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Bushfire Management Statement

for the development of group accommodation
at Chalet 1 (Lot 4b) Christie Street
Falls Creek VIC 3699

Prepared for
Taris Alpine Holdings Pty Ltd

August 2021

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Cover image: Looking north from the site at the broader landscape beyond the Falls Creek Village.

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Version Control

Version	Date	Comments	Name
0.1	3/08/2021	Analysis, mapping and report compilation	Hamish Allan Manager, Bushfire Planning and Design
0.1	4/08/2021	Peer review	Jon Boura Managing Director
1.0	4/08/2021	Bushfire Management Statement (BMS)	To client

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1 Introduction

This Bushfire Management Statement (BMS) has been prepared on behalf of Taris Alpine Holdings Pty Ltd, to show how the development of group accommodation at Chalet 1 (Lot 4b) Christie Street, Falls Creek VIC 3699, can comply with the Victorian planning and building controls that relate to bushfire, specifically the requirements of Clause 13.02-1S *Bushfire Planning*, Clause 44.06 *Bushfire Management Overlay* (BMO) and associated Clause 53.02 *Bushfire Planning* in the Alpine Resorts Planning Scheme.

The site is in the Comprehensive Development Zone - Schedule 1. The development proposal is to construct a holiday dwelling and a 6 unit apartment block on the site. Whilst the development proposes to comply with the BMO1 schedule that applies, it follows the BMO pathway 2, to demonstrate an alternative methodology for meeting the construction requirement in Substitute approved measure AM 3.2 in the BMO1 schedule.

The site is within a declared Bushfire Prone Area (BPA) and is covered by the BMO. In accordance with the application requirements of Clause 44.06-03 (Alpine Resorts Planning Scheme, 2018a), this report includes:

- A *Bushfire hazard site assessment*, including a plan that describes the bushfire hazard within 150m of the site in accordance with the site assessment methodology of *AS 3959-2018 Construction of buildings in bushfire-prone areas* as appropriate;
- A *Bushfire hazard landscape assessment,* including a plan that describes the bushfire hazard of the general locality more than 150m from the site; and
- A *BMO compliance* section, detailing how the development responds to the bushfire risk and the requirements and objectives of Clauses 44.06 and 53.02.

This report also includes a Bushfire Management Plan (BMP) consistent with the CFA's standard permit conditions and BMP guidance (CFA, 2017).

This report has been prepared consistent with guidance provided in the technical guide *Planning Permit Applications – Bushfire Management Overlay* (DELWP, 2017).

1.1 Site summary

Address:	Chalet 1 (Lot 4b) Christie Street, Falls Creek VIC 3699
Property size:	1,183m^2
Local Government Area:	Alpine Resorts (uninc)
Zone/s	Comprehensive Development Zone - Schedule 1
Overlay/s	Bushfire Management Overlay – Schedule 1 (BMO1) Design and Development Overlay – Schedule 2 (DDO2) Erosion Management Overlay – Schedule 1 (EMO1)
Directory reference:	Vic Roads 660 B10
Site assessment date:	28/06/2021
Assessed by:	Hamish Allan

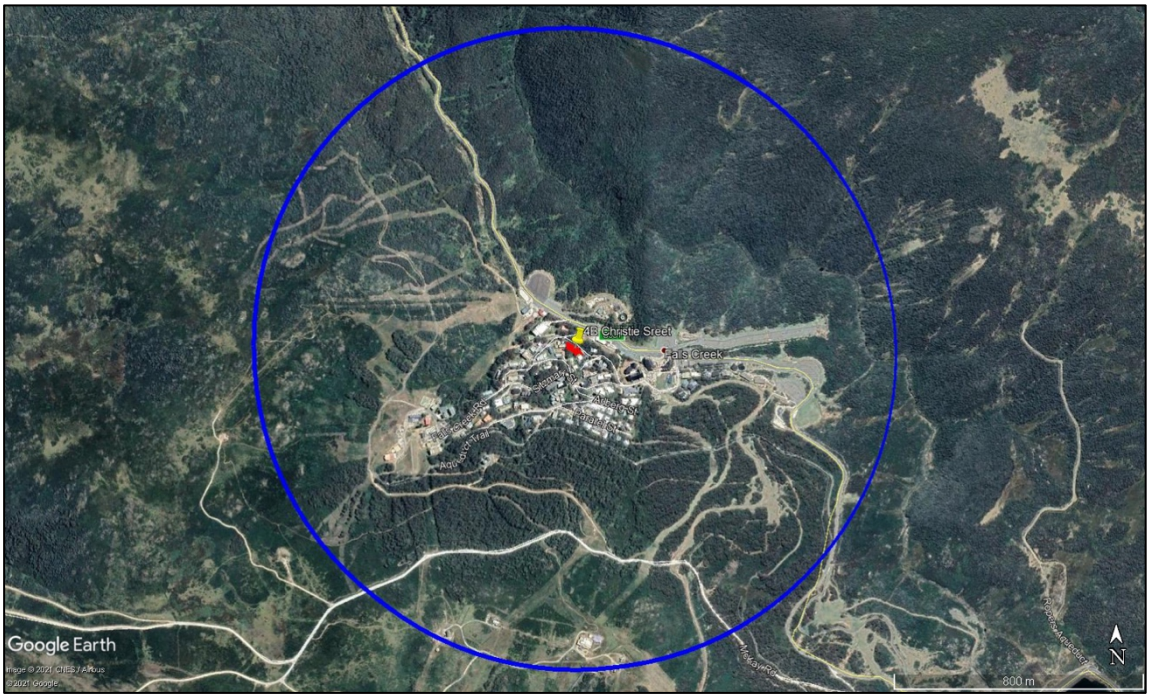


Figure 1 - Site location (site shown in red fill and with a yellow pin, 1km buffer of site in blue outline; ©2021 Google, Image © 2021 CNES/Airbus, Imagery date: 2021-01-19).

2 Bushfire hazard site assessment

2.1 Classified vegetation

Vegetation within the 150m assessment zone around the site has been classified in accordance with the BMO/AS 3959 methodology. Classified vegetation is vegetation that is deemed hazardous from a bushfire perspective.

The classification system is not directly analogous to Ecological Vegetation Classes (EVCs) but uses a generalised description of vegetation based on the AUSLIG (Australian Natural Resources Atlas: No. 7 - Native Vegetation) classification system. The classification is based on the mature state of the vegetation and the likely fire behaviour that it will generate.

2.1.1 Woodland

Several relatively small patches of 'unmanaged' remnant treed vegetation to the north of the site, beyond the Treatment Plant Road, are considered to best accord with the Woodland group of AS 3959-2018. The typical characteristics of Woodland are areas with trees to 30m tall, typically with 10–30% foliage cover dominated by eucalypts (and/or callitris), with a prominent grassy understorey that may contain isolated shrubs (Standards Australia, 2020).

DELWP modelled Ecological Vegetation Class (EVC) mapping indicates this vegetation comprises EVC No. 43 - Sub-alpine Woodland, for which the EVC bioregional benchmark description is: '*Grows on a wide range of geologies and aspects in the higher altitudinal levels above 1200 m. Rainfall is relatively high and snow may persist for long periods over winter. Soils are generally skeletal sandy clay loams with a rich humus topsoil layer. A low, open woodland to 10 m tall dominated by Snow Gum Eucalyptus pauciflora, with the understorey variously consisting of a rich suite of grasses and herbs, or a dense layer of woody shrubs, depending on soil fertility*' (DSE, 2004).

The upper storey of this EVC is dominated by Snow Gum (*Eucalyptus pauciflora*) with a benchmark tree canopy cover of 15% (DSE, 2004).

Note that the location and extent of the Woodland patches shown is indicative only and has not been definitively defined, as the site assessment was undertaken in winter and snow cover in some areas meant the state and fuel hazard posed by understorey vegetation could not be clearly determined.

2.1.2 Modified vegetation

'Modified vegetation is vegetation that doesn't fit into the vegetation classifications in AS 3959-2018 (sic) *Construction of buildings in bushfire prone areas (the standard) because it:*

- *has been modified, altered or is managed due to urban development, or gardening,*
- *has different fuel loads from those assumed in the standard,*
- *has limited or no understorey vegetation, or*
- *is not low-threat or low-risk vegetation as defined in the standard'* (Alpine Resorts Planning Scheme, 2020a).

Modified vegetation may occur where fuel loads are higher than typical residential gardens and therefore the vegetation cannot be excluded as low threat. However, because of the amount of disturbance and modification that has occurred and/or the pattern and configuration of the vegetation (e.g. small, fragmented patches and/or reduced or no understorey/surface vegetation), the fuel load and anticipated fire behaviour is likely to be different from that presumed in the BMO/AS 3959 methodology.

This type of vegetation may not produce a 100m wide fire front moving at a quasi-steady state rate of forward spread, as presumed in the BMO/AS 3959 methodology, but may generate radiant heat and localised flame contact that needs to be fully considered (DELWP, 2017).

