# Yellingbo Conservation Area Bushfire Risk Management Plan

August 2018





Environment, Land, Water and Planning

#### Acknowledgements

This document was made in consultation with: Dr Kevin Tolhurst AM (The University of Melbourne/Tolhurst Bushfire Services) Justin Leonard (CSIRO) DELWP Port Phillip Region Forest and Fire Planning team

#### Photo credits

Front cover: Left and centre images: DELWP. Right hand image; Christian Pearson, Misheye Pages: 7, 9, 10, 12, 18, 32: DELWP YCA Project team and DELWP Powelltown. 21,22: Salahuddin Ahmed

#### Author

Department of Environment, Land, Water and Planning

© The State of Victoria Department of Environment, Land, Water and Planning 2018



This work is licensed under a Creative Commons Attribution 4.0 International licence. You are free to re-use the work under that licence, on the condition that you credit the State of Victoria as author. The licence does not apply to any images, photographs or branding, including the Victorian Coat of Arms, the Victorian Government logo and the Department of Environment, Land, Water and Planning (DELWP) logo. To view a copy of this licence, visit

http://creativecommons.org/licenses/by/4.0/

Printed by Department of Environment, Land Water and Planning, Knoxfield.

ISBN 978-1-76077-221-5 (print)

ISBN 978-1-76077-222-2 (pdf)

#### Disclaimer

This publication may be of assistance to you but the State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

#### Accessibility

If you would like to receive this publication in an alternative format, please telephone the DELWP Customer Service Centre on 136186, email customer.service@delwp.vic.gov.au or via the National Relay Service on 133 677 www.relayservice.com.au. This document is also available on the internet at www.delwp.vic.gov.au.

# Contents

Introduction	2
Context	3
Geographic context	3
Principles of the establishment of the Conservation Area	5
Bushfire management context	5
Understanding bushfire risk	7
Bushfire risk in riparian areas	8
How this plan will be used	9
Our Objective	10
Our Approach	11
Planning principles	11
Local Actions to Mitigate Risk	13
1. Design Revegetation	14
2. Fuel Management	17
3. Improve Readiness and Response	19
4. Engagement, Education & Improvement	20
Appendices	22
Glossary	23
Appendix 1: Fire Operation Planning around the Conservation Area	24
Appendix 2: Community and stakeholder involvement	
CFA brigades in the Conservation Area	26
Appendix 3: Understanding Bushfire Risk	29
1. Fire basics	29
2. Bushfire behaviour	29
3. Bushfire in the landscape	
4. Risk management	35
5. Factors that influence bushfire risk	
References	

# Introduction

In March 2014, the Victorian Government committed to the establishment of the Yellingbo Conservation Area (Conservation Area) in accordance with the Victorian Government Response to the Victorian Environmental Assessment Council (VEAC)'s Yellingbo Investigation Final Report (March 2014).

The Conservation Area will consolidate management of public land areas, including streamside reserves and existing conservation reserves. Consolidated management of these public land areas and targeted restoration projects will improve habitat connectivity, water quality and biodiversity values in the Conservation Area.

The landscape surrounding and containing the Conservation Area has an existing high level of bushfire risk<sup>1</sup>, and local communities have raised concerns that bushfire risk has the potential to increase as a result of revegetating areas of public land, as part of implementing the Conservation Area. The government also recognises the importance of the economic and social values in the Yellingbo Investigation Area<sup>2</sup> (Investigation Area) and therefore community participation and stewardship will continue to play a key role in the new management arrangements. Implementation of the Conservation Area includes the phase out of grazing licences on Crown land, and improved land management, including pest plant and animal control and fencing of streamside reserves.

In response to these concerns, the Minister for Energy, Environment, and Climate Change committed to prioritising the development of a bushfire risk management plan, which incorporates community knowledge and informs a risk-based approach to revegetation and reserve planning that will not increase bushfire risk to the local and broader communities. This document, the *Yellingbo Conservation Area Bushfire Risk Management Plan* (YCA Bushfire Risk Management Plan) is the outcome of the above.

The community is supportive of this plan being prepared and communicated strongly that local knowledge must be incorporated into the development of the YCA Bushfire Risk Management Plan.

1. For information on how this level of bushfire risk has been calculated, see the East Central Strategic Bushfire Management Plan 2015.

<sup>2.</sup> The area of land VEAC considered the environmental values in its Yellingbo Investigation (2013). The area covers just over 51,000 hectares of private and public land situated across the Yarra Ranges and Cardinia shires.

# Context

#### **Geographic context**

The Conservation Area is made up of approximately 3,000 hectares of existing public land reserves and Crown water frontages (Table 1) within the area, extending from Healesville in the north to Millgrove and Hoddles Creek in the east, Emerald and Cockatoo in the south, and the southern Dandenong Ranges in the south-west (Figure 1). Most of the proposed Conservation Area is within the municipality of Yarra Ranges Council, with slightly more than 10 per cent of the southern area within Cardinia Shire.

The Conservation Area will be made up of the following:

Table 1: Summary of current public land units included in the Yellingbo Conservation Area

Current Public Land Unit SF: Stream frontage natural features reserve, NCR: Nature Conservation Reserve	Area (Hectares)	
Yellingbo NCR (including some abutting unused roads)	668	
Warramate Hills NCR and adjoining Woori Yallock Creek and Yarra River SF	497	
Hoddle's Creek Education Area	278	
Yarra River SF upstream from Warramate Hills NCR	247	
Sassafras Creek NCR and Kallista Bushland Reserve (at Beagley's Bridge), Sassafras Creek Bushland Reserve and Sassafras Creek Reserve (consolidation)		
Coranderrk NCR	144	
Beenak Bushland Area	126	
Wright Forest Bushland Reserve and adjoining Cockatoo Creek SF	126	
Little Yarra River SF	100	
McCrae Creek SF	90	
Cockatoo Creek SF	73	
Lower Hoddles and Wet Lead Creeks SFs and Hoddle's	63	
Badger Creek and Yarra River SFs downstream of Warramate Hills NCR, Yarra River Streamside Reserve (Everard Park)	62	
Haining Farm	59	
Upper Hoddle's Creek and Wet Lead Creek SF	52	
Emerald Creek SF	33	
Woori Yallock Creek SF downstream of Yellingbo NCR	33	
Britannia Creek SF	27	
Woori Yallock Creek SF between Yellingbo and Sassafras Creek NCRs	25	
Shepherd Creek SF	16	
Menzies Creek SF	15	
Total	2929	



The YCA Bushfire Risk Management Plan covers the Yellingbo Conservation Area, shaded green in the map below (Figure 1).

Figure 1: Map of the Yellingbo Conservation Area

#### Restricted Revegetation Area - Special conditions for revegetation in streamsides

In January 2017, concerns were raised by the community regarding bushfire risk in the north-east corner of the Conservation Area, including the townships of Yarra Junction, Launching Place, Don Valley, Millgrove and Wesburn. As a result, in the area indicated as *Restricted Revegetation Area* in Figure 1, revegetation on public land is restricted to 10 metres either side of waterways, excluding Haining Farm and Yarra Bridge Streamside Reserve.

#### Ecology

The ecological landscape across the Investigation Area is currently described as being stressed and fragmented, with only half of the original (pre-1750) vegetation remaining, patchily scattered across the area, mostly on private land. Remnant vegetation across the area mostly comprises dry and lowland forests, wet or damp forest types at higher elevations, and riparian or swampy scrubs and woodlands along waterways. On the valley floor and floodplains, heathlands and riparian scrub or heathy woodlands dominate, but have been significantly depleted by clearing since European settlement, particularly in the western part of the Investigation Area.

Three nationally threatened fauna species are found within the Conservation Area: Helmeted Honeyeater (*Lichenostomus melanops cassidix*), lowland Leadbeater's Possum (*Gymnobelideus leadbeateri*) and Growling Grass Frog (*Litoria raniformis*), as well as the only remaining patch of the threatened vegetation community Sedge-rich *Eucalyptus camphora* Swamp. The threatened fauna species are listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, and both the fauna species and the vegetation community are listed under the Victorian *Flora and Fauna Guarantee Act 1988*.

#### Principles of the establishment of the Conservation Area

The Conservation Area is designed to provide greater recognition of the importance of the natural values in the area, and to allow conservation and, where necessary, rehabilitation of our natural assets.

A large proportion of the Conservation Area is already covered by native vegetation. This encompasses large blocks of public land (e.g. Wright Forest Bushland Reserve), as well as existing areas of riparian (streamside) vegetation.

The establishment of the Conservation Area:

- Will be based on a bushfire management plan that uses best-practice science and local knowledge in designing bushfire risk mitigation measures to ensure that implementation of the Conservation Area does not materially increase the bushfire risk to the community.
- Allows for community input, to increase the understanding of how the Conservation Area is used and help shape its future use.
- Will include existing areas of native vegetation on public land; large scale revegetation programs are not being proposed. It is likely that only 300 400 hectares of revegetation will be undertaken across the entire Conservation Area and will span several years.
- Acknowledges and supports the existing management of public land by volunteer groups and individuals, including adjoining landholders, where consistent with the values of the area.
- Only involves existing public land.

