substation facility covers an area of approximately 2.14 hectares and is surrounded by relatively vacant land.

From the Buronga substation, the proposal would run parallel to a 6.5 kilometre long section of ‘Line X5/3’, which connects Buronga substation to the existing Balranald 220kV substation. It also involves a rebuild of the existing TransGrid ‘Line 0X1’ 220kV transmission line from Buronga to the NSW/Victoria border to upgrade it from a single circuit to a double circuit transmission line. Line 0X1 has an existing 50 metre wide easement and ultimately connects the Buronga substation to the existing Red Cliffs 220kV substation in SA.

4. Bushfire risk assessment

4.1 Introduction

Bushfire risk is defined as the chance of a bushfire occurring that will have harmful consequences to human communities and the environment. Bushfire risk has two elements:

- likelihood – the chance of a bushfire occurring; and
- consequence – the impact of a bushfire when it occurs.

Risk reduction can be achieved by reducing the likelihood of a bushfire, the opportunity for a bushfire to spread or the consequence of a bushfire (on natural and built assets). Bushfire management should have a clear objective to reduce both the likelihood of bushfires and reduce the negative impacts of bushfires. It should also consider the costs, inconvenience and dangers of measures taken to reduce the risk of bushfires.

The consequences of bushfire management activities alone and the failure to implement programs also need to be considered.

A range of factors influence bushfire risk. These include:

- the likelihood of human and natural fire ignitions, as influenced by time, space and demographics
- the potential spread and severity of a bushfire, as determined by fuel, topography and weather conditions
- the proximity of assets vulnerable to bushfire fuels, and likely bushfire paths; and
- the vulnerability of assets including natural assets, or their capacity to cope with, and recover from bushfire.

4.2 Methodology

The Australian Standard AS/NZS ISO 31000:2009 and the Emergency Management Australia (EMA) emergency risk management process provides the framework for establishing the context, analysis, evaluation, treatment, monitoring and communication of risk.

Context defines the problem, which in the case of the proposal is the threat posed by bush/grassfire events that may occur on land within and adjoining the transmission line corridor. A further problem is the potential ignition of the vegetation within and adjoining the corridor by a malfunction of the transmission line or substation, or from works during the construction phase of the proposal.

Analysis (determine the likelihood & consequence) and the evaluation of risks of bushfire on the proposal, require the following criteria to be examined:

- fire history in the area
- possibility, probability and sources of ignition
- vegetation type and fuel loads of available vegetation
- topography
- likely fire runs
- climatic or seasonal influences
- surrounding influences on fire behaviour
- the type of development proposed and type of construction.

These criteria are examined in detail in the following sections.

4.3 Existing environment

4.3.1 Fire history

The publication *Understanding bushfire trends in deliberate vegetation fires in Australia* (2008, Bryant) identifies fire occurrences across the State and records 4.5 million hectares of land in the Bourke to Balranald, Cobar Shire and most of the western district of NSW being affected by bush/grass fires during the 1974 – 1975 bushfire season, destroying 50,000 stock and 10,170 kilometres of fencing.

The Wentworth Shire Council website confirms that bushfires are common in the outback and that the worst outbreak of bushfires in the shire was in 1974 – 1975. A State-of-Emergency was declared in December 1974 with a fire destroying 24,000 hectares within Balranald and Wentworth Shires.

A further 3.5 million hectares of land was affected in the Western District of NSW during the 1984 – 1985 bushfire season, destroying 40,000 stock and $40,000,000 in damage.

The Shire of Hay was affected during the 1990 – 1991 bushfire season with 200 cattle and hundreds of kilometres of fencing.

No further specific fire history data is available for the proposal study area beyond 2013.

Figure 4-1 below shows the ten major fires that have occurred in NSW between 1926 – 2013.

