

**BUSHFIRE RISK ASSESSMENT
FOR THE
TRANSGRID SUBSTATION,
WILLIAMSDALE,
AUSTRALIAN CAPITAL TERRITORY**

**PREPARED FOR
TRANSGRID.**



Australian Bushfire Protection Planners Pty Limited.
ACN 083 085 474
RMB 3411 Dog Trap Road
SOMERSBY 2250 NSW
Phone: (02) 43622112 Fax: (02) 43622204
Email: abpp@bigpond.net.au

BUSHFIRE RISK ASSESSMENT
FOR THE
TRANSGRID SUBSTATION,
WILLIAMSDALE
AUSTRALIAN CAPITAL TERRITORY

PREPARED FOR

TRANSGRID.

Assessment Number	Document	Preparation Date	Issue Date	Directors Approval
B06341 - 1	Final	26.12.2006	1.1.2007	

EXECUTIVE SUMMARY

The Australian Capital Territory (ACT) and surrounding areas are supplied via an ActewAGL operated 132kV transmission network radiating from TransGrid's Canberra 330/132kV Substation which is located in the West Belconnen area.

Following joint planning with ActAGL, the agreed network development strategy is the establishment of a 330/132kV Substation in the southeast area of the ACT, connecting into the existing Canberra to Cooma 132kV lines. This substation will be located in the Williamsdale area to service newly identified urban growth areas to the south of Canberra and to also meet the reliability criteria recently established by the ACT Government to ensure diversity of supply to the ACT.

The total project is referred to as the "Second Supply to the ACT". It involves a number of component tasks performed by both TransGrid and ActAGL, depending on the responsibility of each agency. In its functions as the Transmission Network Service Provider role for NSW and the ACT, TransGrid will build the 330/132kV Substation at Williamsdale and perform transmission line re-arrangement works that are required to supply the Substation at 330kV.

The Substation will be an air insulated 330 / 132 kV Substation initially comprising the required 330 kV and 132 kV switchgear plus a single 330/132KV, 375 MVA transformer. The Substation will be designed to allow for expansion in the future.

Following investigation into the suitability of land within the Williamsdale area, nine possible substation sites [A – I] were investigated for the construction of the new Substation.

Sites A & B located on the eastern side of the Monaro Highway, with Site A on the northern side of the existing TransGrid 132kV powerline and Site B to the south of the existing line.

Sites C & D are located on the corner of the powerline at STR 132 and Site E is located on the line of the existing 132kV powerline, north of Angle Crossing Road. Site F is located to the south of the existing powerline, within Block 1653 and to the southeast of STR 133.

Site G is located on the knoll within Block 1471, to the south of Angle Crossing Road. Site H is located to the north of the existing powerline, within Block 1653, between STR 133 and STR 134. The final site is Site I which is located to the south of the existing powerline, within Block 1653, to the south of STR 134 and to the east of Site F.

Of the nine possible locations for the substation, Sites F, H and I were identified as preferred development sites. Field investigations were undertaken to determine the potential bushfire risk to each of the preferred sites. The following is a summary of the results of these investigations:

SITE F.

Possible Site F is located approximately 700 metres to the west of the Monaro Highway and to the south of the existing powerline within Block 1653, southeast of STR 133, on land which slopes to the northwest towards a creekline that flows to the west to the Murrumbidgee River. The site contains extensive re-growth Woodland vegetation and is exposed to the influences of wind driven fires that will advance, under strong northwest and westerly winds, upslope from the Murrumbidgee River corridor into the valley formed by the creek line.

A second fire path is available upslope from the exposed ridge slopes to the southwest. The resultant bushfire risk will be extreme levels of radiant heat and ember attack as the fire advances upslope to the east, along the valley and from the Murrumbidgee River corridor to the southwest.

The potential risk to the substation would necessitate the provision and maintenance of a 100 metre wide managed Asset Protection Zone to the northwest, west and southwest of the substation compound and a 50 metre wide managed Asset Protection Zone to the south and east of the substation compound.

SITE H.

Possible Site H is located to the north of the existing powerline within Block 1653, between STR 133 and STR 134. The site is located to the east of a low ridge line that runs in a north to south direction, forming the eastern ridge line to the Murrumbidgee River corridor. The site rises gently to the northwest, from the creekline that flows to the west beneath the line of the existing powerline, turning to the northeast between STR 133 & STR 134.

The vegetation within Site H consists of grazed pasture grass and scattered Open Woodland trees. The vegetation on the ridgeline to the west and northwest of the site is similar to the vegetation within the proposed substation site.