The vegetation south of the areas of Woodland, adjacent to the treatment plant, is Modified with reduced canopy cover. In some places in the village Modified vegetation occurs as small patches around buildings, resulting in a mix of Woodland and/or Modified and low threat vegetation (see Map 1). Where it is not low threat, it is typically 'partially managed' and/or fragmented into small patches by the presence of non-vegetated areas, which justifies a classification as Modified.

Note that as with the Woodland areas, the location and extent of the Modified patches shown is indicative only as in some areas snow cover meant the fuel hazard posed by understorey vegetation could not be clearly determined. Notwithstanding, due to the relatively small size and fragmented nature of the modified and Woodland patches, they could be considered Modified irrespective of the extent of vegetation management/fuel hazard beneath the tree canopy.

2.2 Excluded vegetation and non-vegetated areas

Areas of low threat vegetation and non-vegetated areas can be excluded from classification in accordance with Section 2.2.3.2 of AS 3959-2018, if they meet one or more of the following criteria:

i. *'Vegetation of any type that is more than 100m[1] from the site.*
ii. *Single areas of vegetation less than 1 ha in area and not within 100m of other areas of vegetation being classified vegetation.*
iii. *Multiple areas of vegetation less than 0.25 ha in area and not within 20 m of the site, or each other, or of other areas of vegetation being classified vegetation.*

[1] This distance extends to 150m in BMO areas.

iv. *Strips of vegetation less than 20 m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the site or each other, or other areas of vegetation being classified vegetation.*

v. *Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings and rocky outcrops.*

vi. *Vegetation regarded as low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition[2], mangroves and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks'* (Standards Australia, 2020).

Low-threat areas excluded from classification generally comprise fragments of vegetation without remnant tree canopy cover throughout the alpine village, within private properties and public areas. Non-vegetated areas include the roads, driveways, paths and structures within the 150m site assessment zone.

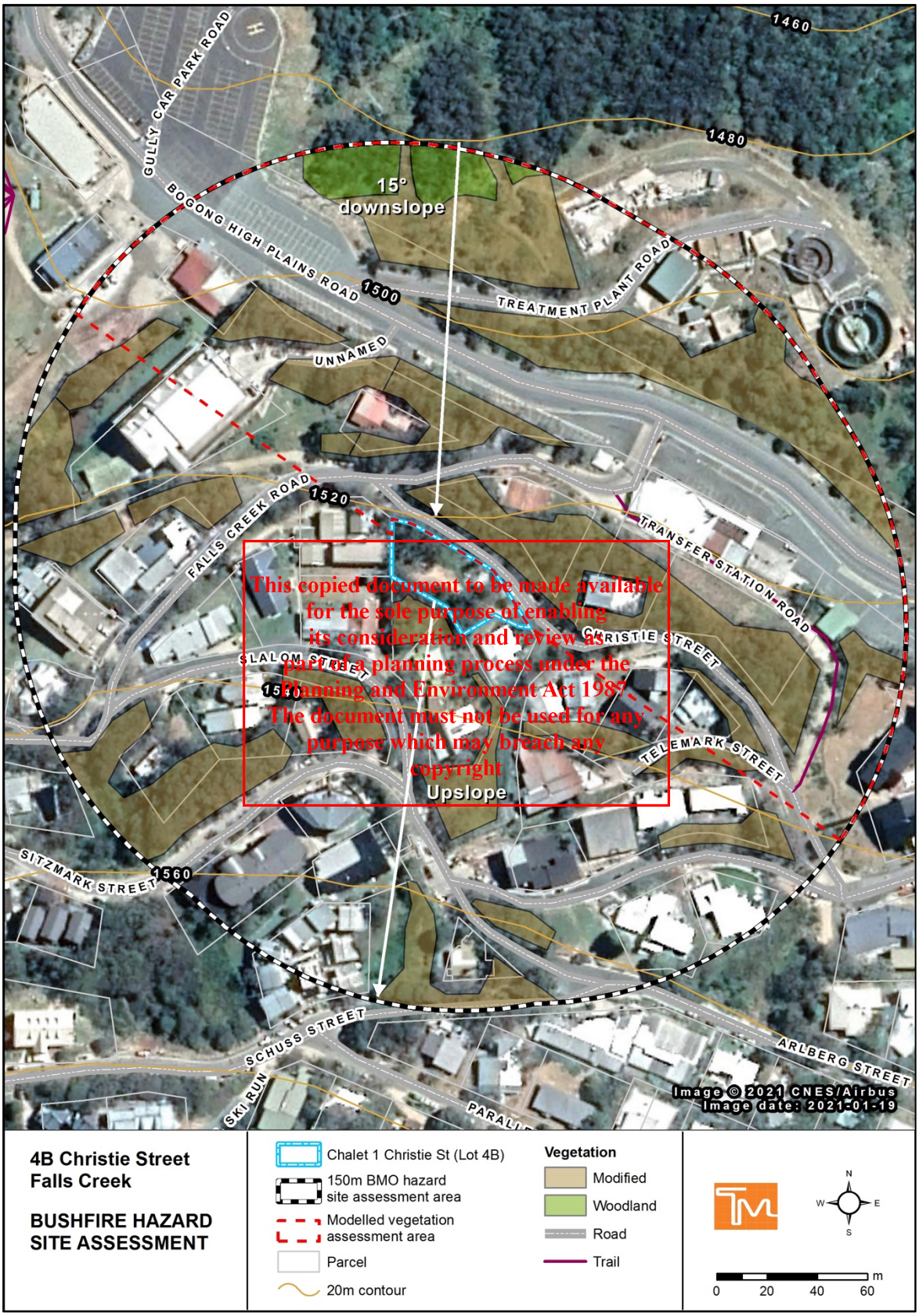
2.3 Topography

The BMO/AS 3959 methodology requires that the 'effective slope' be identified to determine the BAL and applicable defendable space or vegetation setback distances. This is the slope of land under the classified vegetation that will most significantly influence the bushfire attack on a building. Two broad types apply:

- Flat and/or Upslope - land that is flat or on which a bushfire will be burning downhill in relation to the development. Fires burning downhill (i.e. on an upslope) will generally be moving more slowly with a reduced intensity.
- Downslope - land under the classified vegetation on which a bushfire will be burning uphill in relation to the development. As the rate of spread of a bushfire burning on a downslope (i.e. burning uphill towards a development) is significantly influenced by increases in slope, downslopes are grouped into five classes in 5˚ increments from 0˚ up to 20˚.

The site is at an elevation of approximately 1,530m. The land slopes down from the site to the extent of the 150m assessment area to the north-northeast, on a gradient of 15˚ (see Map 1). Accordingly, a 15˚ effective and site slope was applied as inputs to the calculation to determine flame lengths and radiant heat impacts. It is acknowledged, however, that beyond the 150m assessment area, below the treatment plant to the northeast, the downslopes exceed 20˚.

[2] Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, recognisable as short-cropped grass for example, to a nominal height of 100mm (Standards Australia, 2020).



Map 1 – Bushfire Hazard Site Assessment Plan.

Figure 2 – Small patch of Woodland below the site, between the site and Falls Creek Road. It has been classified as Modified due to its small size and lack of connectivity with other vegetated areas.

Figure 3 – Looking west at vegetation north-northwest of the site, below Falls Creek Road.

Figure 4 – Looking up at the site from Christie Street below the north west corner of the site.

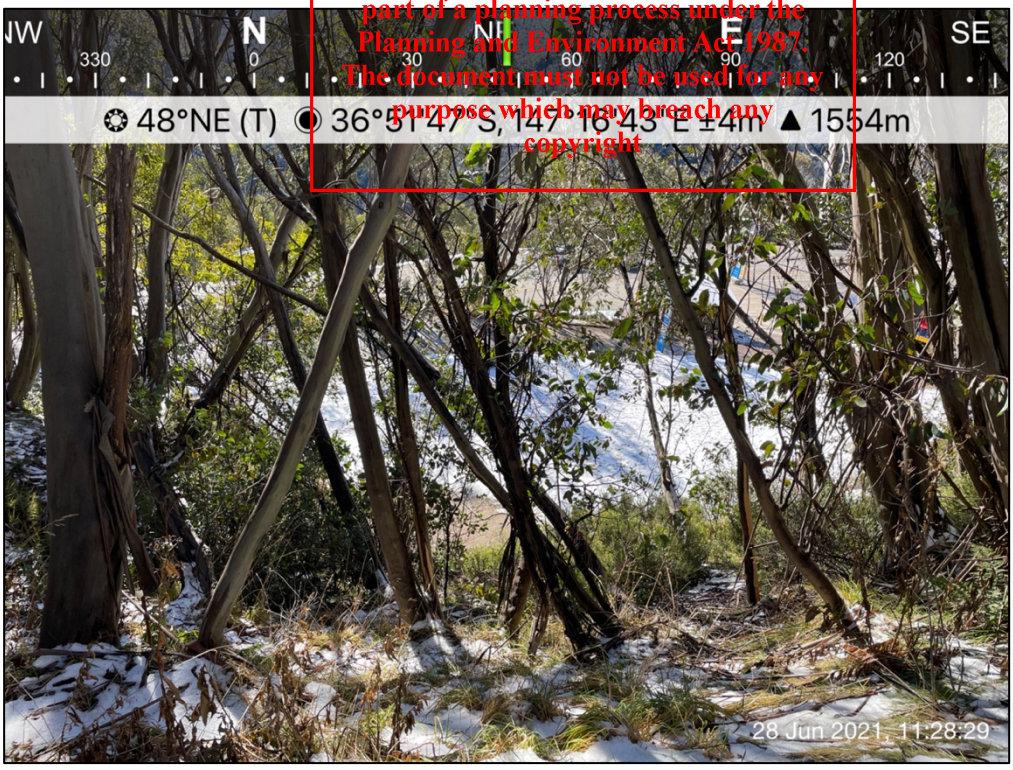


Figure 5 – Looking northeast from the northern edge of Christie Street below the site.