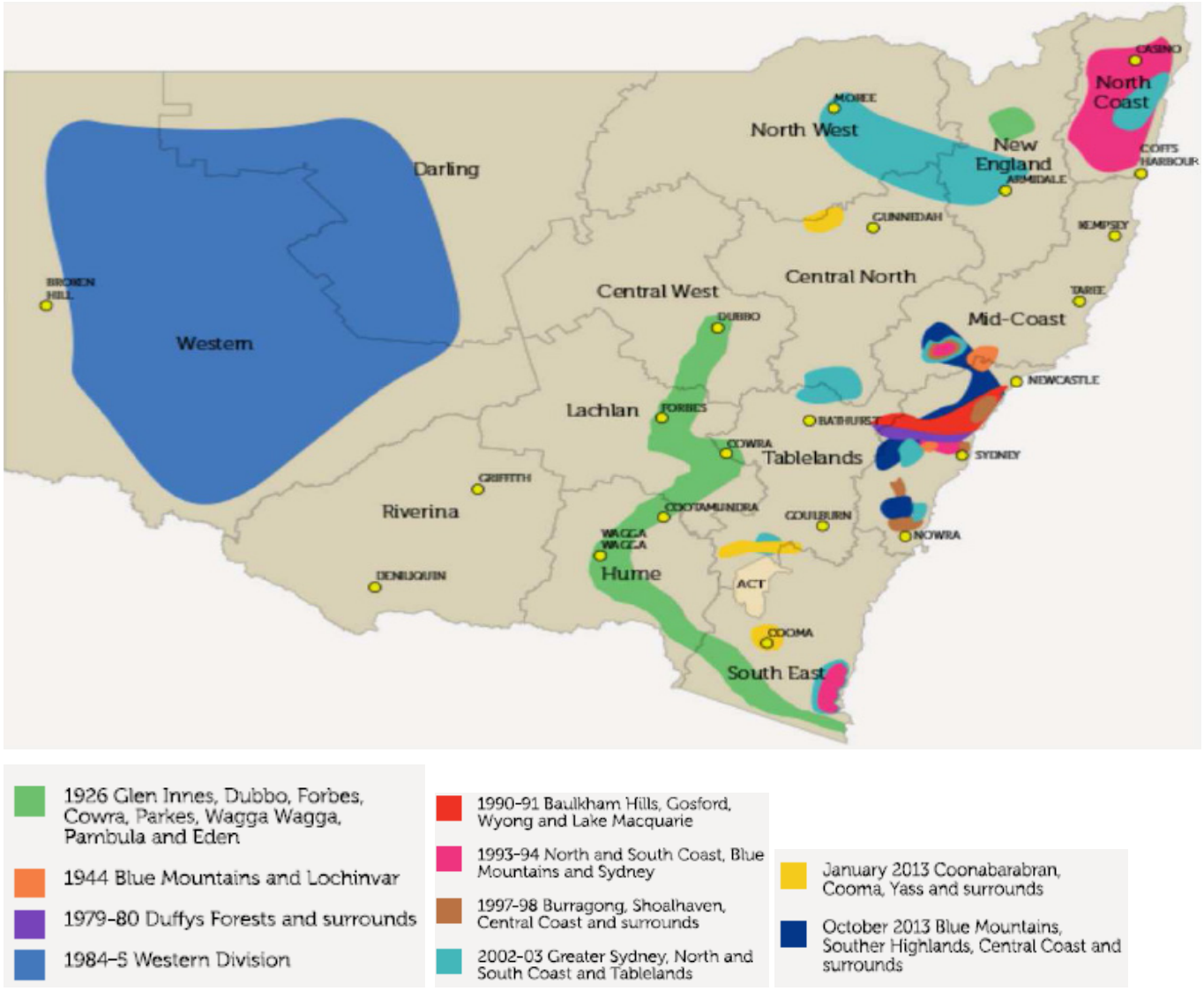

Figure 4-1 Plan of major fires in NSW – 1926 – 2013 – Source Climate Council of Australia

4.3.2 Bushfire ignition / fire sources

Causes of bushfires are natural or human caused. Human causes can be categorised as:

- malicious – including arson
- careless – such as escaped campfires, children and illegal burn-offs
- accidental – uncommon but includes motor vehicle and industrial accidents, farming operations, sparks from machinery (e.g. grinders), fires associated with utilities such as power lines and escaped prescribed hazard reduction burns.

The only common natural cause of bushfires is lightning. The most bushfires within NSW are human caused with many classified as arson. Arson is also a common cause of fire ignition at electrical installations such as substations with the potential for a deliberately lit fire to escape into the adjoining landscape.

Due to the length of the proposal study area, the likely causes of a bushfire impacting the vegetation within the proposal study area are varied. Accidental fire ignition, malicious fire ignition, embers from a remote fire or an uncontrolled fires' advance will allow fire to extend across the broader landscape, developing, under northerly, north-westerly, westerly and south-westerly wind influence into a large 'campaign fire', impacting upon the vegetation within the proposal study area.

Accidental/careless ignition of the vegetation within the road corridors, particularly the Silver City Highway, may also develop into a large 'campaign fire' that has the potential to travel at speed for some distance across the open landscape.