The site is shielded to the northwest and west by the ridgeline and will therefore not be exposed to the direct impacts of the predominant northwest and westerly fire winds. Some exposure remains to the impact of wind driven turbulence in the "lee", or eastern side of the ridgeline. The site is exposed to the potential impact of wind driven fires burning out of the Murrumbidgee River Corridor, under southwesterly wind influences.

The potential risk to the proposed substation within Site H is therefore less than the risk to Site F [and the potential risk the Site I] with the risk being limited to expose from the southwest.

A 100 metre wide managed Asset Protection Zone to the south-western aspect of the substation compound would be required to mitigate the risk from the southwest. A nominal 30 metre wide managed Asset Protection Zone would mitigate the risk to the remaining aspects of the site.

SITE I.

Possible Site I is located to the south of to the existing powerline within Block 1653, south of STR 134 and to the east of Site F. The site slopes to the northwest towards the creekline and contains cleared areas with grazed pasture grass, Woodland re-growth and pockets of Open Woodland vegetation.

Site I is located closer to the Monaro Highway and is protected, from potential fire paths from the northwest and southwest by the ridgelines that rise to the northwest of the creekline [northwest and west of Site H] and by the high ridgeline that runs east to west, south of the development site. This latter ridgeline protects against the direct upslope attack of fire from the southwest, unlike Site F.

Site I remains exposed to the influences of fire advancing from the west, upslope along the creekline with the potential bushfire attack being extreme from this direction. Potential impact will be high levels of radiant heat and ember attack, necessitating a 100 metre wide managed Asset Protection Zone to the west. The potential risk to the southeast and northeast is low, however a 30 metre managed Asset Protection Zone is required to these aspects.

PREFERRED SITE.

A site meeting was held on the 10th November 2006 to examine the three alternative sites – Sites F, H and I. Issues considered included engineering constraints/possibilities, particularly in respect to earthworks required for construction of the compound area and access road; environmental constraints; bushfire risk and visual impact and visual amenity, particularly in relation to the Lessee of Bock 1653, W. Nash.

The site meeting concluded that the preferred site for the construction of the new Substation is Site I.

This Bushfire Risk Assessment identifies the potential bushfire risks to the substation facility constructed on preferred Site I and provides recommendations on bushfire protection measures required to mitigate the bushfire risk. These recommendations are based on the location of the facility as described on Purdon Associates drawing TG 01, TG03, TG04 and TG05, dated 19.12.2006.

The Bushfire Risk Assessment also considers the potential risk that the Substation facilities may generate on the adjoining landscape.

Graham Swain
Director, Australian Bushfire Protection Planners Pty Limited.

TABLE OF CONTENTS.

EXECUTIVE SUMMARY	3
TABLE OF CONTENTS	6
SECTION 1	
INTRODUCTION	7
1.1 The Brief	7
1.2 Objectives of the Brief.....	7
1.3 Study Area	7
1.4 Scope of the Study.....	7
SECTION 2 DESCRIPTION OF STUDY AREA	9
2.1 Site Inspection	9
2.2 Location of the proposed Williamsdale Substation Site.....	9
2.3 Existing Land Use	9
2.4 Surrounding Land Use	9
2.5 Topography	10
2.6 Vegetation within the Substation Compound	11
2.7 Vegetation beyond the Substation Compound	11
SECTION 3 CONTEXT OF THE BUSHFIRE RISK ASSESSMENT ...	12
SECTION 4 BUSHFIRE RISK	13
4.1 Introduction	13
4.2 Management Strategies	13
SECTION 5 BUSHFIRE RISK ASSESSMENT	15
5.1 Introduction	15
5.2 Assessment of Bushfire Risk to Substation.....	15
5.2.1 Fire History of the ACT.....	15
5.2.2 Bushfire Ignition/Fire Sources	16
5.2.3 Climate and Weather	16
5.2.4 Topography	18
5.2.5 Bushfire Fuels	19
5.2.6 Assessment of Bushfire Fuel Hazard	20
5.2.7 Potential Fire Runs.....	21
5.3 Summary of Bushfire Risk to the Substation	21
5.4 Assessment of Bushfire Risk created by the Substation.....	22
SECTION 6 BUSHFIRE PROTECTION MEASURES	24
6.1 Management of the Vegetation	24
6.2 Access	24
6.3 Construction Standards to Buildings	24
6.4 Water Supplies for Fire Fighting Operations.....	25
6.5 Provision of Portable Fire Fighting Equipment.....	25
6.6 Works on Total Fire Ban Days.....	25
SECTION 7 CONCLUSION	26
SECTION 8	27
APPENDIX A	
• Copy of TransGrid Substation Site Selection – Purdon Drawing TG01;	
• Copy of Site Plan of Substation Site – Purdon Drawing TG03;	
• Copy of Proposed Land Acquisition – Purdons Drawing TG04;	
• Copy of Stormwater & Erosion Control Concept Plan – Purdons Drawing TG05.	
REFERENCES	28