#### **Bushfire management context**

Bushfire management on public land is a core responsibility of the Department of Environment, Land, Water and Planning (DELWP). For bushfire management and planning, DELWP and partner agencies, such as Parks Victoria and Melbourne Water, work under the name of Forest Fire Management Victoria (FFM Vic).

There are a range of large scale bushfire risk management strategies already applied to the Conservation Area, from state-wide guiding documents such as the *Code of Practice for Bushfire Management on Public Land 2012* and *Safer Together 2015*, to regional scale Fire Operations Plans (FOPs).

Bushfire response on private land is the responsibility of the Country Fire Authority (CFA) and bushfire risk management on private land is the responsibility of the landholder. The Victorian Government's *Safer Together* program is aimed at all bushfire management agencies working together to provide a 'tender blind' approach.

#### Statewide

#### The Code of Practice for Bushfire Management on Public Land

The *Code of Practice for Bushfire Management on Public Land (2012) (The Code)* directs how DELWP manages bushfire risk on public land. *The Code's* two primary objectives are to:

- Minimise the impact of major bushfires on human life, communities, essential and community infrastructure, industries, the economy and the environment: human life will be afforded priority over all other considerations
- Maintain or improve the resilience of natural ecosystems and their ability to deliver important services such as biodiversity, water, carbon storage and forest products.

*The Code* requires FFM Vic to prepare landscape-level strategic bushfire management plans to achieve the objectives, using a transparent, risk-based process based on scientific evidence and local knowledge. *The Code* also includes outcomes, strategies and actions for prevention, preparedness, fuel management (including planned burning), response, recovery and monitoring, evaluation and reporting.

#### Safer Together

The Victorian Government's *Safer Together* program is a whole-of-Victorian Government initiative that combines strong community partnerships with the latest science and information to more effectively target management actions to reduce bushfire risk. It outlines the following four themes for how DELWP, Parks Victoria, CFA and other agencies will work to reduce the risk of bushfires in Victoria:

- Community first
- · Land and fire agencies working together
- Better knowledge = better decisions
- · Measuring success

An important aspect of *Safer Together* is the move towards a risk-based approach, allowing agencies to determine what action should be taken where for the best reduction in risk.

Full details of Safer Together can be accessed here; http://www.safertogether.vic.gov.au/

#### Planning overlays

The Bushfire Management Overlay (BMO) is a planning control applied to land with the potential to be affected by extreme bushfires. The BMO triggers the need for a planning permit for certain developments and requires new developments to include appropriate bushfire protection measures. This ensures that bushfire hazards, such as vegetation, slope and site access are assessed, and that bushfire protection measures are in place to manage risk.

#### Regional

#### Strategic bushfire management plans

The current landscape-level strategic bushfire management plan (SBMP) covering the Conservation Area is the *East Central Strategic Bushfire Management Plan 2015*<sup>3</sup> (*East Central SBMP*). The SBMP aims to strategically reduce risk across the landscape. It identifies key Priority Fuel Management Areas where risk

<sup>3.</sup> The SBMP is currently being updated as a key output from the Safer Together program.

reduction is most beneficial. The *East Central SBMP* can be accessed at <u>www.ffm.vic.gov.au/fuel-</u> <u>management-report-2016-17/landscapes/east-central</u>

#### Fire Operations Plans

Fire Operations Plans (FOPs) are developed regionally by FFM Vic to outline where and when fuel management activities are undertaken on public land. They are informed by objectives determined in *The Code, Safer Together* and strategic bushfire management planning and developed in collaboration with partner agencies, including Melbourne Water, Parks Victoria and the CFA.

A FOP is a plan for fuel management operations over a three-year period, however can be updated annually based on seasonal conditions, natural events, bushfire events, new information and requests by the community. The Conservation Area is situated in the Port Phillip Region. The current FOP for the Port Phillip Region can be viewed in Appendix 1 and at <a href="http://www.ffm.vic.gov.au/bushfire-fuel-and-risk-management/fire-operation-plans">www.ffm.vic.gov.au/bushfire-fuel-and-risk-management/fire-operation-plans</a>

FOPs will soon be replaced by joint planning between FFMV and CFA to better coordinate fuel management operations between public and private land.

#### Local

Using the principles and data in the state-wide and regional processes, local Bushfire Risk Management Plans can be prepared. The *Yellingbo Conservation Area Bushfire Risk Management Plan* is an example of a local plan.

Following a high level of community interest, Haining Farm underwent a separate, site-specific bushfire risk analysis. Bushfire risk analysis reports and mitigation actions applying to Haining Farm are available at; https://engage.vic.gov.au/yellingboconservationarea

#### Strategies by other agencies

DELWP is responsible for bushfire management on public land. Municipal fire management plans and CFA Readiness and Response Plans address bushfire management activities outside of DELWP's legislated requirements.



A Forest Fire Management Victoria firefighter.



A forest mulcher used in mechanical fuel treatment.

#### **Understanding bushfire risk**

Risk is the combination of likelihood and consequence. Bushfire risk depends on multiple interacting factors. It is the chance (likelihood) of a fire starting, spreading and impacting (consequence) on people, property and the environment (Victorian Government 2015). Risk mitigation involves taking actions to reduce the likelihood and reduce the hazard.

The bushfire risk experienced at a given location will be influenced by the following:

#### Likelihood – The chance of bushfire igniting and spreading

- Weather High temperature, low relative humidity, high wind speeds, atmospheric instability, lightning
- Fuel Amount, type, arrangement
- Topography Slope or mountainous terrain vs low or flat fields
- · Moisture Fuel moisture content, long term drought
- Response and suppression Rapid first-attack suppression, limiting fire spread, protection of community assets.

#### Consequences - factors influencing the levels of threat, hazard, exposure and vulnerability

- · Fuel Proximity, amount, type, arrangement
- · Topography Slope below an asset, location of asset in the landscape
- Weather High temperature, low relative humidity, high wind speeds, atmospheric instability, lightning
- · Moisture Fuel moisture content, long term drought
- Human behaviour Population location in the landscape, human caused ignitions, human decisions before, during and after a fire event
- Property maintenance and building design Defendable space, garden type, arrangement and maintenance, clean gutters, construction materials, radiant heat and ember resistance, etc
- · Access and water supply
- · Ability of assets or occupants to escape or survive fire

#### Bushfire risk in riparian areas

The proposed revegetation is along riparian (streamside) areas. Riparian areas tend to have a limited influence on bushfire spread in the landscape (DELWP, 2018). This is largely because:

- · Fire will spread more quickly in cured grass or crops compared with forest.
- · Trees generally reduce wind speed, and the rate of spread and intensity of fire; and
- Riparian land occupies a relatively small proportion of the broader landscape.

Fire is also much less likely to start in riparian land than other parts of the landscape, typically because it is not as prone to lightning strikes, is remote to easy access for arsonists, typically has fuel too moist to burn and is sheltered from the wind and sun.

Contrary to popular belief, riparian areas do not generally act as a 'wick' or 'fuse'. Fires will generally only burn in the direction of the wind (while spreading more slowly sideways) or up-slope if burning under light wind conditions (CFA, 2016).

It is important to recognise that the actual risk faced at a location will be the result of more than one factor and that some of those factors, such as the management of private property, are outside of the scope of this plan to manage. The components which influence bushfire risk are more thoroughly described in Appendix 3.

Further information on what contributes to bushfire risk is accessible online:

https://www.cfa.vic.gov.au/plan-prepare/how-fire-behaves

# How this plan will be used

The YCA Bushfire Risk Management Plan sits alongside existing fire management plans (Bushfire management context, page 8) and will be used to guide specific planning activities relevant to the establishment and ongoing management of the Conservation Area. This plan will assist DELWP in establishing the Victorian Government response to the Victorian Environmental Assessment Council's Yellingbo Investigation Final Report (March 2014) without a material increase in bushfire risk.

The proposed actions detailed in this plan will be used to meet the stated objectives, inform the development of the *Yellingbo Conservation Area 10 Year Plan* and will guide future management activities.



# **Our Objective**

- Ensure there is no material increase in bushfire risk as a result of revegetating public land to implement the Victorian Government response to the Victorian Environmental Assessment Council's Yellingbo Investigation Final Report (March 2014)
- Maintain or improve the resilience of natural ecosystems and their ability to deliver ecosystem services such as biodiversity, water, carbon storage and forest products

These objectives differ from typical bushfire management plans such as the *East Central SBMP*, which address bushfire risk already present in the landscape. The *YCA Bushfire Risk Management Plan* focusses on ensuring there is no increased risk introduced into the landscape through revegetation in the Conservation Area.



# **Our Approach**

Based on the Victorian Government's *Safer Together* program, DELWP takes a risk-based approach, incorporating scientific and local knowledge to determine risk and effectively target management actions to reduce bushfire risk. DELWP uses the International Standard for Risk Management, ISO 31000:2009 to develop risk management strategies.