4.3.3 Climate and weather

4.3.3.1 General

The use of climatic indices such as air temperature, rainfall, relative humidity and wind (both speed and direction) allow predictions of likely fire behaviour and determine the severity of a bushfire event.

The fire season in western NSW corresponds with the summer months' high temperatures, low rainfall and very low humidity and can occur from September to April with a proclaimed bushfire danger period from October to March.

Bushfire risk management, planning and operations must take into account the likelihood of severe fire weather and the challenges it presents. Extreme and uncontrollable bushfires typically occur when the fire danger rating is over 50, a rating of Extreme. Very High and Extreme Forest/Grass Fire Danger conditions mainly occur between November and March in this region.

4.3.3.2 Temperature and humidity

Analysis of 1946 – 2020 Bureau of Meteorology records for Balranald NSW identify the mean maximum temperature occurs in December and January (30^0C +) with temperature commonly exceeding 40 degrees.

The wettest period is November to February with a mean annual rainfall of 16 millimeters and a low term average of 28.5 millimeters. Low humidity levels prevail for most of the year. Rainfall data from the two nearest Bureau of Meteorology Automatic Weather Stations (AWS), Mildura Airport and Lake Victoria Storage record annual average rainfall of 286 millimeters and 259 millimeters respectively.

The use of climatic indices such as air temperature, rainfall, relative humidity and wind (both speed and direction) allow predictions of likely fire behaviour and determine the severity of a bushfire event.

The fire season in western NSW corresponds with the summer months' high temperatures, low rainfall and very low humidity and can occur from September to April with a proclaimed bushfire danger period from October to March.

These weather conditions will influence the behaviour of fires burning within the Woodland/grasslands vegetation to all aspects of the transmission line route.