SECTION 1

INTRODUCTION

1.1 The Brief.

As part of the Preliminary Assessment for the construction of the new Williamsdale Substation, TransGrid require a Bushfire Risk Assessment to inform the detailed design of the Substation on the potential bushfire risk to the facility and the protection measures required to mitigate the risk. Australian Bushfire Protection Planners Pty Limited has been commissioned to undertake the Bushfire Risk Assessment.

1.2 Objectives of the Brief.

- Prepare a Bushfire Risk Assessment for the proposed Williamsdale 330kV Substation.
- The assessment shall provide recommendations on bushfire protection measures, including the provision and management of fire protection zones, construction standards to buildings and access provisions.
- The assessment shall determine the potential risk of ignition, of the adjoining landscape and built form, from events that may occur within the proposed Substation.

1.3 Study Area.

For the purpose of this report, the boundaries of the Williamsdale Substation study area are defined by land within Block 1653, identified as Site I on the Purdon Associates drawing number TG01 dated 19.12.2006, east to the Monaro Highway; west to the top of the Murrumbidgee River escarpment and 150 metres to the north and south of the proposed bushfire management buffer zone to the Substation Site.

1.4 Scope of Study.

1.4.1 Establish the context:

- Define the problem.
This involves the identification of the nature and scope of issues to be addressed.

1.4.2 Identify the bushfire risk including an assessment of:

- The exposure to possible ignition / fire sources;
- Vegetation type and likely fuel loads and fire hazards arising using the "Overall Fuel Hazard Guide" – Third edition (NRE May 1999);

- The impact of climate and likely fire runs during severe fire danger periods;
- Wind effects;
- The impact of surrounding land uses and fuel loads.

SECTION 2

DESCRIPTION OF STUDY AREA

2.1 Site Inspection.

Graham Swain of Australian Bushfire Protection Planners Pty. Limited inspected the study area on the 28th September 2006 to assess the topography, slopes and vegetation classification within and adjoining the development precinct. Adjoining land was also inspected to determine the surrounding land use/land management, vegetation communities and topography.

2.2 Location of the proposed Williamsdale Substation Site.

The proposed Williamsdale Substation site is located to the west of the Monaro Highway within Block 1653, south of the township of Williamsdale, ACT and contains 11.108 hectares of land identified as Site I on the Purdon Associates drawing TG01, dated 19th December 2006. The site occupies an irregular shaped parcel of land to the south of the existing TransGrid Canberra to Cooma 132kV powerlines with a narrow leg extending east to the Monaro Highway. The substation compound is located to the south of existing tower STR 134 on the TransGrid 132kV powerline.

2.3 Existing Land Use.

The Substation site is currently leased and used for grazing by the Lessee of Block 1653 [W. Nash]. TransGrid are seeking to acquire the site through a land purchase from the current Lessee.

2.4 Surrounding Land Use.

a) North

The land to the north of the Substation site forms part of Block 1653 which is leased by Nash and used for grazing.

b) East

The land to the east of the narrow 'leg' of Substation site forms the carriageway to the Monaro Highway. The land currently forms part of Block 1653 which is leased by Nash and used for grazing.

c) South

The land to the south of the Substation site forms the southern part of Block 1653 which is leased by Nash and used for grazing.

d) West

The land to the west of the Substation site forms part of Block 1653 which is leased by Nash and used for grazing.

2.5 Topography.

2.5.1 Within the Substation Site.

The topography of the land within the Substation Site [identified as preferred Site I on Purdon Associates drawing TG01] consists of the side slopes to a watercourse that is located to the north of the proposed site and flows to the west from the Monaro Highway. The watercourse flows to the west, forming a steep sided gully line that descends to the west into the Murrumbidgee River.

The topography of the land within the eastern portion of the site falls to the northwest at < 6 degrees.

2.5.2 Within the Substation Compound.

The land within the Substation compound falls to the northwest at 4 - 5 degrees to the northwest to the watercourse which is on the northern edge of the Substation Site.