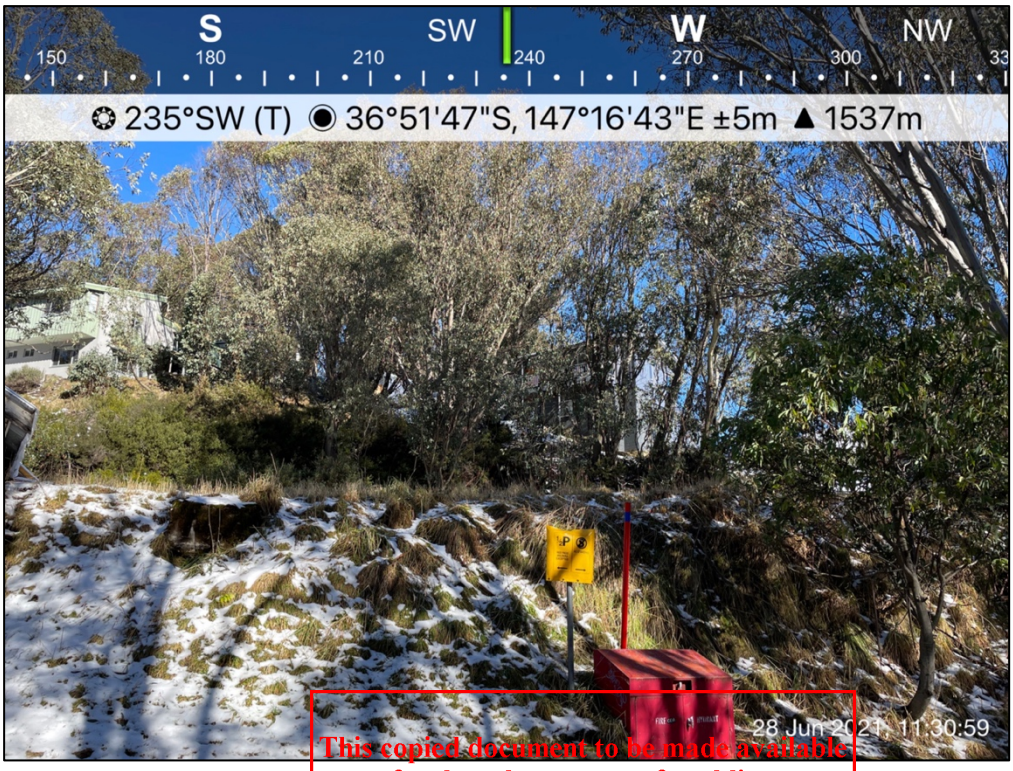


Figure 6 – Looking southwest up at the site from near the proposed entrance on Christie Street. Showing the reticulated fire fighting water supply that is immediately below the site.

Figure 7 – Modified vegetation on a downslope northeast of the site below Christie Street.

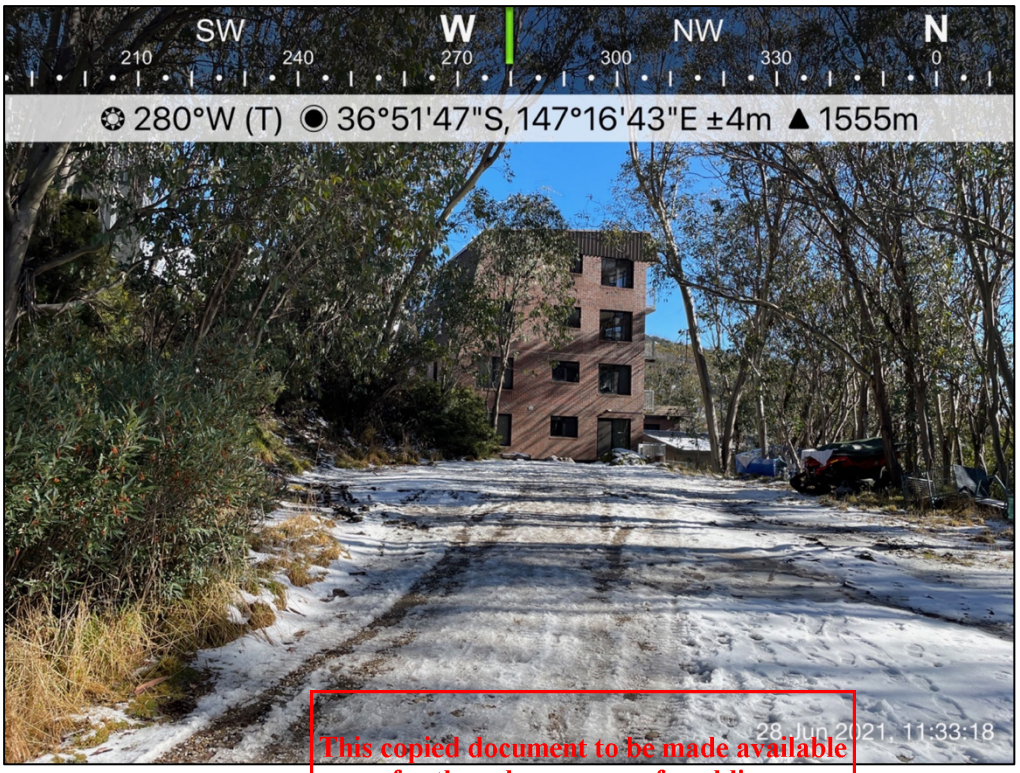


Figure 8 - Looking west across the site.

Figure 9 - Vegetation above and beyond (south of) the site, and on the embankment on the site.

3 Bushfire Hazard Landscape Assessment

3.1 Location description

The development site is located relatively centrally within the Falls Creek Alpine Village, on Christie Street, above the main Bogong High Plains access road into the village (see Figure 10).

The Falls Creek Alpine Village is on the edge of the Bogong High Plains, approximately 380km northeast of Melbourne and 130km southeast of Albury (Falls Creek Resort Management, 2018). The village is at an altitude of approximately 1,550m, near the northeast corner of the Falls Creek Alpine Resort (FCAR) area that comprises approximately 1,520 ha of land surrounded by the Alpine National Park (see Map 2).

The village comprises a built environment in a natural setting, with fragments of managed and unmanaged vegetation, including the cleared ski run areas, surrounded by extensive montane and sub-alpine forests within the Alpine National Park. There are approximately 100 Crown leases within the Resort, the majority of which are used for commercial tourism (Falls Creek Resort Management, 2018).

The permanent summer population at the Resort is approximately 140 people, although many staff who work in the Resort live in Mount Beauty and other nearby towns, with the result that on a given workday the population is approximately 200. Summer guest visitation is variable with numbers on the mountain averaging around 500 and reaching up to 3000 when an event is in progress (Falls Creek Resort Management, 2018).

During snow season the sealed Bogong High Plains Road is the single public access/egress road for the Falls Creek village, leading to and from Mount Beauty, which is 31km away to the northeast. Outside of snow season, including during the fire danger period, Bogong High Plains Road also provides access/egress for the Village to the Omeo Highway to the southeast.

To the northwest of the Falls Creek Village is Frying Pan Spur, which sits above the Village. The land slopes from the spur down through the village to Rocky Valley Creek at the bottom of the valley to the northeast. To the south of the village, running east to west, is Ruined Castle Ridge (Falls Creek Resort Management, 2018). The southern side of the ridge falls to the foreshore of the Rocky Valley Storage Dam in the area known as Sun Valley (see Map 2).