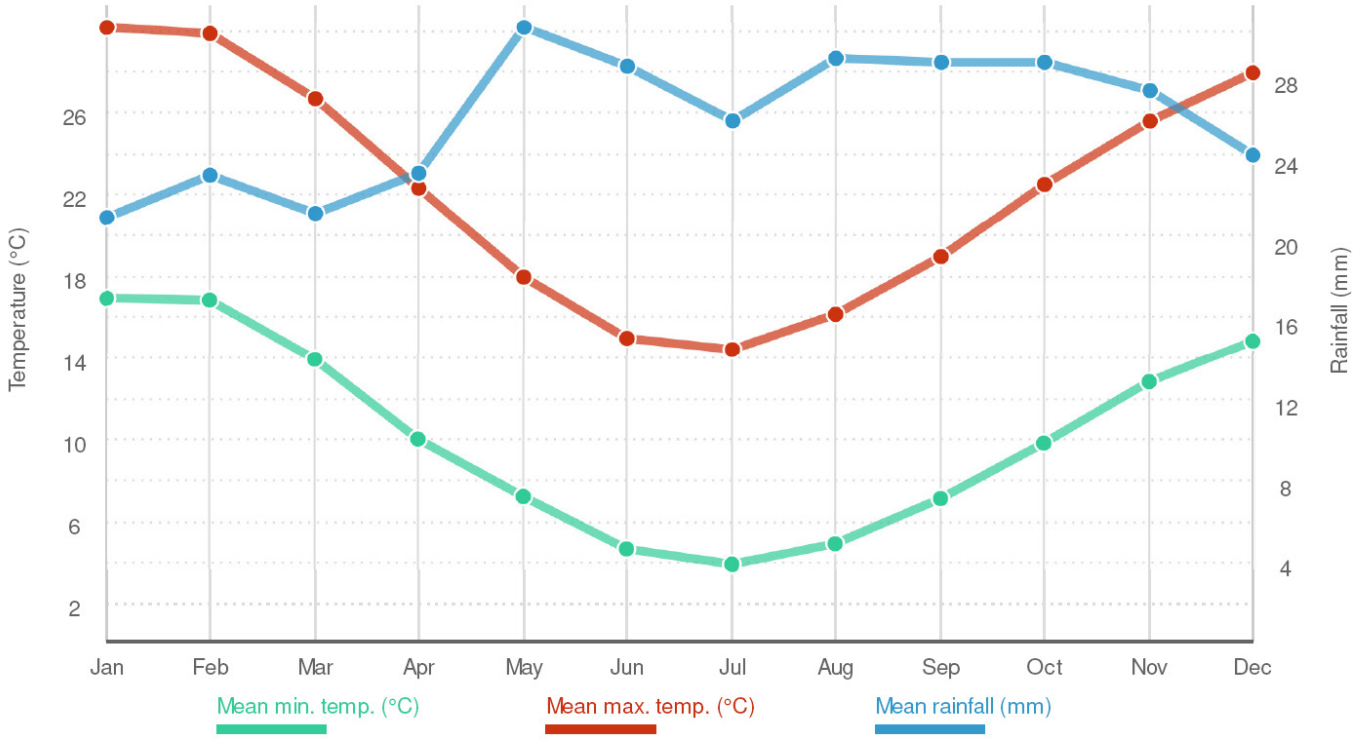

Figure 4-2 Mean rainfall and temperature – Balranald

4.3.3.3 Wind

Wind is an important factor in bushfire behaviour as it influences the rate of spread of the fire front and spreads burning embers/sparks, providing ignition sources for spot fires to distances up to 35 kilometres ahead of the main fire front.

Severe fire weather is typically associated with a north-westerly air flow due to the presence of high pressure systems over the Tasman Sea and the Great Australian Bight with a trough of low pressure separating these systems.

The exposure to wind effects will not vary along the length of the transmission line route due to the gently undulating nature of the landscape. Prevailing strong northwest, west and southwest winds will rapidly spread fires across the open landscape.

4.3.4 Topography

Slope is a critically important factor when assessing fire risk and likely fire behaviour. The rate of fire propagation doubles up a slope of 10 degrees (18 per cent) and increases almost fourfold up a slope of 20 degrees (40 per cent).

The rate of progress downslope tends to slow at a corresponding rate although wind direction in the lee of the hills/ridgelines tends to be unpredictable and can cause fires to change direction unpredictably.

The proposal study area traverses country which is predominantly flat with minor undulations across the flood plains to the creeks and rivers.

For the purpose of examining bush/grass fire behaviour the topography of the land within the proposal study area is considered to be level.

4.3.5 Bushfire fuels

Fuel is a critical element in bushfire risk management, as it is the one factor relating to fire behaviour that can be managed.

There are four 'types' of fuel that contribute to bushfire hazard. They relate to the distribution and nature of combustible material within a vegetated environment and are defined by the *Overall Fuel Hazard Guide – Fourth Edition* (Department of Sustainability & Environment Victoria, July 2010) – (industry standard), as:

- bark fuel hazard
- elevated fuel load
- near surface fuel load; and
- surface fine fuels.

Elevated material is defined as shrubs, heath and suspended material greater than 0.5 metres above ground.

The level of bushfire hazard depends on fuel continuity, height, amount of dead material, foliage thickness and flammability of live foliage.

Flammability of vegetation is at the highest when composition is fine, it contains a lot of dead material, is dense vertically and horizontally and has low moisture content.

Surface and near surface fine fuels are defined as the litter bed and vegetation up to 0.5 metres above the ground. Grasses add to the surface fine fuels and therefore need to be taken into account when assessing the hazard. The risk is higher where greater depth and volume of litter and surface material are present.

Bark has the potential to travel significant distances in a fire situation (spotting) and act as a ladder between surface fuels and the forest crown. Bark contributes to fire hazard when it is loose and fibrous, present in large quantities and in long loose ribbon forms.

4.3.5.1 Assessment of bushfire fuel hazard – Mallee Woodland

While large areas have been heavily modified and disturbed, the transmission line corridor contains areas of remnant vegetation including Mallee Woodlands of mixed age, Low Open Chenopod shrub land dominated by stretches of heavily grazed, and degraded to highly degraded low open chenopod of Black-bush (*Maireana pyramidata*) with a notable absence of palatable species.

Mallee Woodland and sparse shrublands are dominated by low, multi-stemmed, sclerophyllous eucalypts to 10 metres in height with a sparse to dense understorey which is dependent on rainfall and land use management.

Understorey may be dominated by sclerophyllous or non-sclerophyllous shrubs, hummock grasses, chenopods or tussock grasses. Ground layer is strongly influenced by rainfall and fires. Following heavy rain a prominent cover of ephemeral herbs with tussock grasses occur.

Whilst most of the grassland vegetation and grazed Woodland has some level of management by grazing, the success of this management practice can vary depending on the amount of rainfall in the spring period to produce abundant growth of grasses, and also the stock loading and their ability to crop the grasses to levels which will mitigate the intensity of fires that may occur in the cured grass.

Therefore, the assessment of fuel hazard will be determined for unmanaged Woodland/Low Chenopod Shrub vegetation which is the vegetation which will create the most potential for a severe fire event on and within the transmission line corridor.