2.5.2 Beyond the Buffer Zone to the Substation Compound (within the Study Area).

a) North

The topography of the land to the north of the Substation Compound buffer zone rises to the north, beyond the watercourse, at 8 degrees to form the ridgeline to the north of the TransGrid powerline.

b) East

The topography of the land to the east of the Substation Compound, within the eastern portion of the Substation Site and on the land within Block 1653, rises at < 8 degrees to the east to form a low ridgeline that extends to the south along the western aspect of the Monaro Highway.

c) South

The topography of the land to the south of the Substation Compound buffer zone rises at 8 degrees to a knoll. The knoll connects to the ridgeline in the east via a saddle that forms to the southeast of the buffer zone.

d) West

Topography of the land to the west of the Substation Compound buffer zone falls at 2 – 4 degrees to the northwest, increasing in slope further to the northwest.

The land to the southwest of the Substation Compound buffer zone rises to the south to form the continuation of the ridgeline that extends to the west to the edge of the Murrumbidgee River corridor.

2.6 Vegetation within the Substation Compound.

The vegetation within the Substation compound consists of Woodland vegetation with a grazed grassland understorey.

Significant emergent Woodland tree species regrowth is occurring within the Substation site and buffer zone buffer zone to the west of the compound.

2.7 Vegetation beyond the Substation Compound.

(a) North

The vegetation on land within the buffer zone and on the land to the north of the watercourse consists of Open Woodland with a grazed grassland understorey.

b) East & Southeast

The vegetation on the land to the east of the Substation compound consists of Open Woodland increasing to Woodland on the higher slopes of the ridgeline. The understorey vegetation within the Woodland/Open Woodland vegetation consists of low shrubs and grasses. The grass is grazed.

c) South & Southwest

The vegetation on the saddle and knoll to the south and southwest of the Substation compound consists of Woodland. The understorey vegetation consists of shrubs and grasses. The grass is grazed.

d) West & Northwest

The vegetation on the land to the west and northwest of the Substation compound consists of Woodland vegetation with a shrub layer, emergent tree cover and a grassy understorey. The grassy understorey is grazed by sheep and kangaroos.

SECTION 3.

CONTEXT OF THE BUSHFIRE RISK ASSESSMENT

The ACT Government enacted the *Emergencies Act 2004*, as part of its response to the needs identified by the McLeod Inquiry to replace the *Bushfire Act 1936* and sets the legislative basis for bushfire related planning.

Resulting from the changes in legislation, the ACT Planning & Land Authority prepared "*Planning for Bushfire Risk Mitigation*", a guideline adopted under the Territory Plan, that provides guidance to mitigate adverse impacts from bushfires in the ACT.

The Guideline is one of many documents that informs planning and development in the ACT and is taken into account by the ACT Planning & Land Authority when determining development applications and is complementary to the ACT Emergency Services Authority's *Strategic Bushfire Management Plan*, a strategic document outlining measures for the Prevention, Preparedness, Response and Recovery from bushfire in the ACT.

A *Bushfire Prone Area* for the ACT was declared through the *Building Regulations* and came into effect on the 1st September 2004. Under the declaration, all parts of the ACT outside the defined urban area have been designated bushfire prone and the Authority, under Part A (Consideration of Land Use and Development Proposals) of the Territory Plan, can require a site specific bushfire risk assessment to be undertaken during the planning/design process.

This Bushfire Risk Assessment addresses this requirement and has been undertaken using the *Australian Standard for Risk Management AS/NZS 4360* and *AS 3959 -1999*. This assessment determines the level of bushfire risk on the facility, from ember attack, radiant heat and direct flame contact and assesses the level of risk on adjoining land holdings from an emergency which occurs within the Substation Compound.

The following Risk Assessment and resultant recommendations seek to address the protection of the Substation and its equipment from future unplanned bushfire/grass fire events that will occur within surrounding bushfire prone vegetation and provides recommendations on measures required to mitigate the effects of the escape of fire from the facility.

SECTION 4

BUSHFIRE RISK

4.1 Introduction.

Risk has two elements: Likelihood, the chances 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). Bushfires will always occur.

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. (3)

Many options are available to reduce the risk of bushfires starting, spreading and causing damage; reducing the unintended negative consequences of options taken to control risk; and the failure to achieve bushfire management programs. (3)

Bushfire risk is defined as the chance of a bushfire occurring that will have harmful consequences to human communities and the environment. Bushfire risk is usually assessed through consideration of the likelihood of ignition and consequences of a bushfire occurring. 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. (3)

4.2 Management Strategies.

Broad strategies to manage bushfire risk include:

- Eliminate the bushfire (fire) 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);
and
- Administration and organisation; (community preparedness measures). (3)

(3)Strategic BFMP

SECTION 5

BUSHFIRE RISK ASSESSMENT

5.1 Introduction.

The Australian Standard AS/NZS 4360:2004, the ACT Government Enterprise-wide risk management framework and the Emergency Management Australia (EMA) emergency risk management process provide the framework for establishing the context, analysis, evaluation, treatment, monitoring and communication of risk. (3)

Context defines the problem, which in the case of the Williamsdale Substation development, is the threat posed by bush/grassfire events that may occur within the adjoining vegetation, particularly the Woodland vegetation on the steep slopes to the western and north-western aspects of the compound. A lesser threat exists from bush/grass fires burning on the higher slopes to the north, south, southeast and east of the Substation site.