DELWP engaged Dr Kevin Tolhurst AM (University of Melbourne/Tolhurst Bushfire Services) and Justin Leonard (CSIRO) as independent fire science experts in the field of bushfire risk, to examine risk at both a landscape scale and at a local level. Dr Tolhurst and Mr Leonard provided independent advice and expertise in measuring the risk associated with the establishment of the Conservation Area and in developing mitigation measures that can be incorporated into the design of the Conservation Area.

In consultation with Dr Tolhurst, DELWP used PHOENIX Rapidfire bushfire modelling to measure the likelihood of bushfire in the local area (Yellingbo Investigation Area) and possible changes in risk as a result of increased vegetation on Crown land. An independent bushfire risk assessment is available in a report by Dr Kevin Tolhurst at <a href="https://engage.vic.gov.au/yellingboconservationarea">https://engage.vic.gov.au/yellingboconservationarea</a>. A detailed report of the bushfire risk assessment by DELWP supplements Dr Tolhurst's report as an appendix.

A standard setback distance to separate revegetation activities from existing dwellings was determined using state building and planning policies, in consultation with Mr Leonard.

To ensure that local knowledge is incorporated into the YCA Bushfire Risk Management Plan, DELWP has worked with (and will continue to work with) Parks Victoria, Melbourne Water and local CFA brigades in its development and has considered feedback from these groups (Appendix 2).

#### **Planning principles**

It is important to understand what this plan can achieve. As many aspects of bushfire risk planning are already managed, it is important to ensure the *YCA Bushfire Risk Management Plan* is realistic and doesn't conflict with existing arrangements. As well as the priorities identified by the *Safer Together* program, the following principles have guided the development of the *YCA Bushfire Risk Management Plan*:

#### Planning principles of the YCA Bushfire Risk Management Plan

- Human life will be afforded priority over all other considerations.
- Establishment of the Conservation Area will not materially increase the bushfire risk to the local or broader community.
- Establishment of the Conservation Area will maintain or improve the resilience of natural ecosystems and their ability to deliver ecosystem services such as biodiversity, water, carbon storage and forest products.
- A scientific approach using the most up-to-date information and advice from independent experts will be used to develop the YCA Bushfire Risk Management Plan.
- Staff from Parks Victoria, Melbourne Water and local CFA brigades will be involved in the preparation of the *YCA Bushfire Risk Management Plan* to ensure that local knowledge is considered.
- DELWP will be transparent about how decisions have been made and how stakeholder input has been considered.
- DELWP will be transparent about what assumptions have been made in terms of risk assessment and mitigation.
- The plan will not conflict with DELWP or Parks Victoria's legislated obligations.
- The plan will not conflict with other land management policies relevant to the Conservation Area.

#### Within scope:

- Designing revegetation types (including species selection) and locations on public land to ensure no material increase in bushfire risk to the community.
- Determining a minimum revegetation set-back to dwellings.
- Enhancing and improving fire infrastructure, including fire access tracks and water points.

#### Out of scope

- Altering existing planned burning strategies, such as the East Central Strategic Bushfire Management Plan, the Port Phillip Region Fire Operations Plan, and fire management zones.
- Altering the Port Phillip Region Model of Fire Cover (that is, the pre-determined resourcing and positioning of firefighting resources).
- Altering the Port Phillip Region Readiness and Response Plan (that is, the plan that defines the readiness, initial attack, and firefighting procedures to be adopted by DELWP and Parks Victoria staff).
- Altering the Yarra Ranges Council and Cardinia Shire Council Municipal Fire Management Plans.



# **Local Actions to Mitigate Risk**

The independent bushfire risk report (Tolhurst, 2018) stated that revegetation undertaken in implementing the Conservation Area can be achieved without materially increasing bushfire risk across the landscape. The full report: *Bushfire Risk Analysis in the Yellingbo Area* can be accessed at: https://engage.vic.gov.au/yellingboconservationarea.

DELWP recognises however, that the proximity of vegetation to a dwelling is a factor in determining the level of risk to that dwelling. Specifically, the closer vegetation is located to a dwelling, the more likely it is influence the risk of losing that dwelling during a bushfire. This concept is consistent with planning schemes, studies, and the independent bushfire risk report (Tolhurst, 2018). At this scale, risk can be mitigated with careful design of the revegetation corridor.

The *YCA Bushfire Risk Management Plan* will provide guidance to Conservation Area land managers<sup>4</sup> in how they will implement local mitigation measures and revegetation design to ensure no material increase in bushfire risk to adjoining landholders and the broader community. The strategies and actions forming this plan are detailed below. Some strategies already exist in the Investigation Area and are part of the over-arching structure in which the *YCA Bushfire Risk Management Plan* sits, while others are new and specific to the Conservation Area.

Intent	Protection of local assets and values			
Strategy	Prevention	Reduce the threat	Reduce the likelihood	Community resilience
Approach	Design revegetation	Fuel management	Improve readiness & response	Engagement, education & improvement
Actions				
	*Limit the extent of revegetation on public land near dwellings - minimum setback distance of 100 metres *Modify species selection and lower bark hazard vegetation buffers *Restrict revegetation on public land to 10m from either side of the waterway in the <i>Restricted</i> revegeation area (Figure 1)	Develop an asset register/map of areas requiring mechanical fuel treatment *Allow grazing under a Riparian Anagement License where appropriate Conduct Planned Burning operations Maintain existing fuel breaks	Maintain existing access tracks and water points *New access tracks and water points in consultation with local government and CFA brigades Develop an asset register/map of existing and new access tracks and water points Develop a works plan to prioritise maintenance and establishment of access tracks	*Educate local residents on maintenance of properties Implement park closures on days of elevated fire danger, in line with Parks Victoria and DELWP standard practice Investigate the cause of fires Develop a monitoring and evaluating program

Figure 2. Actions delineated with an asterisk and bold text are mitigation strategies and actions specific to the YCA Bushfire Risk Management Plan. The other strategies and actions listed are currently in use in the surrounding area.

4. The public land managers in the Conservation Area include Parks Victoria, DELWP, Zoos Victoria, Trust for Nature, Yarra Ranges Council, Cardinia Shire Council and VicRoads (roadside verges).

#### **1. Design Revegetation**

Revegetation design is about what is planted where. The actions supporting this approach ensure the fire management implications of revegetation will be an integral part of the Conservation Area management.

The proximity of vegetation to dwellings is a primary consideration. Any significant patch of vegetation situated close to assets may pose a fire threat and the independent report (Tolhurst, 2017) identifies fuel within 100 metres as having the greatest influence on the level of risk faced by a dwelling.

Therefore, revegetation of public riparian land that is not currently vegetated will be set-back to allow distance between new vegetation and dwellings or community infrastructure. A setback distance of 100 metres has been determined based on research, state building and planning policies and advice from independent fire experts. Additionally, lower bark hazard vegetation buffers<sup>5</sup> will be used to better manage and moderate ember load potential.

#### Actions:

#### 1.1 Strategically plan revegetation of public land

Within the Conservation Area, the large blocks of public land are already vegetated. Widespread revegetation is not proposed within the Conservation Area, instead there will be targeted revegetation of some rivers and streams, likely to be around 300 – 400 hectares in total. Revegetation of these areas will not be able to happen all at once, rather it will be a process that takes several years to undertake. Delivery of revegetation programs will be identified strategically in the planning process. Programs for revegetation of streamsides will consider what is appropriate to that site and be informed by CFA brigade feedback on waterpoints and access tracks and the necessary revegetation setback.

#### 1.2 Limit extent of revegetation near dwellings

A standard revegetation setback distance of 100 metres will be applied to revegetation activities throughout the Conservation Area. This means that no revegetation will take place within a minimum distance of 100 metres of any dwelling<sup>6</sup>. An example is shown in Figure 3.

This separation distance mitigates flame and radiation interaction with dwellings. Research into house losses from historical fires has revealed that most house losses have occurred within 100 metres of bushland (Ahern and Chladill, 1999; Chen and McAneney, 2010). Given the position of the Conservation Area in the landscape<sup>7</sup> and the vegetation types likely to be planted, the 100 metre setback is considered a conservative measure.

The setback distance has been determined in consultation with Mr Justin Leonard (CSIRO) and using established separation distances specified in state building and planning policies. The Australian Standard *AS3959:2009* recommends defendable space requirements for different Bushfire Attack Level (BAL) rated houses, using slope and vegetation class.

Analysis using DELWP spatial data<sup>8</sup> reveals 97% of the slopes within the Conservation Area are between 0 and 15 degrees, indicating a setback of 100 metres will also cater for slope variation across the Conservation Area.

This action is limited to existing dwellings and does not apply to other infrastructure such as sheds.

#### How the setback will be applied

Where any revegetation is planned, a site assessment will need to take place. As part of any site assessment, all necessary information will be gathered, such as the nearest dwelling, which Ecological Vegetation Class (EVC)<sup>9</sup> will be planted and the slope where vegetation is to be planted.

<sup>5.</sup> The reference document to guide the establishment of the lower bark hazard vegetation buffers will be *Overall fuel hazard assessment guide*. Department of Environment and Primary Industries, 2010

<sup>6.</sup> Some exceptions to this rule are possible. See How the setback will be applied for further details.

<sup>7.</sup> Typically located on low-lying stream-sides and floodplain.