Figure 4-3 Photograph of Mallee Open Woodland –Source Department of the Environment and Energy NVIS Fact Sheet

Using the methodology provided within the *Department of Sustainability and Environment (Victoria) Overall Fuel Hazard Guide* (industry standard), the following Fuel Hazard observation was determined.

(a) Bark Hazard

Mallee Woodland has a smooth trunk with ribbons of bark along the trunk and limbs of the tree. This vegetation has a High Bark hazard.

(b) Elevated Fuel Hazard

Elevated fuel comprises Chenopod shrub and suspended material.

The level of hazard depends on the fuel continuity (horizontal and vertical), height, and proportion of dead material, thickness of the foliage and twigs and flammability of the live foliage. The flammability of the elevated fuel is highest when:

- the foliage, twigs and other fuel particles are very fine (e.g. maximum thickness 1–2 millimetres)
- the proportion of dead material is high
- the fuels are arranged with a high level of density and horizontal and vertical continuity that promotes the spread of flame; and
- the live foliage has low, fuel moisture content.

The vegetation type and time elapsed since the most recent modification (e.g. fire or grazing) substantially determines the level of elevated fuel hazard.

A review of the elevated vegetation in and adjoining the proposal study area has determined that the Mallee Woodland, when not managed, has a High – Very High Elevated Fuel Hazard.

(c) Near Surface and Surface Fine Fuel Hazard

Near Surface Fine Fuel consists of low Chenopods and grasses such as Tussock Grass. The Surface Fine Fuels consist of deposited leaf litter and low grasses with the hazard assessed by measuring litter-bed height.

The Fuel Hazard rating for the Near Surface and Surface Fine Fuel in the Mallee Woodland vegetation is Very High to Extreme.

The Overall Fuel Hazard of unmanaged Mallee Woodland Vegetation is Very High.

4.3.5.2 Assessment of bushfire fuel hazard – grassland & crops

The proposal study area typically traverses areas of rural land, and land that has been developed primarily for agricultural uses such as dry-land grazing with some areas of irrigated horticulture around the Darling River.

Unmanaged grassland and cured (dry) crops present a High to Very High Fuel Hazard Rating.

4.3.6 Potential fire runs

Wind and topography of the land create the potential path that a fire will take.

The topography of the land through which the transmission line traverses is level or gently undulating within an open landscape.

Fires which occur in this landscape will spread in the direction of the wind with the dominant fire spread from the northwest, west and southwest.

4.4 Assessment of bushfire risk during construction of the proposal

The potential sources of ignition of bushfires resulting from the construction of the proposal include:

- construction equipment including bulldozers, excavators and cranes
- motor vehicles
- vegetation removal including mulching
- hot works such as welding and grinding
- electrical faults in equipment
- chemical fires
- construction camps and compounds; and
- arson.

These sources of ignition are explained further in the below sections. In general, the risk of bushfire impact on the transmission line corridor and substation site during construction is high to extreme and is dependent on factors such as fuel loads, weather and the scale (size) of fires which may occur. There is a threat to construction personnel from fast moving bushfire events which may impact large lengths of the transmission line corridor.

Management measures are required to manage and minimise these risks and these are consolidated in Chapter 5.

4.4.1 Construction equipment including bulldozers, excavators and cranes

The use of heavy construction equipment including bulldozers and excavators for building roads, excavating pads and drilling bore holes can create situations where these activities can give off sparks when steel blades encounter rock, resulting in a high level of risk of ignition of vegetation.

This risk can occur over a wider area from the machine operational area.

To reduce the level of risk the use of this equipment in areas where rock is known to occur shall be accompanied by a fire-fighting appliance such as a ‘slip-on’ fire-fighting unit or tanker trailers. This work shall not occur during periods of Total Fire Ban and Catastrophic Fire Weather Days.

4.4.2 Motor vehicles

Motor vehicle exhaust systems are known to ignite grassland vegetation. Diesel powered trucks with pollution control devices in the exhaust system have the potential to emit burning diesel particles which ignite grassland vegetation and forest ground fuels, resulting in a high level of risk of ignition of vegetation.

To reduce the level of risk motor vehicles should not be driven across long cured (dry) vegetation (grass & crops) and should be equipped with a nine kilogram water fire extinguisher. Operators of diesel powered trucks should be made aware of the risk of ignition of vegetation posed by the exhaust emission system. These trucks should be equipped with a nine kilogram water fire extinguisher.

There is also risks associated with collision of a vehicle with a power pole or infrastructure that can result in either a spark, arc from a power supply or fire from spilt fuel being ignited.

4.4.3 Vegetation removal including mulching

The use of specialised slashers, mulching machines and bulldozers used for clearing vegetation create high risk situations when blades contact rock outcrops.