A further problem is the potential escape of fire from within the facility and the impact that that fire may have on the surrounding landscape/built form.

Analysis (determine the likelihood & consequence) and the evaluation of risks of bushfire on the Substation facility, the following criteria must be examined:

- Previous fire history in the area;
- Possibility, probability and sources of ignition (both external and internal);
- 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.

5.2 Assessment of Bushfire Risk to the Substation.

The following sections provide an assessment of the criteria used to determine the potential bushfire impact on the facility.

5.2.1 Fire History of the ACT.

Natural fires have long been part of the ACT landscape. A combination of inherently inflammable vegetation, dry summers, periodic drought and lightning ignitions, resulted in fires of small and large size, of high and low intensity, with periodic conflagrations that have covered the landscape. Much of the native vegetation in the ACT is subject to periodic fires; particularly the dry forest, woodland and grassland communities, and many are fire-adapted ecosystems. Recurrent bushfires and management burning have shaped the condition of the existing plant communities. (3)

The Strategic Bushfire Management Plan for the ACT states: “*The ACT has a history of severe damaging bushfires with large areas burnt in the bushfire seasons of 1919/20; 1925/26; 1938/39; 1951/52; 1978/79; 1982/83; 1984/85; 2000/01 and in 2002/03*”.

The impact of the 2002/03 bushfire is regarded as the most serious since the ACT was established. Severe fires will burn out large areas of land, travel long distances, threaten homes, lives and other assets and be uncontrollable until the weather moderates. The majority of the area burnt and most damage (including loss of life) occur over a relatively short time.

These relatively rare but severe events cause more than 95% of the damage and loss to people, property and assets. Bad or severe fires are not necessarily large scale fires. Close to the edge of Canberra’s suburbs, relatively small bushfires are always potentially damaging. Planning to reduce the likelihood and consequence of bushfires in the ACT must take into account the full range from small grass fires to landscape-wide severe fires. (3)

Historically, there are patterns and trends in which fires, especially severe fires that cause significant damage to built and/or natural assets, start and spread.

For the purpose of analysing fire risk that might emerge in the ACT, a dangerous and damaging fire has the potential to occur when the following conditions prevail:

- Continuous available fuel – fuel at moisture content sufficiently low to enable rapid combustion, arising from drought effects or the maturing and drying, of grasslands.
- Exposure of vulnerable assets. The ‘catchment’ for such bushfires may be within several hundred metres or many (60-70) kilometres from the asset/s.
- A combination of weather conditions that generate a forest or grass fire danger index of Very High (24) or greater. Typically in the ACT, prevailing adverse fire weather will have a strong Northerly through South Westerly influence.
- Fire in the landscape not effectively suppressed. (3)

Figure 1 of the *Strategic Bushfire Management Plan for the ACT* identifies the approximate location of major fires and shows that the Substation site was not impacted by the 2003 bushfires as the fires’ easterly advance was halted on the Murrumbidgee River to the west of the site. The 1939 fire also advanced towards the site from the west and was controlled on the Murrumbidgee River.

(3)*Strategic BFMP.*

5.2.2 Bushfire Ignition / Fire Sources.

Causes of bushfires, including those in the ACT, are natural or human caused. Human causes can be categorised as:

- Malicious – including arson;
- Careless – such as escaped campfires, children and burning off without a permit; and
- Accidental – uncommon but includes motor vehicle and industrial accidents.

The only common natural cause of bushfires in the ACT is lightning. The vast majority of ACT bushfires are human caused with many classified as arson.

The likely causes of a bushfire impacting the Substation site are varied. Accidental or malicious ignition of the vegetation within the Murrumbidgee River corridor to the northwest through to the southwest may threaten the facility. Ignition of this vegetation by embers from a remote fire, or an uncontrolled wild fires advance to the east, out of the Murrumbidgee River corridor, may also extend through the vegetation in the valley system to the west and northwest of the Substation site.

Accidental/careless ignition of the vegetation within the Monaro Highway corridor may also impact the Substation site with the fire extending through the adjoining farming land under prevailing northeast to southeast winds.