<sup>8.</sup> The spatial layer used to identify slope across the Conservation Area was 'BLD\_SLOPECLASS\_DEG'.

Adjoining landholders will have the opportunity to be involved with the extent of revegetation near their property. Revegetation can occur within the 100 metre setback distance, only with the adjoining landholder's consent. Additionally, planting vegetation might be considered within the setback, in the context of land management works such as:

- Erosion management: such as planting vegetation to stabilise an eroding bank
- Weed management: where weeds are treated, they must be replaced with another plant or a different weed tends to replace it, making weed management futile.

Such instances will be considered on a site-by-site basis and only with the consent of the adjoining landholder.

The agency managing the area being revegetated will be responsible for implementing required design measures.

It is possible that the process of implementing the Conservation Area will identify landholder encroachments (e.g. unauthorised structures) on public land. Encroachments will be managed through a compliance strategy, informed by relevant legislation. Management of revegetation around such encroachments will be determined on a case-by-case basis and ultimately subject to the compliance strategy.

#### 1.3 Modified species selection and lower bark hazard vegetation buffers

In addition to the 100 metre setback, lower bark hazard vegetation buffers will be used to better manage and moderate ember load potential. Tree species likely to produce an area of *Very High* or *Extreme* bark hazard, according to the *Overall fuel hazard assessment guide (2010)*, will be avoided.

Revegetation at a given location will be based upon the appropriate EVC benchmark. Over an area, different species within an EVC may contribute to fire risk at differing levels. Revegetation programs can deviate from the EVC benchmark, in order to avoid planting species likely to produce of a *Very High* or *Extreme* bark hazard over the revegetation area.

For example, Messmate (*Eucalyptus obliqua*) is identified by the *Highlands -Southern Fall EVC Benchmarks* as forming part of *EVC 18: Riparian Forest*. When it is present as the dominant over-storey species for an area, it can produce an *Extreme* bark hazard. Therefore, where EVC 18 is used for revegetation, planting Messmate will be avoided.

However, it should be noted that an existing level of risk is already present within the landscape. In the event of a large bushfire, significant ember sources already exist in the surrounding areas of forest and it is likely that dwellings would still be impacted by embers from these other sources.

In some circumstances, certain types of vegetation can filter embers and provide relief from the wind (CFA, 2016). This is also recognised in the CFA document *Landscaping for bushfire* (2011). This principle forms the basis of this action.

#### 1.4 North-East Corner – Special conditions for revegetation in streamsides

In January 2017, the Victorian Government responded to community concern regarding bushfire risk in the north-east corner of the Conservation Area, including the townships of Yarra Junction, Launching Place, Don Valley, Millgrove and Wesburn. The government's response included a decision that, for this area only (Figure 1: *Restricted revegetation area*), revegetation is to be restricted to a maximum of 10 metres either side of waterways, excluding Haining Farm and Yarra Bridge Streamside Reserve.

9. Ecological Vegetation Classes (EVC) are the standard unit for classifying vegetation types in Victoria.



Figure 3. How the design measures in this plan could be incorporated into the Conservation Area.

#### 2. Fuel Management

Fuel management aims to reduce fine fuels, such as leaves, twigs, bark and grass, in order to reduce bushfire hazard. It is typically done through planned burning, or mechanical treatments such as slashing or mulching. These existing fuel management objectives are determined by *Safer Together: A new approach to reducing the risk of bushfire in Victoria*, the *East Central Strategic Bushfire Management Plan* and the *Port Phillip Region FOP*.

Establishment of the Conservation Area will mean changes in the way some of the land is managed. The following actions ensure fuel management activities can incorporate those changes.

#### Actions:

#### 2.1 Develop an asset register for areas requiring mechanical fuel treatment

Some parts of the Conservation Area, such as access tracks or where pasture cannot be revegetated, may require mechanical fuel treatment. Through GPS and recording field data, the details of new areas requiring slashing or mulching will be recorded for annual treatment. This action will commence with the broader planning of the Conservation Area and continue with ongoing management.

#### 2.2 Grazing under a riparian management licence

Implementation of the Victorian Government Response to the Victorian Environmental Assessment Council's Yellingbo Investigation Final Report (March 2014) will include the phase out of grazing licences on riparian Crown land in the Conservation Area. Where landholders enter into a riparian management licence, they may in some circumstances be permitted to use grazing as a management tool. Use of grazing in this way will help to limit the accumulation of long pasture grass in areas that are not available for revegetation. Stock will not be permitted to graze in already vegetated areas of the Crown frontages.

Riparian management licences and licence conditions will be agreed on a case-by-case basis according to DELWP's *Managing grazing on riparian land: Decision support tool and guidelines 2016*, and the document: *Licensing Principles for Fencing and Grazing within the Yellingbo Conservation Area,* which will be included in the *Yellingbo Conservation Area 10 Year Plan.* 

Grazing under a management licence is a practical management outcome from changes in land management and is not a conventional fuel treatment option for public land. Grazing will not form part of the Port Phillip Region FOP or contribute to fuel treatment targets.

Fire protection works on licensed riparian land is the responsibility of adjoining landholders, licenced for the management of a Crown land water frontage, as specified in the licence conditions. On public land where there is no licence, DELWP is the responsible agency.

Further information on Crown water frontage licences can be found at: <u>https://www.water.vic.gov.au/waterways-and-catchments/riparian-land/riparian-land-in-victoria</u>.

#### 2.3 Conduct planned burning

Planned burning is a useful fuel management tool to not only reduce bushfire risk, but also to improve ecological values. When planned burning is undertaken with clear ecological objectives and carried out in the correct season, it can reinvigorate ageing vegetation communities and encourage flowering and seeding in certain vegetation communities.

The *Code* describes the application of four different Fire Management Zones (FMZs) to achieve fuel treatment aims in a particular area, such as asset protection or landscape management (DSE, 2012). Planned burning will be carried out on areas of public land in the Conservation Area, according to the FMZs assigned by the *East Central Strategic Bushfire Management Plan*. The majority of planned burning occurs where the highest risk is, which tends to be outside the Conservation Area.

Some vegetation communities within the Conservation Area are unsuitable for management through planned burning (Cheal, 2010). It is expected that planned burning will not be carried out in those areas.

The *Port Phillip Regional FOP* (see *Bushfire management context, page 7*) details when and where planned burns happen in the Conservation Area. While most burns are on public land, some cross-tenure burns with CFA are planned within the surrounding area.

See Appendix 1 for a map showing areas in and around the Conservation Area planned for burns within the current FOP cycle. For more information on planned burning in the Port Phillip Region, including Traditional Cultural Heritage burns, see the *Port Phillip Region FOP*.

#### 2.4 Maintain existing fuel breaks

Strategic fuel breaks are constructed breaks in vegetation used to assist in fuel management operations. They can provide safe access routes for firefighters, provide a fuel-reduced area from which to conduct back burning ahead of an approaching fire or to assist in implementing a planned burn. Established fuel breaks existing in reserves which are to become part of the Conservation Area will continue to be maintained as fuel breaks and access tracks. Access tracks will be considered in design measures for some areas. This will be developed in conjunction with the ongoing feedback from local CFA brigades and the broader planning process. Access tracks will be maintained through annual mechanical treatment under the FOP or through riparian management licenses.



#### 3. Improve Readiness and Response

Historically, more than 80% of fires in Victoria are supressed before they exceed five hectares in size. Rapid suppression of fires before they develop to a size and intensity that makes them difficult to control is an important strategy in managing bushfire risk.

 The DELWP objectives for fire response are to control 80% of fires at less than 5 hectares and at first attack, and for 80% of fires to be contained by 0800 the next day (DSE, 2012). The CFA has similar operational targets for bushfire containment (CFA, 2017).

While altering the Readiness and Response Plans is outside of the scope of this plan, practical actions such as maintaining and improving access and waterpoints can be incorporated into the Conservation Area to allow for better response to fire. Details for such measures have been sought from local agency staff and CFA volunteers.

The actions detailed below have already begun and will continue to be updated as necessary.

#### Actions

#### 3.1 Maintain existing access tracks and water points

Continue to consult with local CFA brigades to identify location of existing tracks and water points, including condition and maintenance requests.

#### 3.2 Local CFA brigades to identify new access tracks and water points

Continue to consult with local CFA brigades to identify location and priority of proposed access tracks and water points to further support response and suppression. This process has begun and will continue to be updated as necessary (Appendix 2).

Some proposed access tracks and water points may be located outside of land under DELWP's management or conflict with other management activities. All proposed water points and access tracks will be evaluated to determine viability. Evaluation will be based on the following considerations:

- Is it within a DELWP or Parks Victoria management area?
- · Is removal of existing vegetation required?
- · Are significant environmental or conservation values present?
- Is the site a high priority for the brigade?

Where a proposed site has been evaluated as potentially unviable, DELWP will explore alternative options with the CFA captain proposing the site.

Refer to Appendix 2 for locations identified so far. As yet, none of these locations have been evaluated.