To reduce the level of risk these machines should only be used in rocky locations with the aid of a fire-fighting appliance such as a ‘slip-on’ fire-fighting unit or tanker trailers. This work shall not occur during periods of Total Fire Ban and Catastrophic Fire Weather Days.

4.4.4 Hot works

Hot works undertaken such as welding, grinding, drilling can produce sparks which have the capacity to spread for some distance on the wind, resulting in an extreme level of risk of ignition of cured (dry) vegetation.

To reduce the level of risk precaution should be used during all external hot works with shielding and a water supply (nine kilogram water fire extinguisher) provided. No external hot works should be undertaken during periods of Total Fire Ban and Catastrophic Fire Weather Days.

Emergency external hot works undertaken during periods of Total Fire Ban and Catastrophic Fire Weather Days shall have a NSW Rural Fire Service fire-fighting appliance on stand-by at the works.

4.4.5 Electrical faults in equipment

Electrical faults, including faulty power leads and generators also create a high level of risk of ignition of vegetation.

To reduce the level of risk equipment should be checked weekly for potential faults.

4.4.6 Chemical fires

The inappropriate storage of incompatible or flammable chemicals have the potential to cause a chemical fire or explosion. The failure to clean up a flammable chemical spill or address leaking containers can also lead to a fire.

To reduce the risk of fires from these events all chemicals should be managed and stored in accordance with safety data sheet requirements.

4.4.7 Construction compound and camp sites

Hot works undertaken within the construction compound, such equipment maintenance which includes welding and grinding and vegetation management such as mechanical slashing can produce sparks which have the capacity to spread for some distance on the wind, resulting in an extreme level of risk of ignition of cured (dry) vegetation.

To reduce the level of risk precaution should be used during all hot works/grinding and vegetation slashing within the construction compound and camp sites with shielding and a water supply (nine kilogram water fire extinguisher) provided. No hot works should be undertaken during periods of Total Fire Ban and Catastrophic Fire Weather Days.

External cooking fires (such as BBQ), electrical faults and the inappropriate discarding of lit cigarettes can cause ignition of grassland within and external to the camp site.

Management protocols should be introduced to reduce the risk of ignition from external cooking fires, electrical faults and ignition from discarded cigarettes.

4.4.8 Arson

A malicious act (e.g. arson) can occur where-ever human activity occurs and can result in high risk to the proposal and the operators of the equipment.

To reduce the level of risk TransGrid would need to engage appropriate security measures to monitor the actions of unauthorised persons within the proposal corridor, works compounds and adjoining land during the bushfire danger period to minimise the risk of an arson attack being successful.

4.5 Assessment of bushfire risk during operation

4.5.1 Bushfire risk to the proposed transmission lines during operation

There is a high probability that the proposed transmission lines could be impacted by a bush/grass fire when ignition occurs in any unmanaged vegetation during periods of high fire danger, when excessive dry (cured) fuel is available and weather conditions result in high temperatures, low humidity and strong winds travelling across the landscape from the northwest, west and southwest direction.

The risk to the transmission lines under these conditions would be dependent on the scale (size) of the fire. The risk from large scale fire events would be high to extreme.

However, the transmission lines would be constructed within easements which would be cleared of vegetation/maintained in line with the following principles which are standard TransGrid transmission line management procedure:

> All tall growing vegetation on the easement corridor shall be removed. Tall growing vegetation is any vegetation species which may intrude on the vegetation clearance requirements at maximum line operating conditions (refer Table 4-1) (maximum conductor sag and maximum conductor blowout) at that location now or at any time in the future. The assessment of tall growing vegetation would be undertaken during detailed design and ongoing through construction by a qualified Level 4 or Level 5 arborist. An arborists report shall be provided identifying the vegetation to be removed along the transmission line route in relation to the final detailed designed transmission line conductor profiles.

  In relation to the two transmission lines proposed, the clearance distances required are expected to be:

  – nine metre clearance between vegetation height and maximum conductor sag point for the 330kV line; and
  – 8.3 metre clearance between vegetation height and maximum conductor sag point for the 220kV line.

  Vegetation within the easement that would encroach on these clearance distances would be removed.

  Based on the expected tower and conductor heights vegetation with heights of between two and four metres from ground level is expected to be able to be retained in the easements. Noting that:

  – two metre tall vegetation would occur at the centre area of the easement and four metres tall vegetation could occur as distance from the centreline of the conductor (line) increases
  – for the 80 metre wide 330kV easement, this vegetation clearing would only be required for the centre 60 metre wide section.