5.2.3 Climate & Weather.

- **Generally.**

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 the ACT corresponds with the summer months' high temperatures and low rainfall, and can occur from September to April with a proclaimed bushfire danger period from October to March.

There is significant variability from year to year. Fire seasons may be serious in three out of every 15 years, but this can vary considerably.

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.

Many of the major house loss events have occurred at fire danger ratings over 70, on a scale of 0 to 100. Analysis of 1951 – 2004 meteorological records identified the days of Very High and Extreme fire danger from the Forest Fire Index (FFDI) at Canberra airport:

- 0.1% of days (19 Days in 53 years) had a FFDI exceeding 70;
- 0.5% of days (94 days in 53 years) had a FFDI exceeding 50
- 18% of January days had Very High FFDI, and 2% of January days had Extreme FFDI.

(3)

- **Temperature & Humidity.**

Very High and Extreme Forest Fire Danger conditions mainly occur between November and March, with average temperatures ranging between 23 degrees to 28.5 degrees. The hottest month is January with an average 28.5 degrees daily although regularly higher temperatures are recorded with December and January sharing the driest daily humidity ratio of 35 percent.

These weather conditions will influence the behaviour of fires burning within the Woodland/grasslands vegetation to all aspects of the Substation site.

- **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.

The western edge of the Substation site will be fully exposed to the influence of north-westerly and westerly winds which will increase the rate of spread of fires burning upslope from the west.

Hot north easterly winds have the potential to generate a threat of bushfire impact on the Substation site. However, the impact from the northeast will be mitigated by the shielding effect of the higher ridgeline to the east of the Monaro Highway. Milder south and south easterly winds have the potential to extend fires towards the site, but the higher ridgeline and saddle to the south and southeast will slow the forward approach of fire from this direction. This ridgeline will also mitigate the impact of fires burning upslope, under south-westerly wind influences, from within the Murrumbidgee River corridor

5.2.4 Topography.

- **Generally.**

The topography of the land in the local area is dominated by undulating low ridgelines that fall from a higher ridgeline located to the east of the Monaro Highway. From the foot of this ridgeline, the landform falls to the west, incised by numerous watercourses that flow to the west into the Murrumbidgee River.

These watercourses have cut valley lines which generally run east to west and have full exposure to the prevailing northwest, west and southwest wind influences.

- **Slope.**

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%) and increases almost fourfold up a slope of 20 degrees (40%).

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 Substation compound slopes to the northwest at 4 – 5 degrees to the watercourse with the adjoining land to the west falling to the northwest and west initially at 8 –10 degrees (15 – 18%), increasing on the slopes to the west of tower STR 132, falling to the west into the Murrumbidgee River.

The topography of the land to the south and southwest of the Substation site rises at 8 degrees (15%) with similar slopes to the southeast, east and to the north of the adjoining creek line.

5.2.5 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 three '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 – Third Edition (NRE May 1999), as

- Elevated fuel load
- Surface fine fuels; and
- Bark.

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 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.

5.2.6 Assessment of Bushfire Fuel Hazard.

An overall Fuel Hazard for vegetation within the land adjoining the Substation site can be determined using the NRE Overall Fuel Hazard Guide. The predominant fuel available to a fire burning on land adjacent to the Substation site varies from grazed grassland to Woodland with a shrub and grassland understorey.

Whilst most of the vegetation has some level of management by grazing the grassland vegetation, 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 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 the unmanaged Woodland vegetation to the northwest through to the southwest, which is the predominant vegetation which will create the most potential for a severe fire event on the facility.

- ***Unmanaged Woodland vegetation to the northwest, west and southwest of the Substation Site.***

Using the methodology provided within the NRE Overall Fuel Hazard Guide, the following Fuel Hazard observation was determined.

(a) Bark Hazard:

The Woodland vegetation includes Yellow Box Red Gum, which has a smooth trunk and long ribbons of bark into the crown of the tree. Therefore this vegetation has a High Bark hazard.

(b) Elevated Fuel Hazard:

Elevated fuel comprises shrub, heath 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 mm)*
- *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.*
- *The live foliage has low, live fuel moisture content.*

The vegetation type and time lapsed since the most recent fire substantially determines the level of elevated fuel hazard.

Site investigation was undertaken to determine the structure of the elevated fuel and an estimated Elevated Fuel Hazard of High – Very High, was determined for those areas of Woodland vegetation that may remain, from time to time, unmanaged by either grazing or hazard reduction burning.