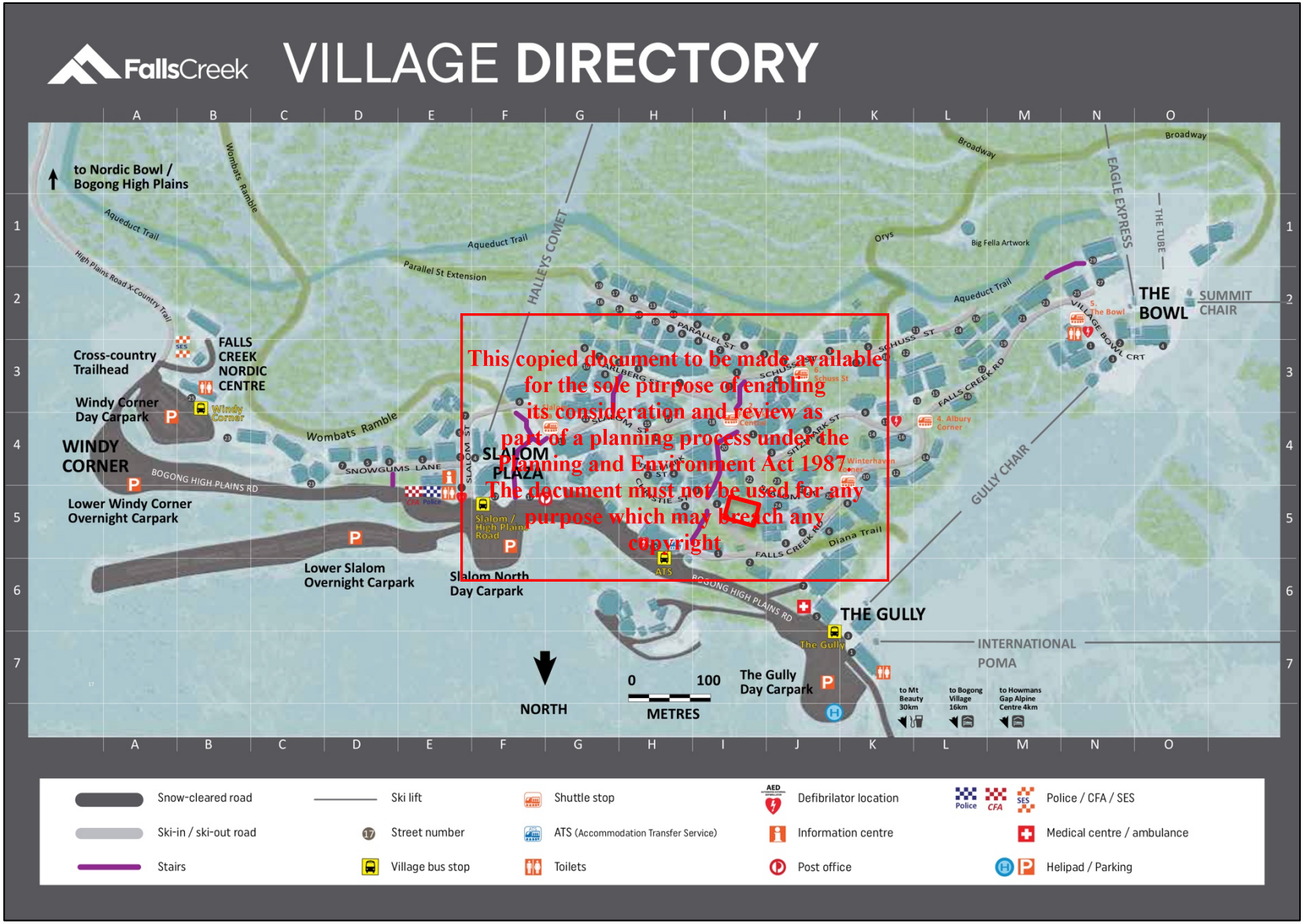
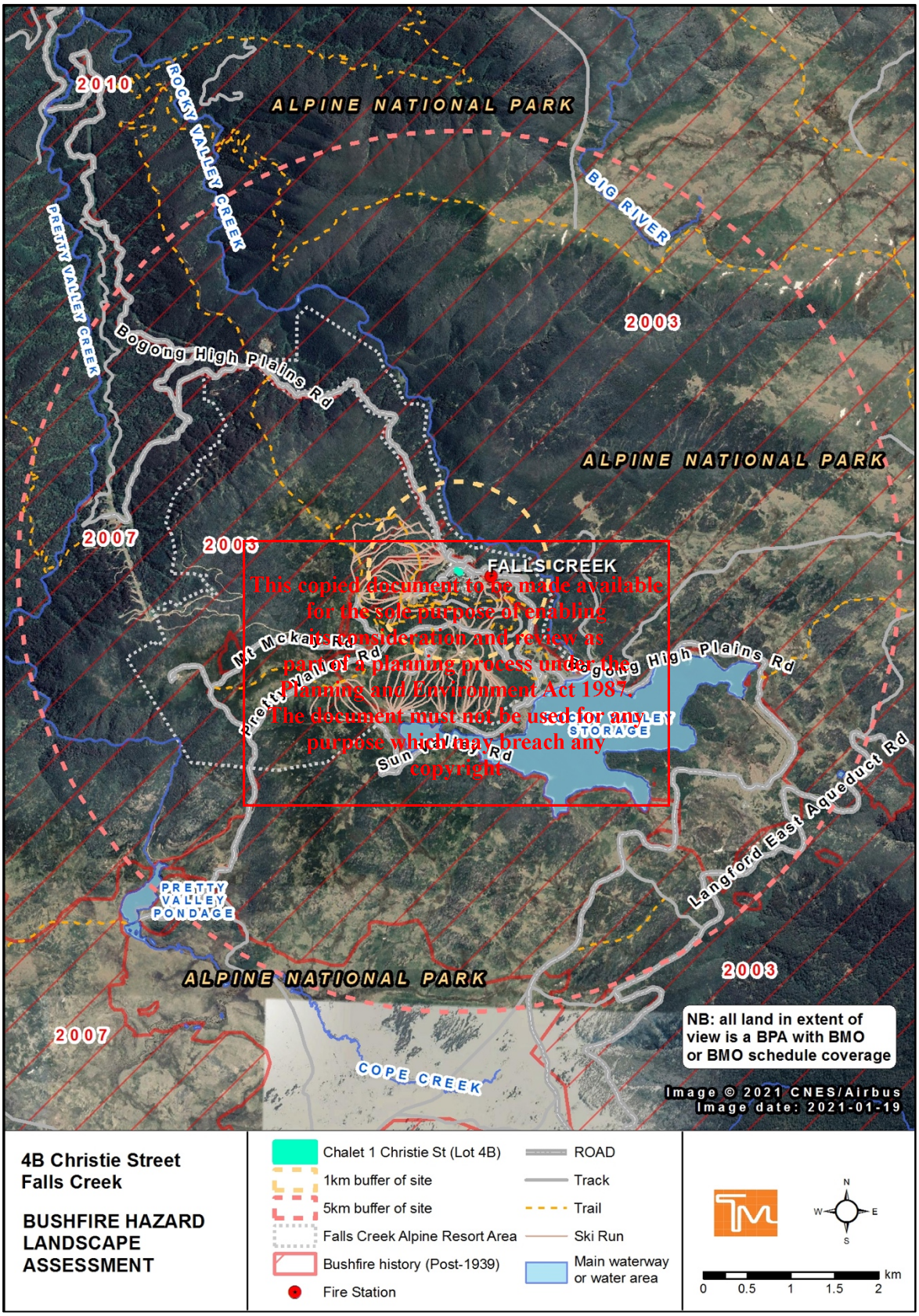


Figure 10 - Falls Creek Village Map (Falls Creek Resort Management, undated) showing site location within the village (red rectangle).



Map 2 - Bushfire Hazard Landscape Assessment Plan.

3.2 Landscape risk

Clause 13.02-1S of the Planning Policy Framework prioritises the protection of human life over all other policy considerations. Clause 13.02-1S *Bushfire Planning* stipulates that development must properly assess bushfire risk, including consideration of the hazard (and the resultant risk) beyond the site level (Alpine Resorts Planning Scheme, 2018c). BMO applications under Clause 53-02-4, must also have regard to the nature of the bushfire risk arising from the surrounding landscape (Alpine Resorts Planning Scheme, 2020a).

To assist in defining the risk beyond the site scale, four 'broader landscape types' are described in the DELWP technical guide *Planning Applications Bushfire Management Overlay*. They represent different landscape risk levels and are intended to streamline decision-making and support more consistent decisions based on the landscape risk (DELWP, 2017).

The four types range from low risk landscapes where there is little hazardous vegetation beyond 150m of the site and extreme bushfire behaviour is not credible, to extreme risk landscapes with limited or no evacuation options and where fire behaviour could exceed BMO presumptions.

The landscape surrounding the Village best accords with the highest risk landscape, Broader Landscape Type 4 (see Table 1).