#### 3.3 Develop an asset register of existing and new access tracks and water points

Data will be gathered on existing and new access tracks and water points, to develop an asset register for ongoing management. This action will commence with the broader planning of the Conservation Area and continue with ongoing management.

#### 3.4 Develop a works plan to prioritise maintenance and establishment of access tracks

In consultation with Parks Victoria, water authorities, and local government, develop a work plan to prioritise maintenance and water point establishment requests.

#### 4. Engagement, Education & Improvement

With more people moving into peri-urban environments, it is important to understand that bushfire risk is not only contingent on fuel levels and vegetation. Building, property design and maintenance of private property are also highly important factors in determining bushfire risk.

Landholders and visitors can play a key role in mitigating risk through engaging in fire safe actions and responses. Recognising this, the engagement, education and improvement strategy comprises of the following actions;

#### Actions

#### 4.1 Inform adjoining landholders on the maintenance of properties

The area within 30 metres of a dwelling is the most important when preparing a property for bushfire. There are guidelines in place to encourage private property owners to remove vegetation from around buildings and other assets.

In the course of establishing the Conservation Area, DELWP will inform local residents on the local council planning schemes, combined with the latest research on what puts houses at risk.

#### 4.2 Implement park closures on days of elevated fire danger

On days of elevated fire danger, Parks Victoria and DELWP will close some visitor areas, and volunteer activities cease. It is recommended that upon transition of management of the Conservation Area from DELWP to Parks Victoria, the public areas be assessed to determine what fire danger days warrant their closure and inclusion in the risk register.

Information about park closures can be found on the Parks Victoria public website:

<u>http://parkweb.vic.gov.au/safety/closures</u> and on the Forest Fire Management Victoria public website: <u>https://www.ffm.vic.gov.au/permits-and-regulations/closures-of-parks-and-forests</u>

#### 4.3 Investigate the cause of fires

During the decade 2004 - 2014, 51% of bushfires responded to by DELWP were caused by accidental or deliberate action by people, 27% by lightning and the remainder (22%) had other or unknown causes (DELWP, 2015).

The *Code of Practice for Bushfire Management on Public Land 2012* states DELWP will investigate the origin and cause of bushfire on public land. Determining the cause of a fire helps address the likelihood of a fire occurring, by understanding how and where fires start.

The process to undertake an investigation will be conducted in accordance with the existing DELWP procedural guidelines.

#### 4.4 Monitoring, Evaluation and Reporting

Monitoring, evaluating and reporting is important to improve management strategies and actions over time and to more effectively and transparently report on management outcomes.

The Yellingbo Conservation Area Bushfire Risk Management Plan incorporates the latest information from leading experts in order to meet the plan's key objectives. DELWP and Parks Victoria will continue to work with experts to further refine and improve upon the strategies included in the Plan during the implementation of the Conservation Area. This will include investigating further integration of risk management practices across land tenure border.

Monitoring, Evaluation and Reporting on the proposed management actions within this plan will be managed through the Conservation Area 10 Year Plan. Once actions have been prioritised and introduced into the landscape, it is recommended that Parks Victoria tailor a monitoring program to determine the success of the implemented actions. The following option is therefore presented as a recommendation only.

DELWP has developed a comprehensive framework; *The Monitoring, Evaluation and Reporting Framework for Bushfire Management on Public Land (the DELWP Monitoring Framework),* to provide guidance on how

20 Yellingbo Conservation Area Bushfire Risk Management Plan August 2018 to monitor, evaluate, and report on the planned burning program across Victoria. The overarching principles of the *DELWP Monitoring Framework* can still be applied to this plan.

The DELWP Monitoring Framework states:

Monitoring, evaluation and reporting allows land managers to quantify the success of their bushfire management actions and strategies for achieving objectives. This in turn supports transparent reporting to government and the community on the outcomes of bushfire management.

Like the *DELWP Monitoring Framework*, effectiveness of the *YCA Bushfire Risk Management Plan* should be measured against the primary objectives for bushfire management outlined in *The Code* (DSE, 2012). It should also be measured against the additional local objectives outlined in this plan.



# Appendices

## Glossary

**Bushfire Attack Level (BAL)**: A measure of the severity of a building's potential exposure (threat) to ember attack, radiant heat and direct flame contact, based on radiant heat (*AS 3959:2009*)

Bushfire Management Overlay (BMO): a planning control applied to land with the potential to be affected by extreme bushfires

**Bushfire risk:** The combination of the likelihood of a fire starting, spreading and impacting on people, property and the environment

**Bushfire threat**: Potential impact of bushfire on assets based upon fuel hazard, separation distance and the slope under a given climatic condition. Bushfire threat can be described by the Bushfire Attack level (BAL)

The Code of Practice for Bushfire Management on Public Land 2012 (The Code); directs how DELWP manages bushfire risk on public land

Crown land water frontage: Any strip of Crown land that runs alongside designated rivers and streams

CFA: Country Fire Authority

DELWP: Department of Environment, Land, Water and Planning

DEPI: (Former) Department of Environment and Primary Industries

DSE: (Former) Department of Sustainability and Environment

**East Central bushfire risk landscape:** The area of land covered by the *East Central Strategic Bushfire Management Plan.* The Yellingbo Conservation Area is within this the East Central landscape.

Ecological Vegetation Class (EVC): A system of classifying vegetation communities

**Fire Management Zone (FMZ)**: A zoning described in *Code of Practice for Bushfire Management on Public Land 2012* which establishes the primary objective for fuel management in areas of the landscape.

**Forest Fire Danger Index (FFDI)**: Measure of the chances of a fire starting, its rate of spread, intensity and difficulty of suppression in forest

**Forest Fire Management Victoria (FFMV):** The lead agency for bushfire management on public land, made up of staff from DELWP, Parks Victoria, Vic Forests and Melbourne Water

**Fire Operations Plan (FOP):** Fuel treatments on public land such as planned burning or slashing are managed in the FOP

Haining Farm: A 59-hectare area of public land currently managed by Parks Victoria and forms part of the Conservation Area

Riparian: Land that runs alongside rivers, creeks and other waterways

**Riparian management licences:** A license for Crown land water frontage that allows the licensee to manage all or part of the frontage, to protect and improve the riparian environment

Strategic Bushfire Management Plan (SBMP): These plans identify where it is best to undertake fire management to achieve DELWP's bushfire management objectives

**VEAC:** Victorian Environmental Assessment Council

**YCA**: The Yellingbo Conservation Area. The proposed Conservation Area which will include approximately 3,000 hectares of the public land, as described in the *Victorian Government Response to Victorian Environmental Assessment Council's Yellingbo Investigation Final Report (2014)* 

**Yellingbo Investigation Area**: The area of land VEAC considered the environmental values in its Yellingbo Investigation (2013). The area covers just over 51,000 hectares of private and public land situated across the Yarra Ranges and Cardinia shires

**Yellingbo Nature Conservation Reserve:** An existing reserve managed by Parks Victoria, located in Yellingbo. Contains the last remaining area of the habitat community Sedge-rich *Eucalyptus camphora* Swamp, which is the last remaining habitat of the Helmeted Honeyeater and lowland Leadbeater's possum

**Safer Together:** A state-wide Victorian Government approach to reducing bushfire risk. It adopts a risk reduction target to guide fuel management.

# Appendix 1: Fire Operation Planning around the Conservation Area

Fire Operations Plan maps show where the planned burns in and around the Conservation Area are occurring in 3-year cycles. It also displays slashing, fuel breaks and fuel management zones. FFMV, Melbourne Water and CFA planned burns are displayed. It is important to note that the highest risk to bushfire will come from outside of the Conservation Area. Based on weather patterns and fire behaviour, some risk will come from the north of the Conservation area.



Map 1.1. The Port Phillip Fire Operations Plan for the northern end of the YCA. Areas north of the Conservation Area, within the Port Phillip Region have also been included



Map 1.2. The Port Phillip Fire Operations Plan for the southern end of the Conservation Area. Areas south of the Conservation Area within Port Phillip Region have also been included.