(c) Surface Fine Fuel Hazard:

Surface Fine Fuel Hazard is assessed by measuring litter-bed height. The Surface Fine Fuel in the Woodland vegetation consists predominantly of grass with accumulated leaf litter beneath trees. The vegetation within the leased land holdings to the northwest through to southwest was assessed during the site inspection on the 28th September. The inspection revealed that due to severe drought conditions and grazing by Kangaroos and livestock, minimum surface fine fuels were available, except for leaf litter loadings beneath trees.

The estimated Surface Fine Fuel Hazard Rating is Low, however, over the lifetime of the Substation, growth periods will occur when Surface Fine Fuel Hazard Ratings will be Very High to Extreme due to the extent of cured grasses and accumulated leaf litter fuels.

Overall Fuel Hazard of the unmanaged Open Woodland Vegetation to the northwest through to the southwest of the Substation.

The Overall Fuel Hazard for the unmanaged Open Woodland vegetation to the northwest through to the southwest of the Substation site is **Very High**.

5.2.7 Potential Fire Runs.

The Substation site is located on the southern side of a watercourse that falls to the west and northwest into the Murrumbidgee River corridor. The site will be impacted by severe wind patterns', including wind eddies, from strong north-westerly to westerly wind conditions. These winds will drive potential fire runs out of the Murrumbidgee River corridor into the valley to the west of the site with potential to over run the facility and advance to the foot-slopes of the ridgeline east of the Monaro Highway.

5.3 Summary of Bushfire Risk to the Substation.

The last major bushfire to impact upon the vegetation within the vicinity of the Substation site occurred during the 2003 fires when the properties to the west of the Murrumbidgee River were burnt under wildfire conditions. Had the fire not been stopped on the river, the Substation site would have been impacted by this fire event.

Due to the site being located on the eastern rim of the Murrumbidgee River valley and also being exposed to the influences of strong, drying northwest to southwest winds that will, due to the steep slopes to the west, increase the rate of spread of a fire upslope towards the east, the Substation site will continue to be exposed to an extreme level of risk, irrespective of the fuel management protocols recommended within the Substation buffer zone.

Fire over-run is likely to occur during future major fire events from the northwest and west with potential impact from the north through to the southwest, although the latter will be mitigated by the shielding effects of the ridgeline to northwest, southeast, south and southwest of the Substation site and to the east of the Monaro Highway.

The mitigating factor which reduces the potential risk to the facility is the type of facility proposed. The Substation will house electrical transformers and switch gear that is relatively fire resistant and protected against the entry of burning embers.

The associated buildings are constructed from non-flammable materials such as masonry external walls and steel roof sheeting. Section 6 of this report provides recommendations maintenance of the Asset Protection Zones within the compound, the buffer zone and the provision of construction standards to the buildings within the Substation.

5.4 Assessment of Bushfire Risk created by the Substation.

The generation and distribution of electricity has the potential to cause fire ignition within the Substation Compound. Ignition sources include:

- Equipment malfunction – transformer explosion; burn out of motors/fans and overhead wiring failure; and
- Human Error.

The incidence of equipment malfunction is rare. Transformers can explode and have the potential to shed 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 is likely to cause the greatest level of risk of ignition to the surrounding bushfire prone vegetation.

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

Work practices should be established in recognition of the likely risk of ignition of the adjoining vegetation. These should include the provision of portable fire extinguishers during maintenance activities that involve cutting, grinding, welding etc.

Particular attention shall be given to work practices during the construction and commissioning stages of the facility. A temporary water supply shall be made available during this period.

SECTION 6

BUSHFIRE PROTECTION MEASURES.

6.1 Management of the Bushfire Prone Vegetation.

(a) Within the Substation.

The Substation compound shall be managed to provide minimal vegetation within the security fence to the Transformers and building/s. Landscaping to the building curtilage shall consist of fire retardant species planted in clumps rather than rows that might allow the transfer of fire to the building/s and have a separation distance of at least two (2.0) metres from the exterior walls of the building.

(b) Within the Buffer Zone & Access Handle to the Substation.

The Woodland vegetation within the Buffer Zone to the Substation compound and the access handle to the Monaro Highway, shall be regularly managed to minimise combustible ground and understorey litter.

Management of the combustible fuels within the Buffer Zone and access handle shall be undertaken to maintain a Low – Moderate Overall Fuel Hazard, in accordance with the methodology provided by the NRE Overall Fuel Hazard Guide. Management shall be implemented by regular stocking of the zone, or by a combination of mechanical slashing/stocking/hazard reduction burning.

Existing mature trees shall be retained with understorey shrubs removed and isolated clumps of emergent trees can remain to provide replacement of older trees.