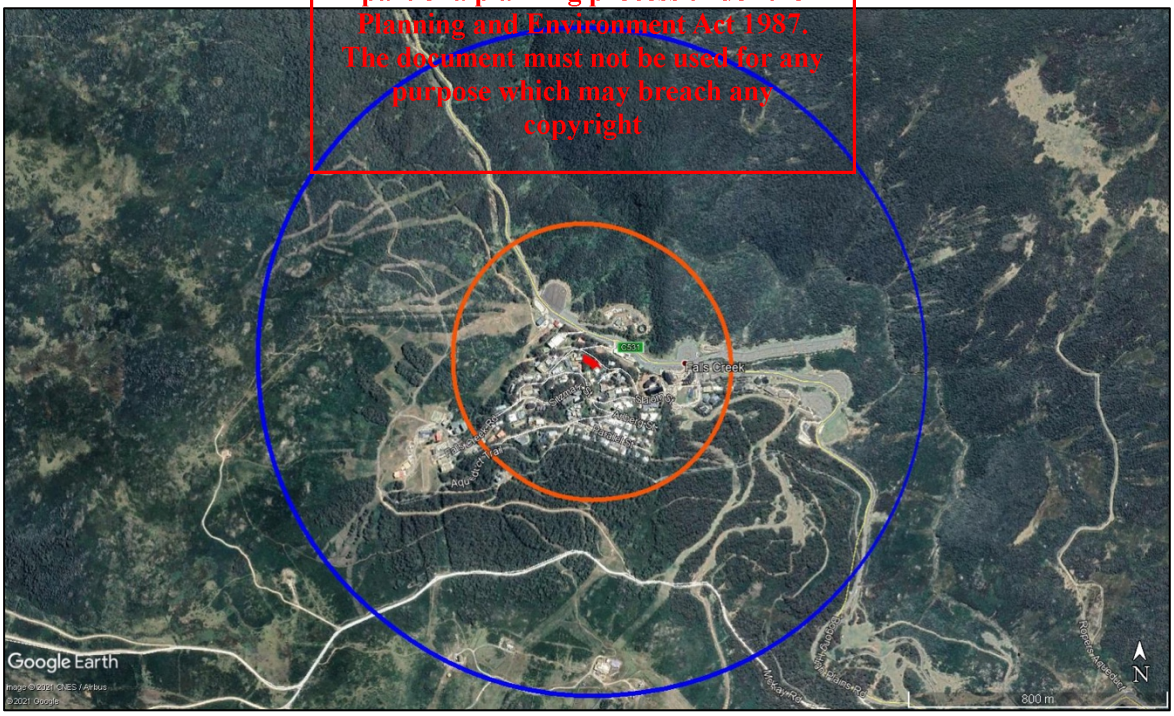


Figure 11 - Site (in red fill) with 400m neighbourhood assessment area in orange outline and 1km local assessment area in blue outline (©2021 Google, Image © 2021 CNES/Airbus, Imagery date: 2021-01-19).

Table 1 - Landscape risk typologies (from DELWP, 2018a).

Broader Landscape Type 1	Broader Landscape Type 2	Broader Landscape Type 3	Broader Landscape Type 4
• *There is little vegetation beyond 150 metres of the site (except grasslands and low-threat vegetation).* • *Extreme bushfire behaviour is not possible.* • *The type and extent of vegetation is unlikely to result in neighbourhood- scale destruction of property.* • *Immediate access is available to a place that provides shelter from bushfire.*	• *The type and extent of vegetation located more than 150 metres from the site may result in neighbourhood-scale destruction as it interacts with the bushfire hazard on and close to a site.* • *Bushfire can only approach from one aspect and the site is located in a suburban, township or urban area managed in a minimum fuel condition.* • *Access is readily available to a place that provides shelter from bushfire. This will often be the surrounding developed area.*	• *The type and extent of vegetation located more than 150 metres from the site may result in neighbourhood-scale destruction as it interacts with the bushfire hazard on and close to a site.* • *Bushfire can approach from more than one aspect.* • *The site is located in an area that is not managed in a minimum fuel condition.* • *Access to an appropriate place that provides shelter from bushfire is not certain.*	• *The broader landscape presents an extreme risk.* • *Fires have hours or days to grow and develop before impacting.* • *Evacuation options are limited or not available.*
I N C R E A S I N G R I S K →			

The broader landscape is one of potentially extreme bushfire risk. As noted above, the topography is complex and often very steep, with a mix of high fuel forest (at lower elevations), woodland and grassland. Fire behaviour may be beyond the default assumptions in the BMO, with the potential for severe fire winds and pyrocumulonimbus fire behaviour associated with convective plumes.

Surrounded as it is by the Alpine National Park, and remnant vegetation within the FCAR area, the site could be approached by bushfire from any direction over steep, rugged and often inaccessible terrain. No specific potential fire runs are shown in Map 2 as fires could approach the site from any direction, over many kilometres.

It should be noted, however, that areas of land within the FCAR area around the Village are significantly modified to provide for recreational skiing, including extensive areas cleared of wood and shrub vegetation for ski runs and associated trails and infrastructure. This is especially the case to the northwest, west, southwest and to a lesser extent, to the south[3] (see Figure 11).

These areas of modified vegetation would reduce the intensity of any large bushfire threatening the village. Similarly, the Rocky Valley Storage Dam provides a useful buffer to a large landscape scale bushfire approaching from the south (see Map 2). Supporting this analysis, the FCAR Municipal Fire Management Plan notes that:

- *Fires approaching from the west or north are protected by cleared alpine ski runs and associated snow making infrastructure.*
- *Fires approaching from the east are protected by BHP Road and the Rocky Valley Reservoir.*
- *Fires from the south are protected by a steep downhill slope and the Frying Pan Spur Aqueduct.* (Falls Creek Resort Management, 2016).

Falls Creek was threatened, but not burned, by fire in January 2003, when the Village was evacuated and again by the Victorian Alpine Fire Complex in December 2006 (2006-2007 fire season), as shown in the fire history in Map 2.

The FCAR Municipal Emergency Management Plan (Falls Creek Resort Management, 2018) identifies a large/regional bushfire as the number 1 hazard facing the resort, with a High confidence rating and High residual risk rating. Specified measures to treat the risk are:

- '*Targeted vegetation management program for public land high risk areas and key infrastructure sites.*
- *Maintenance of fire access roads.*
- *Lease area compliance inspections.*
- *Maintenance/testing of water supply, plant and equipment*' (Falls Creek Resort Management, 2018).

3.3 Climate and fire weather

The Forest Fire Danger Index (FFDI) (and the Grassland Fire Danger Index (GFDI)) represent the level of bushfire threat, based on weather and fuel conditions. An FFDI 50/GFDI 70 is applied in alpine areas of Victoria[4] by the building system, to determine BALs using Method 1 of AS 3959-2018 based on building setback distances from classified vegetation. The Alpine area is defined in the National Construction Code for Victoria as land 1,200m above the Australian Height Datum[5] (AHD) (ABCB, 2020).

[3] It is noted that a band of 'unmodified' or 'less-modified' remnant vegetation poses a hazard immediately to the south of the village between McKay Road and the Aqueduct Trail that more or less follows the southern edge of the village.
[4] In non-alpine areas of Victoria an FFDI 100/GFDI 130 applies for determining BALs using Method 1 of AS 3959-2018.
[5] As note previously the site is at an altitude of approximately 1,530m.

The indices are also used for predicting fire behaviour including the difficulty of suppression, forecasting Fire Danger Ratings (FDRs) and determining an appropriate level of preparedness for emergency services. Table 2 displays the FDRs, their FFDI range[6] and the description of conditions for each FDR.

Note that the FFDI benchmark is intended as a representation of extreme fire weather conditions, but has been exceeded during some significant fire events, including at some locations in Victoria on 'Black Saturday' 2009. Therefore, it is important to note that the applicable FFDI is not necessarily the *worst-case* conditions for any particular location, including the Falls Creek Alpine Village.

Table 2 - Fire Danger Ratings (Source: AFAC, 2017; CFA 2017b).

Forest Fire Danger Index	Grassland Fire Danger Index	Fire Danger Rating (FDR)	Description of conditions
100+	150+	Code Red	The worst conditions for a bush or grass fire. Homes are not designed or constructed to withstand fires in these conditions. The safest place to be is away from high risk bushfire areas.
75-99	100-149	Extreme	Expect extremely hot, dry and windy conditions. Fires will be uncontrollable, unpredictable and fast moving. Spot fires will start, move quickly and will come from many directions. Homes that are situated and constructed or modified to withstand a bushfire, that are well prepared and actively defended, may provide safety. You must be physically and mentally prepared to defend in these conditions.
50-74	50-99	Severe	Expect hot, dry and possibly windy conditions. If a fire starts and takes hold, it may be uncontrollable. Well prepared homes that are actively defended can provide safety. You must be physically and mentally prepared to defend in these conditions.
25-49		Very High	If a fire starts, it can most likely be controlled in these conditions and homes can provide safety. Be aware of how fires can start and minimise the risk. Controlled burning off may occur in these conditions if it is safe.
12-24		High	
0-11		Low – Moderate	

Especially in southern Australia, since the 1950s there has been an increase in the length of the fire weather season and an increase in extreme fire weather. It is projected that there will be further increase in the number of dangerous fire weather days and a longer fire season for southern and eastern Australia (CSIRO/BOM, 2020).