# Appendix 2: Community and stakeholder involvement

The Yellingbo Conservation Area Bushfire Risk Management Plan has been developed in response to community concerns about bushfire. Feedback related to bushfires, gained during community consultations regarding the establishment of the Conservation Area, has been used to inform the development of this plan. The community consultations were as follows;

- Drop-in sessions were held with the local community to identify issues with implementation of the Conservation Area (2016)
- Consultation took place with CFA brigade representatives to establish the risk context and identify
   opportunities for improving response times
- A community meeting and workshop were held to discuss the redevelopment of Haining Farm within the Conservation Area, including the potential for bushfire risk to increase, and what mitigation measures the community wanted to see at the site (December 2016)
- A community-based working group was established to develop a concept plan for Haining Farm (the Haining Farm Working Group) that does not increase the bushfire risk to the local or broader community. The methodology used was the basis for developing the *Yellingbo Conservation Area Bushfire Risk Management Plan* (2017)
- Independent bushfire management experts were involved to provide advice to the Haining Farm Working Group on bushfire risk at Haining Farm and across the greater Conservation Area (2017)
- Haining Farm bushfire risk modelling scenarios were presented to the community for feedback on the preferred revegetation option (2017)
- Two workshops on bushfire risk in the Yellingbo Investigation Area held with local CFA brigade captains, involving bushfire experts Dr Kevin Tolhurst AM (University of Melbourne/Tolhurst Bushfire Services) and Justin Leonard (CSIRO) (October-November 2017)
- Local CFA brigades met with DELWP officers and provided spatial data on existing and proposed water points and access tracks (2017-ongoing)
- Local residents have taken the opportunity to comment generally on bushfire risk during other consultation processes for the Conservation Area (The Haining Farm engagement process and the Conservation Area Plan Survey, November 2017). Valuable community feedback has been gained through these other processes
- Review by local DELWP and Parks Victoria staff (2018)
- Note that the process to talk with the CFA brigades regarding new water points and access tracks is on going

#### **CFA brigades in the Conservation Area**

The Conservation Area is covered by twenty-four CFA brigade response areas, in both CFA Districts 8 and 13, and CFA South East and North East Regions.<sup>10</sup>

District 13 Brigade Response Areas			
Badger Creek	Hillcrest	Menzies Creek	• Wandin
Coldstream	Hoddles Creek	• Monbulk	Wesburn - Millgrove
Clematis	<ul> <li>Kallista - The Patch</li> </ul>	• Olinda	Yarra Junction
Emerald	Lilydale	Sassafras & Ferny Creek	Yellingbo
Gruyere	Little Yarra	Seville	

10. While all brigades were contacted all brigades were able to provided advice/feedback during consultations.

Healesville	Macclesfield	• Silvan	
District 8 Brigade Response Areas			
Cockatoo	Gembrook		

CFA brigades with areas of the Conservation Area within their response area were provided with maps and asked to provide information on existing water points and access tracks within the reserve area and to submit a 'wish list' including requested new water points and access tracks.

Maps 2.1 and 2.2 show outputs from this discussion. It's important to note that this process is ongoing and further conversation with the CFA brigades will be occurring to refine new water points and access tracks.



Local CFA Brigade Feedback

Map 2.1. Existing and requested fire response infrastructure in and around the northern half of the Conservation Area.



Map 2.2. Existing and recommended fire response infrastructure in and around the southern half of the Conservation Area

# Appendix 3: Understanding Bushfire Risk

Bushfire risk is a combination of multiple factors. It is a combination of the likelihood of a fire starting, spreading and impacting on people, property and the environment. It involves the interaction of weather conditions on a particular day, seasonal weather conditions, fuel arrangement, type and extent of vegetation, the capability of fire agencies to supress and limit the spread of fire, the design and location of a dwelling within the landscape, how and if a property is defended and where in the landscape a fire starts.

This appendix gives a brief explanation on some of the basic factors contributing to bushfire risk.

#### 1. Fire basics

Fire needs three components to occur: heat, oxygen and fuel. Often referred to as the 'combustion triangle', if any one of these components are taken away, a fire can't happen (Figure 3.1).



Figure 3. 1. The Combustion Triangle

Firefighting approaches are based on removing one of the three components:

- 1. Water absorbs **heat** and so is commonly used by firefighting agencies to extinguish fires. This can either reduce the impact of **heat** on the fire or remove the heat element from the fire.
- 2. Clearing vegetation from around a house or creating a **fuel** break around bushland areas reduces the **fuel** available to a bushfire.
- 3. Smothering a frypan fire in a kitchen with a fire blanket will starve the fire of **oxygen**. This treats the **oxygen** element of the fire triangle.

#### 2. Bushfire behaviour

The bushfire behaviour triangle, like the combustion triangle above, describes the three key factors influencing how a bushfire behaves (Figure 3.2). Bushfire behaviour is driven by a relationship between fuel, weather, topography as well as environmental moisture and atmospheric stability.



Figure 3. 2. The Bushfire behaviour triangle. (Credit: Adapted from an image by Dr Kevin Tolhurst)

#### **Fine fuel**

Fuel is the only element of the bushfire behaviour triangle that people (firefighters, partner agencies and the wider community) can influence. How intense a fire becomes or how fast it spreads depends on the vegetation or fine fuels: the amount, type, condition and arrangement across the landscape. There are different types of fine fuels that can contribute to the risk of a bushfire starting, the intensity of fire and the difficulty of extinguishing a fire. It is important to note that while all vegetation can be considered fuel, it does not all contribute to bushfire risk in the same way, or to the same extent. Fuel is also dynamically influenced by weather conditions such as relative humidity or long-term drought.

Some vegetation types and arrangements can reduce the amount of risk, others will increase the amount of risk. The arrangement and amount of fuels in the landscape is a key component of this.

The different types of fuel are divided into 5 strata shown in the diagram below.



Figure 3.3: Five strata of fuel. (Source: Overall fuel hazard assessment guide, July 2010)

- Surface fuel fine fuels lying on the ground such as leaves, twigs and bark. Fine fuels influence the rate of spread of a fire.
- Near surface fuel both live and dead plant material that is in touch with the ground, but not lying on it. Fuel in this layer will always burn when the surface layer burns. This layer influences the rate of spread and flame height of a fire.
- Elevated fuel both live and dead plant material in a mainly upright position. Can include suspended leaves, bark and twigs. A low intensity fire can pass beneath this fuel layer without consuming much if any of it. This layer influences the flame height and rate of spread of a fire.
- Bark fuel bark located on tree trunks and branches. Bark fuel can span the entire height of the tree from the ground to the canopy. This layer can cause or contribute to spotting during a bushfire. Different bark-types will contribute to fire behaviour to a different extent.

• Canopy fuel – crown layer of the tallest trees. Under some conditions, the canopy layer may play a significant role in fire behaviour. The risk of fire reaching the crown layer is largely dependent on the physical connection between the crown layer and the lower fuel layers, including bark fuel.



Figure 3.4. Bark burning on Messmate (*Eucalyptus obliqua*). The embers in this photo are a result of flaming pieces of bark. Stringy bark-types such as these contributes to intense, short-distance spotting.

#### Weather

Weather is the greatest contributor to fire severity. Temperature, relative humidity, wind direction and speed, and atmospheric stability each affect the availability of fuel, how fire spreads and how the fire interacts with the environment.

Dryness (based on rainfall and evaporation), wind speed, temperature and humidity are combined to advise the Forest Fire Danger Index (FFDI). The higher the FFDI, the more extreme the bushfire weather. The average FFDI in a region is used to determine the Fire Danger Rating (Figure 3.5). Fire Danger Ratings predict fire behaviour should a fire start, and how hard it will be to put out.

A Total Fire Ban sets legal restrictions on what activities can or cannot occur in a particular district for that day. It aims to reduce the activities that may start a fire. Total Fire Bans are declared by district - there are 9 Total Fire Ban districts across the State of Victoria. A Total Fire Ban can also be declared for the whole state of Victoria.

Each day during the fire danger period, the Bureau of Meteorology forecasts the expected Fire Danger Index for each district considering a range of factors including:

- Temperature
- Relative humidity
- · Wind speed

• Dryness of vegetation and soil (recent rainfall).

Each rating has corresponding actions that people should take depending on the predicted Fire Danger (CFA, 2018)



Fire Danger Rating	Forest Fire Danger Index
Low – Moderate	0 - 11
High	12 – 24
Very High	25 – 49
Severe	50 – 74
Extreme	75 – 99
Code Red	100 +

Figure 3.5. A Fire Danger Rating sign, with corresponding FFDIs.

#### Topography

Topography has a major impact on the speed with which a fire will spread. Bushfires and grassfires will move faster uphill and with greater intensity but generally move slower and with less intensity downhill.



Figure 3.6. The influence of an uphill slope on fire speed

(Source: https://www.cfa.vic.gov.au/plan-prepare/how-fire-behaves)

#### Increased bushfire behaviour

Under *Severe* to *Code Red* Fire Danger Ratings, fire intensity and behaviours are primarily influenced by weather conditions. Under these conditions, bushfires rapidly develop to high intensity. Fire intensity refers to the amount of energy released by a bushfire and is expressed in kilowatts per square metre (kW/m<sup>2</sup>). One kW/m<sup>2</sup> is the amount of energy released by a small bar heater. Out of control bushfires can generate intensities in excess of 100,000 kW/m<sup>2</sup>, whereas planned burns are usually less than 500kW/m<sup>2</sup>.

Bushfires under such conditions can display extreme characteristics, such as:

- Fast spreading; as high winds are normally a factor contributing to severe bushfires, these fires tend to move rapidly through the landscape
- Convection columns; convection refers to the upward movement of hot air, smoke and burning particles (embers) created by a bushfire. This convective process can cause localised winds as the updraft of air sucks air towards the fire and carry embers ahead of the main fire front, causing spot fires to ignite.

- Embers and spotting; spotting is where embers ignite fuel ahead of the main fire front. Extreme fire behaviour results in large amounts of embers being carried up in the convection column creating a dynamic and unpredictable situation on the ground. A high amount of spotting can result in an 'area of fire' rather than a typical fire front. An uphill run can cause embers to be launched from the top of hills in the convection column, starting spot-fires in the landscape ahead.
- Pyrocumulus clouds; as convection columns rise into the atmosphere they also cool. This cooling action can condense any water vapour trapped within the column into clouds above the fire. Although rare, a pyrocumulus cloud can develop into a thunderstorm, that may cause lightning.