- Vegetation within 20 metres of each transmission line structure shall be removed to provide clear access to the structure.
- All hazard trees located on the easement corridor shall be removed. Hazard trees are any tree or part of a tree that if it were to fall, would infringe on the Vegetation Clearance Requirements at maximum conductor sag. Hazard trees shall be identified during detailed designed based on the transmission line conductor profile.

Table 4-1 TransGrid vegetation clearance requirements for easements

Nominal System Voltage	Vegetation Clearance at Maximum Line Operating Conditions (Minimum Safe Working Distance + Regrowth Rate)
220kV	1.8m + Regrowth allowance
330kV	3.0m + Regrowth allowance
500kV	3.9m + Regrowth allowance

Source: (Transmission Line Construction Manual – Major New Build, TransGrid February 2020)

The transmission line tower structures would be between 50 and 80 metres tall and constructed from steel, which is a non-combustible material. This means that the structures would be high enough above the ground so that fires occurring within the grassland and woodland vegetation surrounding the easement would not be expected to generate sufficient height to directly impact the conductors with flame contact.

The towers and conductors would be likely to be impacted by radiant heat from these fire occurrences. The levels of radiant heat are not likely to impact upon the integrity of the tower structure, the conductors and their connectors (insulators).

The residual risk of bushfire on the transmission lines and their supporting structures is therefore reduced to moderate.

4.5.2 Bushfire risk created by the proposed transmission lines during operation

The distribution of electricity via high voltage transmission lines and associated equipment has the potential to cause ignition of bushfire fuels, either within or adjoining the transmission line easement.

Ignition sources which can be attributable to high voltage transmission lines and associated equipment include:

- trees or tree branches falling/touching conductors and bird strikes
- equipment malfunction – transmission line failure including damage caused by high winds, lightning strike or mechanical damage [i.e. aircraft strike]
- wind causing transmission lines to contact each other
- arc to ground and arc between conductors caused by Ionise particles in dense bushfire smoke
- heat causing power lines to sag and connect with the ground/vegetation/structures
- lightning strikes
- human error – faulty installation
- failure of power line including breakage of wires, poles, cross arms, insulators and associated equipment
- pole-top fires caused by dust build up on insulators, causing arcing from the conductor to the tower/cross arm
- arcing to ground through smoke plumes; and
- electrically induced fire – current or voltage transfer due to fault and failure of the earthing system at transmission line structures.

The incidence of these ignition sources from transmission lines supported on high towers which are maintained clear of trees and combustible materials is rare.

However, if one of these ignition sources should occur during prolonged drought conditions when combustible fuels are available, the risk of ignition is high. Necessitating monitoring and rapid response to any incident/emergency that is likely to cause line failure and therefore the potential for fire ignition within the bushfire prone vegetation.

The bushfire risk from the transmission lines infrastructure to the surrounding environment is therefore moderate.

4.5.3 Bushfire risk to the Buronga substation during operation

The proposal includes the expansion to the existing TransGrid 220kV Buronga Substation to a 330kV operating capacity. The existing facility occupies Lot 1 in DP 717938, on Arumpo Road, Buronga.

Figure 4-4 Buronga Substation location plan

As shown in Figure 4-4, the substation site is located to the northeast of the Buronga Township and is adjoined to all aspects by vacant land with open woodland vegetation (refer Figure 4-5).

The minimum Asset Protection Zone to the existing facility is 11 metres with a Bushfire Buffer Zone of three metres around the perimeter fence of the switchyard and a minimum eight metre safety clearance to active network equipment.

These protection measures would be maintained in the design of the planned expansion to the substation.

With the planned protection measures in place the potential bushfire risk to the substation is considered to be low – moderate.

Figure 4-5 Photograph of land to the southwest of the substation site. This vegetation is typical to all aspects of the substation site

4.5.4 Bushfire risk from the Buronga substation during operation

The generation and distribution of electricity has the potential to cause fire ignition within the Buronga substation.

Ignition sources include:

- equipment malfunction – transformer explosion; burn out of motors/fans; wiring failure
- human error.

The incidence of equipment malfunction is rare. Transformers can explode and have the potential to spread molten metal and burning oil for some distance from the transformer.

Fans and motors fail with the potential impact restricted to localised sparks and in some cases, the shedding of hot/molten metal. Overhead wiring failure is uncommon and is usually the result of physical damage from lightning strikes or sparks given off during light rain, as a result of dust build up on the insulators over extended dry periods.