[6] The GFDI ranges for each FDR in Table 2 may vary in some jurisdictions.

Climate change is contributing to these changes in fire weather including by affecting temperature, relative humidity and associated changes to the fuel moisture content (CSIRO/BOM, 2020). The Australasian Fire and Emergency Service Authorities Council (AFAC) identify that a failure of building codes and land use planning to adequately adapt to climate change is a significant risk (AFAC, 2018).

Climate change trends associated with the risk of bushfire, support the adoption of a precautionary and conservative approach in identifying and responding to bushfire risk. It is noted that the objective of Clause 13.01-1S *Natural hazards and climate change* in the Planning Policy Framework is to minimise the impacts of natural hazards and adapt to the impacts of climate change through risk-based planning. Two of the specified strategies to achieve the objective are:

- *'Consider the risks associated with climate change in planning and management decision making processes'* and;
- *'Site and design development to minimise risk to life, property, the natural environment and community infrastructure from natural hazards'* (Alpine Resorts Planning Scheme, 2018d).

The FCAR Municipal Emergency Management Plan Notes states that the Resort's climate is temperate, characterised by mild summers and cold winters. Further, '*…summers are cool, wet and windy with maximum temperatures averaging around 18C and rarely exceeding 27C, with overnight minimum temperatures averaging around 8C. The average humidity level over summer is approximately 65%, and the majority of days experience winds greater than 20kph, generally from the northwest. Significant rainfall and thunderstorm activity can also occur in the summer months*' (Falls Creek Resort Management, 2018).

Further, the FCAR Municipal Fire Management Plan states that '*The high elevation of the Resort results in relatively mild summers and this in turn has a significant impact on the FDI levels experienced during the fire season. Generally speaking the cooler temperatures, higher humidity and frequent rain periods tend to keep FDI levels within the "Low – Moderate" FDR. However the greater prevalence for strong winds places upward pressure on the FDI. When coupled with the occasional warm spell this can lead to days of High or even Very High FDR*' (Falls Creek Resort Management, 2016) (see Figure 12).

For the purposes of determining BALs in the Victorian building system, the simple 'Method 1' of AS 3959-2018 applies an FFDI 50 in alpine areas[7].

Neither CFA nor DELWP have published guidelines for varying the default FFDI/GFDI values used in the planning (or building) system. Without detailed FFDI analysis using Falls Creek weather data, or another appropriately comparable historic weather dataset, an FFDI return interval has

[7] Areas 1200m or more above the Australian Height Datum (AHD) (ABCB, 2020).

not been calculated for the site. Instead, a precautionary approach has been adopted for the alternative methodology in this report by applying a higher, and therefore more conservative, FFDI 75 input value, rather than the FFDI 50 'default value' for alpine areas used in the building system. Note that FFDI 75 is the threshold between a Severe and Extreme FDR (i.e. the lowest of the FFDI range for an Extreme FDR).

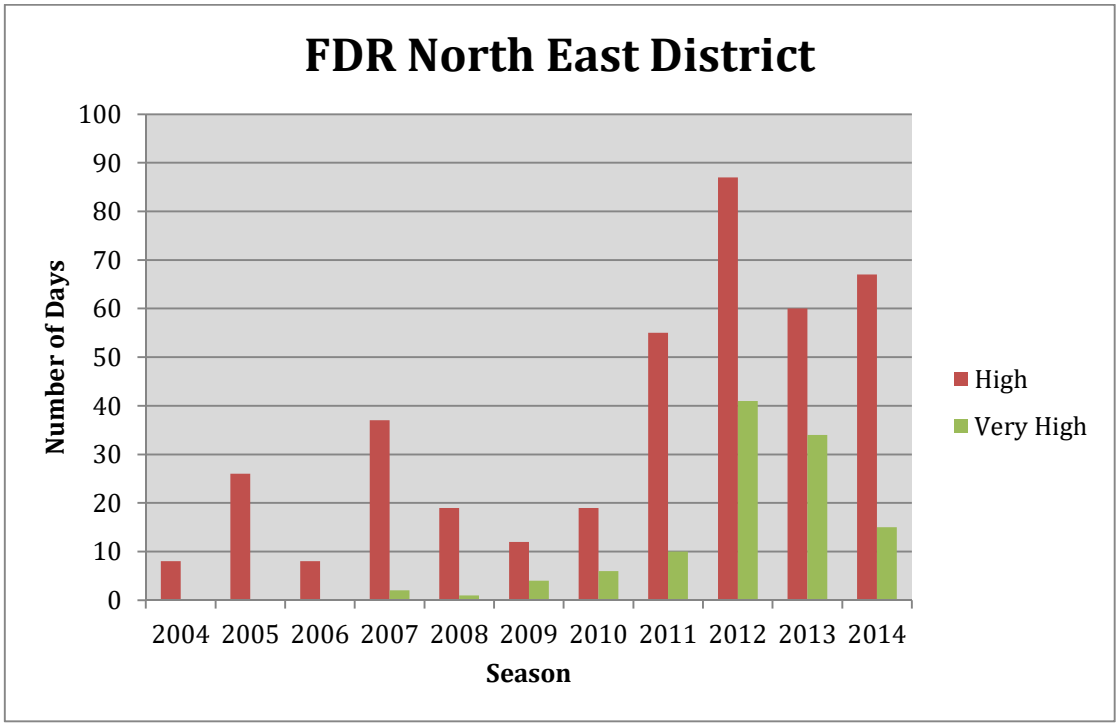


Figure 12 – Reproduction of 'Figure 1: Annual FDR Variation for Falls Creek' in the FCAR Municipal Fire Management Plan (Falls Creek Resort Management, 2016).

4 BMO compliance

This section identifies how the proposed development responds to the bushfire risk and the requirements of Clause 44.06 and associated Clause 53.02 of the Alpine Resorts Planning Scheme.

4.1 Landscape, siting and design objectives

'Development is appropriate having regard to the nature of the bushfire risk arising from the surrounding landscape.

Development is sited to minimise the risk from bushfire.

Development is sited to provide safe access for vehicles, including emergency vehicles.

Building design minimises vulnerability to bushfire attack' (Alpine Resorts Planning Scheme, 2020a).

Compliance with these objectives at Clause 53.02-4.1 can be achieved via the following approved measures.

4.1.1 Approved measure 2.1 Landscape

'The bushfire risk to the development from the landscape beyond the site can be mitigated to an acceptable level' (Alpine Resorts Planning Scheme, 2020a).

As identified in Section 3, the landscape is one of extreme bushfire risk. However, the Falls Creek Alpine Resort, DELWP and Parks Victoria take a strategic and integrated approach to fire management designed to minimise the occurrence and mitigate the effects of bushfires (Falls Creek Resort Management, 2016). The CFA also has a volunteer brigade located at the resort. Resources are devoted to mitigating the risk to people, infrastructure and fire-sensitive habitats and flora on the mountain, during the summer fire danger period. Additionally, at this time greatly reduced numbers of people are on the mountain, compared to the peak ski season period that the development is primarily for.

Accordingly, it is proposed that the risk can be mitigated to an acceptable level by implementing the bushfire protection measures in compliance with the BMO1, varied to include an enhanced BAL-29 construction standard instead of BAL-40 construction, via an alternative methodology as provided for in Substitute approved measure AM 3.2 in the BMO1.

4.1.2 Approved measure 2.2 Siting

'A building is sited to ensure the site best achieves the following:

- *The maximum separation distance between the building and the bushfire hazard.*

- *The building is in close proximity to a public road.*
- *Access can be provided to the building for emergency service vehicles'* (Alpine Resorts Planning Scheme, 2020a).

The siting and layout maximise the setback from the hazard (i.e. unmanaged vegetation) as far as practicable (see Map 3). However, the relatively small size of the site is a significant siting constraint that precludes viable alternative siting options and any possible alternative siting options will not appreciably influence the risk.

The proposed development is close to the road and access and egress can comply with the requirements for emergency vehicles.

4.1.3 Approved measure 2.3 Design

'A building is designed to be responsive to the landscape risk and reduce the impact of bushfire on the building' (Alpine Resorts Planning Scheme, 2020a).

A minimum BAL-29 standard is proposed for the buildings. The BAL-29 design and construction will be 'enhanced' by the additional protective feature of ensuring that all external building elements (i.e. the entire external façade of the building) will be of non-combustible materials. This includes the decorative canopy/façade on the apartment building.

All BAL construction standards above BAL-Low are 'deemed to satisfy' the National Construction Code requirement that applicable buildings be designed and constructed to reduce the risk of ignition from a bushfire, appropriate to the:

(a) 'potential for ignition caused by burning embers, radiant heat or fame generated by a bushfire; and

(b) *intensity of the bushfire attack on the building'* (ABCB, 2020).