#### 3. Bushfire in the landscape

Bushfire movement through the landscape is influenced by a combination of weather, terrain, the fire behaviour itself (convection, spotting distance and intensity), where in the landscape the fire ignites, local fire history and early fire suppression activity. Fires in either grassland or bushland will spread in the direction of the wind where the fire will also burn with the most intensity (known as the head of fire) and spread slowly outwards on the flanks, resulting in an elliptical shape. Spread will also be influenced by topography, which can not only alter the rate of spread but also locally influence wind direction.

Fires at lower intensities will be more impacted by suppression efforts, moisture content in fuels and breaks in vegetation. Fires at higher intensities will be more difficult to suppress and will more easily jump breaks in vegetation by greater flame lengths or through embers starting spot fires.

#### Bushfire and riparian areas

Riparian vegetation runs along rivers, creeks, estuaries, lakes and wetlands and provides a range of important social, environmental, economic and recreational values.

Riparian land poses a lower fire threat to a landholder's property and assets, including to crops, livestock and built assets (such as houses and farm buildings), than the threat posed by other parts of the landscape. Although any significant patch of vegetation situated close to assets may pose a fire threat, under low-to-moderate fire danger conditions, well-managed riparian vegetation is less likely than pasture or crops to contribute to the spread of fire across a property or the wider landscape (DELWP, 2018).

Riparian areas have a limited influence on bushfire spread in the landscape, due to a number of factors. These have been summarised below from the jointly DELWP and CFA commissioned *Riparian Land and Bushfire: Resource Document 2016*:

- Fires will spread more rapidly in cured grass or crops compared with forest (provided there is limited spotting)
- Riparian land occupies a relatively small proportion of the landscape (typically less than 100 metres in width)
- · A fire burning across a narrow forested riparian area will only contribute embers for a short period
- · Trees generally reduce wind speed and can filter embers
- Fuel and soil moisture is higher
- Fires are less likely to start in riparian areas than other parts of the landscape, typically because it is not as prone to lightning strikes, is remote from access for arsonists, has fuel too moist to burn and is sheltered from the wind and sun.
- A common misconception relates to riparian areas acting as a 'wick' or 'fuse'. Fires will generally only burn in the direction of the wind (while spreading more slowly sideways) or slope if burning under light wind conditions (CFA, 2016).

CFA (2016) *Riparian land and bushfire. Resource document* highlights that while vegetated riparian areas can have only a limited influence on bushfire at the landscape scale, extensive areas of vegetation may pose a threat to nearby houses and agriculture. The extent of this threat is largely dependent on the distance between the vegetation and the asset, and the level of preparedness of the asset.

#### Bushfire impact on life and property

Bushfires impact life and property through:

- <u>Direct flame contact</u> when the flames of a fire front make contact with objects (such as vegetation and buildings) causing them to ignite.
- <u>Radiant heat</u> heat generated by a fire. From a distance, and depending on a fire's temperature, radiant heat can "pre-heat" anything directly in its path, such as vegetation or the external walls of a house, causing them to deteriorate and in some cases, catch fire before direct flame contact even occurs. Radiant heat is the biggest cause of death during fires. The best protection from radiant heat is distance or ensuring there is a solid barrier to stop the heat, such as a concrete wall.
- <u>Ember attack and spotting</u> occurs when burning bark, leaves and pieces of debris from the main front of the fire are carried ahead of the fire by wind and land on or around houses. This can start new fires. Ember attack is the most common way houses catch fire during bushfires because embers can travel hundreds of metres ahead of a fire front.
- <u>Convection</u> refers to the energy released by the bushfire. This energy can create fire storms and destructive winds. Property can be directly impacted by convection through strong winds or indirectly through falling trees, increased ember propagation or increased radiant heat.

Research from historical fires shows that the initial risk of houses catching alight is more likely to be from ember attack rather than an advancing flame front (Table 2). Embers cause houses losses by igniting dry fuels gathered in gutters, or around timber door and window frames, under and on timber decking or stairs and through house vents, timber or brush fencing, firewood stockpiles and other dry, fine fuels associated with a dwelling.

	Canberra 2003	Victoria 2009
Embers and some radiant heat from surrounding objects	34%	33%
Embers only	49%	19%
Predominantly radiant heat	5%	5%
Flame contact from bush vegetation	2%	13%
Other	1%	2%
No direct bushfire attack	7%	7%
Unknown	2%	22%

#### Table 2. Bushfire elements that cause house losses from two major south east Australian bushfires (Leonard et al 2009).

Analysis of factors contributing to house losses in the Black Saturday bushfires showed that fuel management within 40 metres of a house made the greatest contribution to risk reduction. Planned burning was most valuable where it had occurred in close proximity to houses (within 500 metres) within the previous 5 years (Gibbons et al, 2012).

It is important to note that in townships, houses become a fuel source and if they catch alight, will emit enormous amounts of radiant heat in their immediate area. In a scenario where a bushfire or grassfire burns into a township area, burning houses will impact on neighbouring houses and will create a fire which burns independently of the bushfire, as was observed in Canberra in 2003 or more recently in California in 2017.



Figure 3.7. How embers impact a house. (Source: https://www.cfa.vic.gov.au/plan-prepare/how-fire-behaves)

#### 4. Risk management

DELWP uses the Australian/New Zealand Standard AS/NZS ISO 31000:2018 Risk Management (Standards Australia and Standards New Zealand), an internationally accepted standard method for analysing risk, for risk assessment under a range of State, National and International guidelines and legislated obligations. Under ISO 31000, risk assessment involves the calculation of the magnitude of potential consequences (levels of impacts) and the likelihood (levels of probability) that these consequences will occur.

Assessments of bushfire risk are therefore considering a number of important relationships:

- The likelihood that a bushfire will ignite and spread
- The likelihood that a bushfire will demonstrate particular behaviours as it moves -the rate of spread, directions of spread, intensity of the fire and height of the fire
- The impact (consequences) that a bushfire may have on values associated with local communities and the landscape in which they reside.

The primary risk management objectives for fire management agencies are: to minimise or decrease the likelihood of severe bushfires occurring where they will cause unacceptable consequences; and to minimise the consequences to important community values in the event that bushfires do occur.

Given that people (firefighters, partner agencies and communities) can't influence weather or topography, the primary method to decrease the likelihood and/or consequences of bushfires is to alter the fuel within the landscape, by changing the presence and/or amount of flammable vegetation.

Although it is theoretically possible to prevent all loss by bushfire through the total removal of bushfire fuels across the landscape, such a measure is not possible in practical terms and is unacceptable to the community. A balance must be struck between measures taken to reduce or avoid loss due to bushfire and the protection of other values.

If bushfires were to be completely prevented in the landscape, significant negative impacts to ecological condition are likely to occur, as well as impacts to ecosystem services and the elements of our community's wellbeing that are dependent on these services. However, fire of inappropriate frequency and/or intensity can cause damage to natural ecosystems. Inappropriate fire regimes are a threat to biodiversity, water

catchments, air quality and landscape values. Both too much and too little fire can do damage to ecosystems.

#### 5. Factors that influence bushfire risk

There are different factors which contribute to bushfire risk before, during, and after a potential bushfire event. So far, the factors which influence bushfire behaviour have been discussed. However, there are other factors which influence the likelihood that a bushfire will ignite and spread and impact on community values.

#### Ignition likelihood

Bushfires tend to be ignited by either lightning or human causes. Historically, human ignitions have accounted for most bushfires. Accidental and deliberate ignitions from people contributed to 51% of bushfires between 2004-2014 (DELWP, 2015). The risk of ignitions increases around populated areas and when members of the public are unaware about the dangers of using fire or certain types of equipment during periods where there is a heightened bushfire risk. Risk is reduced through the use of fire restrictions and education campaigns.

#### Preparation of private property

Preparation of private property and building to construction standard for bushfire prone areas (AS3959) can play a significant role in the risk to individual houses.

- Bushfires are fuelled by and spread through vegetation, therefore the closer vegetation is located to a house the more likely it is to influence the risk of losing a house during a bushfire.
- Private landholders are responsible for preparing their properties.
- The constructions standard of a building also has a significant role in the determining the resilience of a building to elements of a bushfire, such as embers or radiant heat.

Further information on how to prepare your property can be found at:

https://www.cfa.vic.gov.au/documents/20143/71585/Your-Guide-to-Property-Preparation\_WEB.pdf/a0cfdac9-99ca-48e6-d36f-b3a5ef9c6a9c



#### Figure 3. 8. Preparing properties

(Source: https://www.cfa.vic.gov.au/documents/20143/69511/CFA-BMO-Defendable-space-Aug-14.pdf/)

Bushfire planning provisions can be viewed at Clauses 13.05, 44.06 & 52.47 of the Victoria Planning Provisions. More information on how to interpret these requirements, can be found on the DELWP website, including the *Technical Guideline – Planning Permit Applications Bushfire Management Overlay September 2017.* 

- CFA recommends to private landholders that the safest way to avoid death or injury during a bushfire is to be well away from the threat.
- If a landholder and their property are well prepared (including having two able bodied adults available for active defence) and the conditions are not too dangerous, the risks of a property being impacted or destroyed by bushfire are significantly reduced. However, if a landholder is underprepared, or changes

their mind at the last minute and tries to evacuate, the risk of loss of life and property significantly increases.