Whilst these occurrences may generate a potential ignition source, it is the human error factor that would cause the greatest level of risk of ignition to the surrounding bushfire prone vegetation.

The extent of the proposed clearance between the Buronga substation equipment and the compound fence, combined with the gravel ground cover within the compound, would mitigate the risk of the transfer of an ignition within the compound to the surrounding vegetation.

The bushfire risk from the operation of the substation is considered to be low – moderate.

5. Mitigation measures

5.1 Overview of management approach for bushfire risk

Broad strategies to manage bushfire risk include:

- eliminate the bushfire risk (make the land-use decision first by asking the question about whether development should or should not proceed in a given area)
- design or substitution (review location)
- engineering controls (infrastructure, building standards and landscaping)
- administration and organisation; (community preparedness measures).

The risk of bushfire impact on the corridor during construction is high to extreme and is dependent on factors such as fuel loads, weather and the scale (size) of the fire. There is a threat to construction personnel and contractors from fast moving bushfire events which may impact large lengths of the transmission line corridor.

A Bushfire Risk Management sub-plan will form part of the Construction Environmental Management Plan (CEMP) for the proposal. The sub-plan will be prepared by a suitably qualified professional and will include (but not limited to):

- protocols for the relocation of workers to nominated safe refuge zones during a bushfire emergency, either within or remote to the work zone (Bushfire Emergency and Evacuation Plan (BEEP)
- protocols for the management of bushfire risk and fuel management during construction. This will include restriction and/or prevent of certain activities that present bushfire risks on days with a fire danger rating of equal to or greater than 'high', and as directed by relevant state authorities
- training to inform construction workers of bushfire risks and preventative actions, including risks associated with the operation (and maintenance) of vehicles, plant and equipment.

5.2 Specific mitigation measures recommended

This section summarises the mitigation measures recommended for the proposal to mitigate bushfire risk.

Table 5-1 Mitigation measures

ID	Identified mitigation measure	Applicable location(s)
BF-1	A minimum 50 metre wide managed Asset Protection Zone will be provided to the hazard perimeter of the construction equipment and camp site buildings. This zone will be regularly maintained to provide a maximum grass height of 100mm – 150mm during the prescribed Bushfire Danger Period and when the grassland fuel reaches 70% cured. Vegetation inside the construction and camp sites will be regularly maintained to a maximum height of 75mm.	Main construction compounds and accommodation camp sites
BF-2	Buildings within the construction compound and camp site will be constructed to comply with Section 3 and Section 5 (BAL 12.5) of A.S. 3959 – 2018 –*'Construction of Buildings ion Bushfire Prone Areas'.* The sub-floor space of each building will be enclosed with stainless steel flymesh securely fixed to the external wall/s and buried into the ground. All joints will be overlapped and sealed.	Main construction compounds and accommodation camp sites

ID	Identified mitigation measure	Applicable location(s)
BF-3	Water for fire-fighting operations will be confirmed during detail design with consideration to occupancy density and site layout. This will include onsite static water supply and fire-fighting hose reels. All weather access having a minimum width of 4.0 metres will be provided to the static water supply tanks.	Construction and camp sites
BF-4	Security measures will be implemented to minimise the risk of arson within and adjoining construction areas. The location of appropriate security measures will be determined using a risk-based approach.	Whole of proposal
BF-5	The proposal will be designed, operated and maintained in accordance with TransGrid's Bushfire Risk Management Plan. This includes reduction in fuel loads, management of asset protection zones and inspections of infrastructure	Whole of proposal
BF-6	The Buronga substation Emergency Response Manual will be updated to include the new proposed design and required revised emergency response procedures.	Buronga substation

6. References

Australian Standard A.S. 3959 – 2018 – *'Construction of Buildings in Bushfire Prone Areas'*

Building Code of Australia

Bryant, Colleen, 2008. *Understanding bushfire trends in deliberate vegetation fires in Australia*. Australian Institute of Criminology

Climate Council of Australia, 2014. Be Prepared: Climate Change and the NSW Bushfire Threat

NSW Department of Sustainability & Environment Victoria, July 2010. *Overall Fuel Hazard Guide – Fourth Edition*

NSW Rural Fire Service, 2019. *Planning for Bushfire Protection*

NSW Rural Fire Service, 2015. *Guideline for Bushfire Prone Land Mapping*

N.S.W Rural Fire Service, 2009. *Bushfire Environmental Assessment Code 2009*

TransGrid, February 2020 – *Transmission Line Construction Manual – Major New Build*

Wentworth Shire Council Website, accessed June 2020