4.2 Defendable space and construction objective

'Defendable space and building construction mitigate the effect of flame contact, radiant heat and embers on buildings' (Alpine Resorts Planning Scheme, 2020a).

In the BMO1 schedule that applies to the FCAR area, Substitute approved measure (AM) 3.2 for construction states that.

'The construction of buildings must be one of the following:

- *BAL-40 construction in accordance with AS3959 Building in Bushfire Prone Areas (Standards Australia).*
- *Determined by a suitably qualified and experienced practitioner that the building will be capable of withstanding an equivalent level of predicted bushfire attack and levels of exposure.*

- *A suitably qualified and experienced practitioner has the same meaning as 'fire safety engineer' within the Building Regulations 2006.*
- *Determined using an alternative methodology to the satisfaction of the relevant fire authority.*
- *Buildings must be provided with defendable space to the satisfaction of the relevant fire authority* (Alpine *Resorts* Planning Scheme, 2020b).

The development proposes to comply with this measure via dot point 4 in AM3.2 above, i.e. using an alternative methodology to the satisfaction of the relevant fire authority.

4.2.1 Alternative methodology for AM3.2

The BMO/AS 3959 methodology for determining a BAL assumes, amongst other things, a 100m wide flame front moving directly at a site or building at a 'quasi-steady state' rate of forward spread for the effective slope. It also assumes a 100% homogenous fuel loading for the classified vegetation in the assessment area.

However, as identified in the site hazard assessment, the fuels within the assessment area comprise an irregular mosaic of Modified vegetation, low threat vegetation and non-vegetated areas. Only a few small patches of Woodland are identified at the periphery of the 150m assessment area, that could sustain a fully developed fire that meets the design fire conditions. The greater risk to the site is the Modified vegetation closer to and around the site. The rate of spread of a fire approaching the village and site will likely be moderated by the discontinuities in the fuel hazard. The BMO Modified vegetation class, anticipates circumstances such as this and provides for a minimum BAL-29 construction standard in response to Modified vegetation in Table 2 to Clause 53.02-5.

In order to assess whether a BAL-29 may be a sufficient response to the Modified vegetation, or if a higher construction standard should be applied, the alternative methodology of Penney and Richardson (2019) and Penney *et al.* (2020) has been adopted to model fire spread and calculate a Radiant Heat Flux (RHF) value for the site. This approach is based on calculating available fuel loads that will contribute to fire behaviour over the area being assessed, using a 'Vegetation Availability Factor' equation.

'*Whilst the head fire flame width should be considered as the width of the continuous fuel contributing to the active fire front, the area covered by potential fuel load available for contribution to the RoS and intensity of the active fire as a fraction of the total assessment area is defined as the vegetation availability factor (Vf), given by:*

$$Vf = \frac{Fuel\ cell\ area\ (m^2)}{Assessment\ area\ (m^2)}$$

where the fuel cell area is the coverage of vegetation present within a 100 m by 100 m assessment area directly in front of the receiving body. The available surface fuel load wA (t/ha), and the available total fuel load WA (t/ha), are then defined as

$$wA = w \times Vf$$

and

$$WA = W \times Vf$$

where w and W are respectively the surface fuel load and total fuel load sourced from relevant jurisdictional data sets. The calculated fuel loads can then be applied to the relevant fire behaviour equations of RoS, fire line intensity, and flame length for the purposes of determining the suitability of wildfire fighting strategies and tactics or for calculating the radiant heat flux on receiving bodies in the path of the head fire' (Penney and Richardson, 2019).

For the fuel cell and assessment areas, the area of all Modified and Woodland vegetation within the 150m assessment area in front of the site has been calculated (see 'Modelled vegetation assessment area' shown in Map 1). The calculation determined that 34.2% of the assessment area comprises Modified vegetation or Woodland, resulting in a Vf of 0.34. A summary of the resultant RHF calculations based on the resultant reduced Woodland fuel loads arising from applying the Vf, is provided in Table 3 and an analysis Map is provided as Map 3.

Table 3 - Summary of the RHF calculations.

Attribute	Value
Input	
Vegetation	Woodland
FFDI	75
Flame temp (K)	1090
Flame emissivity	0.95
Flame width (m)	100
Heat of combustion (kJ/kg)	18,600
Surface fuel load (t/ha)	5.1
Overall fuel load (t/ha)	8.5
Effective slope (°)	15
Site slope (°)	15
Elevation of receiver (m)	calculated
Building-vegetation setback distance (m)	***10***
Output	
'Steady state' rate of spread (km/h)	1.3
Flame length (m)	9.4
Elevation of receiver (m)	1.9

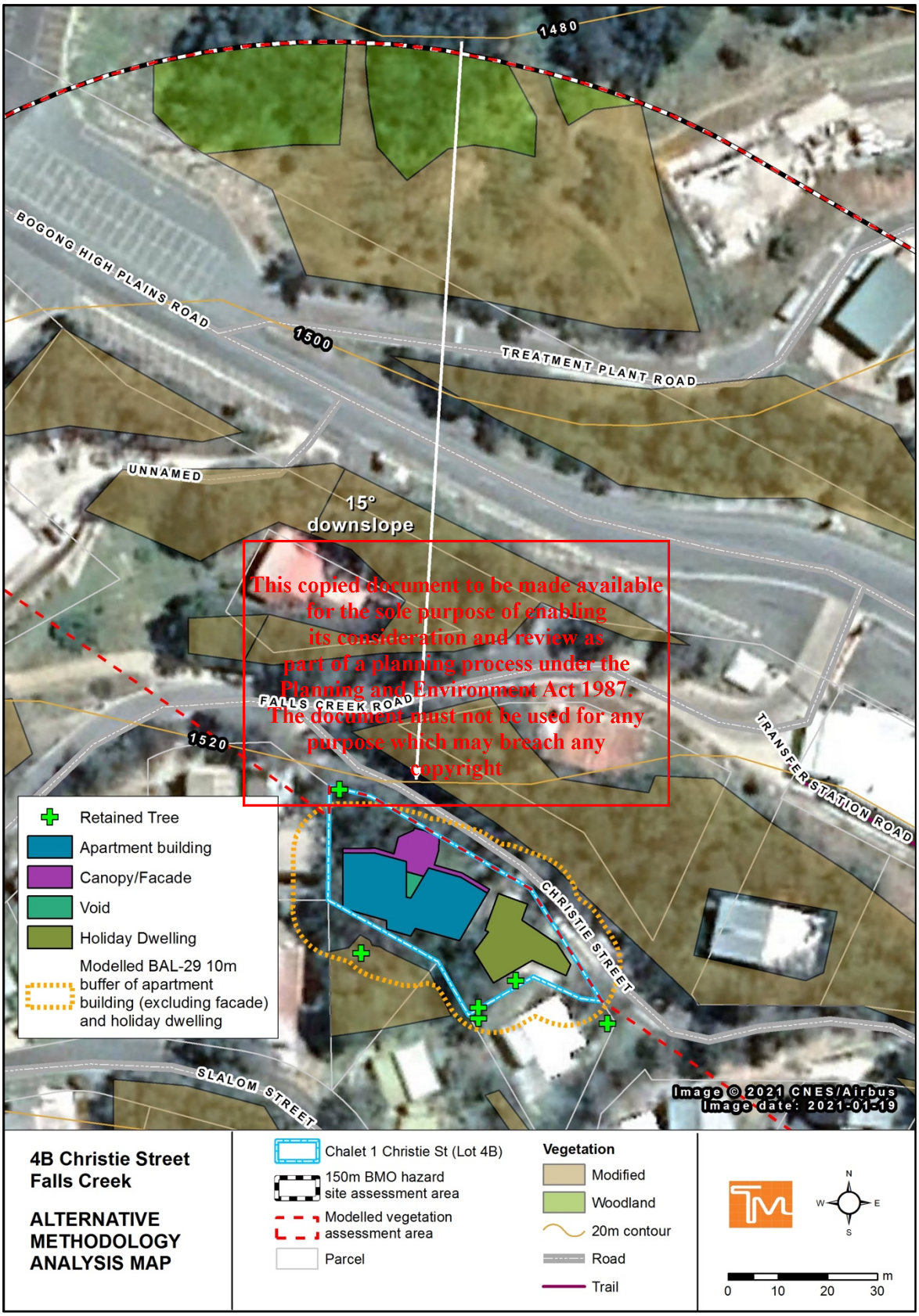
Flame angle (˚)	78.0
Path length (m)	9.0
Radiant heat at input setback distance (kW/m^2)	**28.5**

It needs to be recognised that bushfire modelling outcomes have a high degree of uncertainty due to the need to simplify or make assumptions about inherently complex systems including vegetation, topography and weather. It is imperative that all fire behaviour modelling be seen only as an indicative rather than authoritative description of potential fire behaviour on a site. Cruz and Alexander (2013) found that only 3% of modelled outcomes represented observed outcomes for rates of spread in surface and crown fires and suggested an error interval of +or-35% is a reasonable standard for assessing model performance.