Tree separation shall maintain an Open Woodland structure of the vegetation.

6.2 Access.

The proposed access road to the Substation will be constructed to accommodate vehicles carrying the equipment to the facility. This access will provide suitable emergency access to the Substation site. In addition to the entry road, a 4.0 metre wide gravel access road shall be constructed to provide a perimeter loop road to the Substation compound.

The gravel access road formation shall be designed to carry a fully laden Rural Fire Service tanker of 15 tonnes GVM.

6.3 Construction Standards to Building/s.

The construction of the Control Building/s shall comply with the specifications of Level 3 construction in accordance with Australian Standard A.S 3959 – 1999.

The following additional construction standards shall apply:

- External openings such as vents; louvres; skylights; cable entry ducts and air-conditioning intake grilles shall be protected against the entry of flying embers. These openings shall be fitted with external mesh screens comprising stainless steel mesh with a maximum aperture of 2.0mm.
- External louvers installed at a height of less than 900mm above the finished ground line shall have automatically operated fire shutters fitted to the exterior of the louver.
- External timber doors shall be solid core with a minimum thickness of 35mm, sheeted to the external face with 1.5mm thick zincalume steel sheeting.
- The threshold, stiles and head of roller shutter external doors, if installed, shall be sealed to prevent ember entry.

6.4 Water Supplies for Fire Fighting Operations.

A static water supply for fire fighting operations shall be provided. The static water supply shall have a storage capacity of 40,000 litres stored in a concrete tank fitted with a 65mm outlet complete with 65mm ball valve and Stortz coupling. Access for ACT Rural Fire Service tankers shall be provided to within 4.0 metres of the tank to enable connection to the suction line of the tanker pump.

6.5 Provision of Portable Fire Fighting Equipment.

To mitigate the risk of ignition of the surrounding vegetation, from a fire occurrence within the Substation Compound, the following measures will be implemented:

- Portable Fire Extinguishers shall be provided, strategically located throughout the compound;
- Contractors undertaking drilling, cutting, grinding and welding operations on the Substation Site shall not undertake such works without the provision of a portable fire extinguisher.

6.6 Works on Total Fire Ban Days.

Contractors shall not undertake drilling, cutting, grinding and welding operations on Total Fire Ban days – unless during an emergency in which case a fire fighting appliance shall be on stand-by outside the facility.

SECTION 7

CONCLUSION.

“Canberra is – and always will be – prone to occasional serious bushfire attack and the realisation of this needs to pervade the psyche of the City, its inhabitants and those who govern it.”

(Ron McLeod (August 2003) Inquiry into the Operational Response to the January 2003 Bushfires in the ACT).

The risk from fires burning within the Woodland vegetation adjoining the Substation site has been determined as being Extreme, due to the availability of combustible fuels, exposure to the prevailing fire winds from the northwest to the southwest and the topography of the landform to the western aspect of the Substation site.

Whilst the proposed development is not for a habitable purpose, damage to the Substation resulting from bushfire impacts to the infrastructure will have an impact on the electricity supply to the ACT and the southern parts of NSW.

Therefore, mandatory management of a buffer zone to the Substation Site will be necessary to reduce the potential level of risk. In addition to the provision of a managed buffer zone to the facility, construction measures are recommended to improve the protection of the building/s and equipment against the impacts of burning embers.

The provision of the recommended fire protection measures mitigate the likely fire intensity on the facility and therefore enhance its ability to operate during times of impact from bushfires. The facility will however, continue to be affected by smoke impacts and potential arcing to ground of the power lines due to heavy smoke.

Ignition of the surrounding vegetation may occur from fires that ignite within the Substation facility. Recommendations have been made on the provision of fire fighting equipment and work practices to mitigate this risk.

SECTION 8

APPENDIX A

- **Copy of TransGrid Substation Site Selection – Purdon Drawing TG01;**
- **Copy of Site Plan of Substation Site – Purdon Drawing TG03, showing Bushfire Management Zone & Perimeter Fire Trail;**
- **Copy of Proposed Land Acquisition – Purdons Drawing TG04;**
- **Copy of Stormwater & Erosion Control Concept Plan – Purdons Drawing TG05.**

REFERENCES:

- Strategic Bushfire Management Plan for the ACT – January 2005.
- The Canberra Spatial Plan – ACT Planning & Land Authority – March 2004.
- AS/NZ - 4360 : 2004 Risk Management
- Emergency Risk Management – Applications Guide. (EMA) 2000).
- Overall Fuel Hazard Guide – NRE. May 1999.
- Planning for Bushfire Risk Mitigation for new development & redevelopment – ACTPLA.