Furthermore, the forest fire behaviour model applied in the RoS calculation was developed from the study of lower intensity fires. It has been shown to under predict rates of spread under extreme or catastrophic weather conditions (Gould, 2007; Cheney *et al.*, 2012). It also does not account for spotting which may significantly influence the rate of spread.

Notwithstanding the above qualifications, the methodology indicates that based on a 10m setback of the buildings from areas of classified vegetation, RHF is calculated to not exceed 29kW/m^2, commensurate with a BAL-29 construction standard. Note that the 10m setback shown in Map 3 is taken from the enclosed deck area on the northern side of the apartment building and does not include the exterior decorative façade. Note however, that the facade and all other external building elements will be of non-combustible materials which would assist to mitigate the effect of any transient flame contact or short time duration higher levels of RHF that might be experienced e.g. from isolated flaming trees or shrubs closer to the building.

The defendable space on the property can meet the vegetation management requirements stipulated in Table 6 at Clause 53.02-5 (see Appendix A of this report) as detailed in the Bushfire Management Plan provided as Map 4.



Map 3 - Analysis map.

4.3 Water supply and access objectives

'A static water supply is provided to assist in protecting the property.

Vehicle access is designed and constructed to enhance safety in the event of a bushfire' (Alpine Resorts Planning Scheme, 2020a).

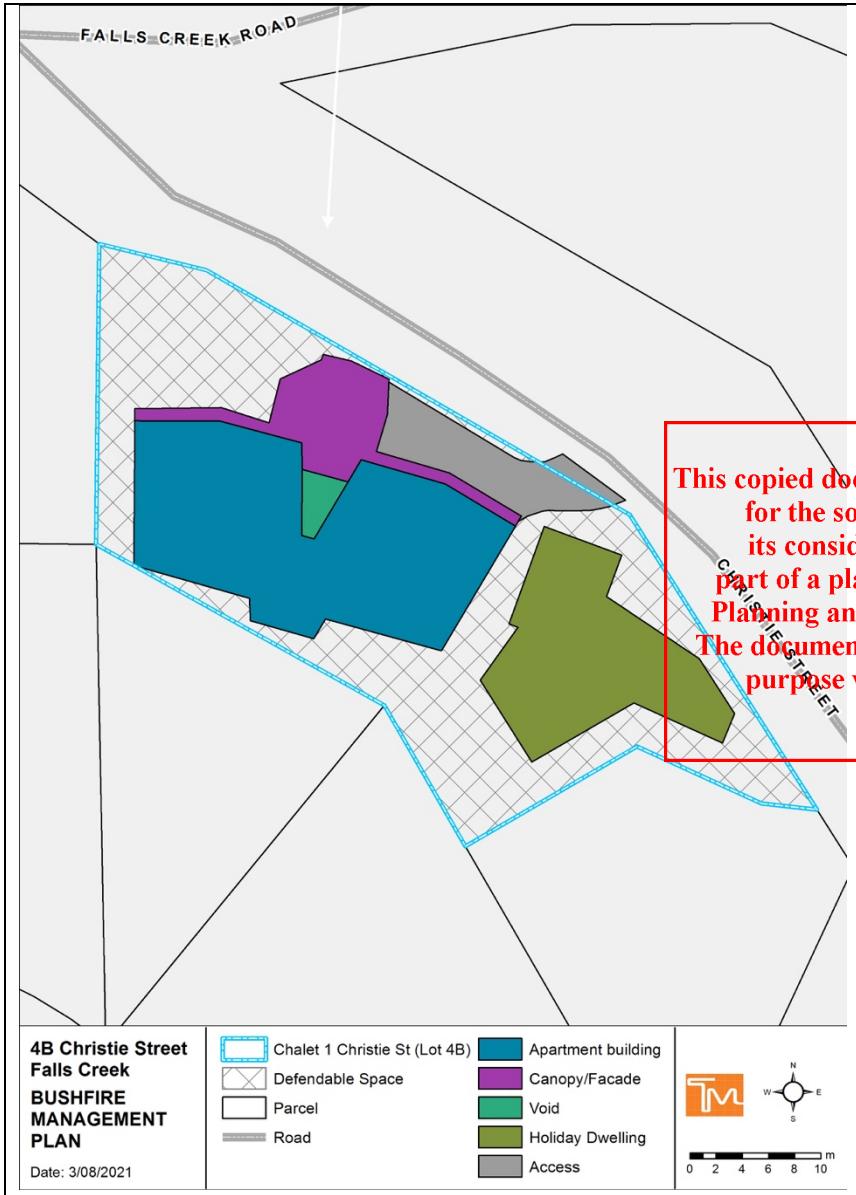
These objectives can be achieved via utilisation of the existing alpine village fire fighting water and access infrastructure. The village incorporates a reticulated hydrant system for fire fighting, and snowmaking infrastructure is used to assist mitigate bushfire impacts within and around the village (see Figure 6).

This is in accordance with Substitute approved measure AM4.2 in the BMO1 schedule for the resort, which does not require a static water supply.

It is also noted that Clause 13.02-1L *Bushfire Planning – Alpine Resorts* has a strategy to: '*Facilitate the provision of sufficient quantities of water for landowners, leaseholders and emergency services to enable them to suppress a fire and defend property'* (Alpine Resorts Planning Scheme, 2021).

As the driveway is less than 30m long and no access to a water supply is required, no specific access requirements are considered applicable.

Map 4 following, comprises a Bushfire Management Plan (BMP), detailing all of the required bushfire protection measures for the development, consistent with the CFA's standard permit conditions and BMP guidance (CFA, 2017).



Map 4 - Bushfire Management Plan.

Construction Standard

The buildings must be designed and constructed to a minimum BAL-29 standard with the addition that all external building elements are of non-combustible materials.

Defendable Space Management

Defendable space must be provided for to the property boundaries and be managed in accordance with the following requirements:

- Grass must be short cropped and maintained during the declared fire danger period.
- All leaves and vegetation debris must be removed at regular intervals during the declared fire danger period.
- Within 10 metres of a building, flammable objects must not be located close to the vulnerable parts of the building.
- Plants greater than 10 centimetres in height must not be placed within 3m of a window or glass feature of the building.
- Shrubs must not be located under the canopy of trees.
- Individual and clumps of shrubs must not exceed 5m^2 in area and must be separated by at least 5m.
- Trees must not overhang or touch any elements of the building.
- The canopy of trees must be separated by at least 5m.
- There must be a clearance of at least 2 metres between the lowest tree branches and ground level.

5 Conclusion

The proposed development of group accommodation at Chalet 1 (Lot 4b) Christie Street, Falls Creek VIC 3699 was assessed against Clause 44.06 and Clause 53.02 of the Alpine Resorts Planning Scheme. The site is in the Comprehensive Development Zone - Schedule 1 and this report has followed pathway 2 at Clause 53.02-4 to demonstrate a response to the Substitute approved measures of the BMO1 schedule that applies.

The development is exposed to Woodland and Modified vegetation.

The proposed siting of the development maximises the setback from hazardous vegetation as far as is practicable, however the small site size is a significant constraint.

The development proposes to respond to Substitute approved measure AM3.2 for construction, by use of an alternative methodology to calculate RHF that the buildings may be exposed to. This approach determined that RHF may not exceed 29kW/m^2, which is commensurate with the proposed BAL-29 construction standard. As an additional protective feature, all external building elements will be of non-combustible materials.

All vegetation within the defendable space that extends to all property boundaries, can be managed in accordance with Table 6 to Clause 53.02-5.

Please Note: The bushfire protection measures proposed in this document do not guarantee survival of the building or the occupants in the event of a bushfire. The client is strongly encouraged to develop and practice a bushfire survival plan including determining triggers for leaving early on days of severe or higher, fire danger. Information and assistance including a template for a Bushfire Survival Plan is provided on the CFA website at <http://www.cfa.vic.gov.au/plan-prepare/>.

6 Appendices

6.1 Appendix A: Vegetation management requirements

As per Table 6 to Clause 53.02-5:

'Defendable space is provided and is managed in accordance with the following requirements:

- *Grass must be short cropped and maintained during the declared fire danger period.*
- *All leaves and vegetation debris must be removed at regular intervals during the declared fire danger period.*
- *Within 10 metres of a building, flammable objects must not be located close to the vulnerable parts of the building.*
- *Plants greater than 10 centimetres in height must not be placed within 3m of a window or glass feature of the building.*
- *Shrubs must not be located under the canopy of trees.*
- *Individual and clumps of shrubs must not exceed 5 sq. metres in area and must be separated by at least 5 metres.*
- *Trees must not overhang or touch any elements of the building.*
- *The canopy of trees must be separated by at least 5 metres.*
- *There must be a clearance of at least 2 metres between the lowest tree branches and ground level*

Unless specified in a schedule or otherwise agreed in writing to the satisfaction of the relevant fire authority' (Alpine Resorts Planning Scheme, 2020a).

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