- Human behaviour, especially choices made on the spur of the moment, are difficult to predict. It is also difficult to measure how physically and mentally well prepared an individual is to defend their property, and whether they will definitely stay even if they are prepared.
- Preparation must include physical preparation (removal of fuel sources and removing structural weaknesses to ember attack) and psychological preparation, including having a realistic understanding of the extreme stresses and challenges of bushfires and personal vulnerability to these stresses.

#### **Response and suppression**

- Rapid response and suppression of fires before they reach a size and intensity which makes them difficult to control an important strategy in managing bushfire risk (Section 3 of the YCA Bushfire Risk Management Plan). Response and suppression can be influenced by:
- · The availability of resources
- The location of the fire (how near or far away it is)
- The accessibility to the fire (if crews cannot gain access to a fire it will spread more rapidly)
- The condition and accessibility of water points, such as water tanks, hydrants and dams (if water points are not maintained suppression crews will find it difficult to refill appliances)
- · Decisions made during suppression efforts.
- Risk assessment using PHOENIX RapidFire (refer;<u>https://engage.vic.gov.au/yellingboconservationarea</u>) is limited in how it can measure risk when it comes to response and suppression. The benefits of first attack are measurable, such as calculating the effectiveness of the immediate response of a certain number of vehicles and aircraft. However, it is not possible to measure variables that may hinder first attack, such as the condition of roads or the location of water points relative to the location of the fire. It is also not possible to account for decisions made during suppression efforts.
- The local knowledge of DELWP and CFA members, however, points to the need to consider the variables mentioned, even if they cannot be measured.

#### Knowledge, preparedness, warnings and evacuation

- If communities are underprepared for the event of a bushfire, they are more likely to suffer loss of life and property as a result. The best way to influence human behaviour during a bushfire is to educate community members well in advance about how to prepare their properties, develop a bushfire plan, understand warnings, and know when to evacuate. Tourists and visitors can increase risk as they have no knowledge of fires or the local area, they are generally the least prepared and make uninformed decisions
- Significant research in the last decade has shown that the primary causes of death and/or injury from bushfire have been from leaving too late and/or inadequate preparation of properties.
- As noted above, it is difficult to measure how physically and mentally well prepared an individual or community is to make good decisions to prepare for and respond to a bushfire threat.

#### **Recovery and rehabilitation**

After a bushfire has occurred, the impacts from the fire can vary in severity depending on how well they are managed. Impacts can be mitigated by a properly managed recovery and rehabilitation effort, including preplanning certain steps and priority actions if a bushfire occurs.

## References

Ahern A. and Chladill M. (1999) How far do bushfire penetrate urban areas? In

Proceedings of the 1999 Australian Disaster Conference, pp. 21-26, Emergency

Management of Australia, Canberra.

Cheal D. (2010) *Growth stages and tolerable fire intervals for Victoria's native vegetation data sets. Fire and adaptive management report no. 84*. Department of Sustainability and Environment, East Melbourne, Victoria, Australia

Chen K. and McAneney J. (2010) *Bushfire penetration into urban areas in Australia: A spatial analysis.* Prepared for the bushfire CRC by Risk Frontiers, Macquarie University. Report CRC.304.001.

Country Fire Authority (2018). <u>https://www.cfa.vic.gov.au/plan-prepare/how-fire-behaves</u>, accessed March 2018

Country Fire Authority (2018). <u>https://www.cfa.vic.gov.au/warnings-restrictions/bans-and-rating-faqs#Declared</u> accessed July 2018

CFA (2011) Landscaping for bushfire: Garden design and plant selection, Country Fire Authority, East Burwood, Victoria

CFA (2018) *Glossary of terms*. <u>https://www.cfa.vic.gov.au/plan-prepare/glossary-of-terms</u>, accessed March 2018

CFA (2016) *Riparian land and bushfire. Resource document. Version 2.* Report prepared by obliqua pty ltd for the Country Fire Authority and Department of Environment, Land, Water and Planning. CFA, East Burwood, Victoria

#### https://www.cfa.vic.gov.au/about/guides

CFA (2016) *Riparian land and bushfire. Resource document. Supporting information.* Report prepared by obliqua pty ltd for the Country Fire Authority and Department of Environment, Land, Water and Planning. CFA, East Burwood, Victoria

CFA (2017) CFA Plan 2017-18. Country Fire Authority, Burwood East, Victoria. 17pp.

https://www.cfa.vic.gov.au/about/our-plan

CFA (2014) *Defendable space (Bushfire Management Overlay)*. Country Fire Authority, Burwood East, Victoria. <u>https://www.cfa.vic.gov.au/documents/20143/69511/CFA-BMO-Defendable-space-Aug-14.pdf/</u>

DELWP (2018), <u>https://www.water.vic.gov.au/waterways-and-catchments/riparian-land/riparian-reports-tools-and-guidelines</u>, accessed March 2018

DELWP (2015) *East Central strategic bushfire management plan.* Department of Environment, Land, Water and Planning, Melbourne, Victoria

DELWP (2017), *Bushfire Management Overlay Information for landowners*. Department of Environment, Land, Water and Planning, Melbourne, Victoria

DELWP (2018) Licensing principles for fencing and grazing within the Yellingbo Conservation Area.

DELWP (2016) *Managing grazing on riparian land: Decision support tool and guidelines.* Department of Environment, Land, Water and Planning, Melbourne, Victoria

DELWP (2015) *The Monitoring, Evaluation and Reporting Framework for Bushfire Management on Public Land*. Department of Environment, Land, Water and Planning

DEPI (2010) Overall fuel hazard assessment guide. Department of Environment and Primary Industries

DSE (2012) *Code of Practice for Bushfire Management on Public Land*. Department of Sustainability and Environment, Melbourne, Victoria

DSE (2012) *Model of Fire Cover Review 2012* The State of Victoria Department of Sustainability and Environment, Melbourne, Victoria

DSE (2004) EVC/Bioregion Benchmark for vegetation quality assessment: Highlands -Southern Fall Bioregion. Victorian Government Department of Sustainability and Environment, Melbourne, Victoria

38 Yellingbo Conservation Area Bushfire Risk Management Plan August 2018 Gibbons P., van Bommel L., Gill A.M., Cary G.J., Driscoll D.A., Bradstock R.A., Knight E., Moritz M.A., Stephens S.L., and Lindenmayer D.B. (2012) *Land management practices associated with house loss in wildfires.* OloS ONE 7(1)e29212. doi:10.1371/journal.pone.0029212

Hines F., Tolhurst K., Wilson A. and McCarthy G. (2010) *Overall fuel hazard assessment guide*. 4<sup>th</sup> Edition, Fire and adaptive management, report no. 82. The State of Victoria Department of Environment and Primary Industries, Melbourne, Victoria

Leonard, J., Blanchi, R., Leicester, R., Lipkin, F., Newnham, G., Siggins, A., Opie, K., Culvenor, B., Cechet, B., Corby, N., Thomas, C., Habili, N., Jakab, M., Coghlan, R., Lorenzin, G., Campbell, D. & Barwick, M, 2009,.'*Building and Land use planning research after the 7th February 2009 Victorian bushfires. Preliminary findings*'. [Online]. Melbourne: Interim report USP2008/018 - CAF122-2-12. Available from: http://www.bushfirecrc.com/managed/resource/bushfire-crc-victorian-fires-research-taskforce-final-report.pdf

Leonard J. (2006) *Building performance in Bushfires.* Report to the Victorian Bushfires Royal Commission. Report TEN.066.001.0003.

Standards Australia and Standards New Zealand (2009) *AS 3959:2009 Construction of buildings in bushfire prone areas.* <u>http://infostore.saiglobal.com/store/details.aspx?ProductID=1101539</u>

Victorian Environmental Assessment Council (2013) *Yellingbo Investigation Final Report.* The State of Victoria, Victorian Environmental Assessment Council, East Melbourne, Victoria

Victorian Government (2015) Safer together: A new approach to reducing the risk of bushfire in Victoria. The Victorian Government, Melbourne, Victoria

https://www.safertogether.vic.gov.au/

Victorian Government (2014) Victorian Government Response to Victorian Environmental Assessment Council's Yellingbo Investigation Final Feport. Department of Environment and Primary Industries, Melbourne, Victoria

Victorian Government (2008) *Living with fire. Victoria's Bushfire Strategy.* Victorian Government, Melbourne, Victoria. Accessed March 2018 through

https://web.archive.org/web/20091026220110/http://www.dse.vic.gov.au/DSE/nrenfoe.nsf/childdocs/-44688EB30B57BF124A2567CB000DB2EF-41DBDCBD209E6B32CA25751C000FAB2F?open This page is intentionally blank

#### delwp.vic.gov.au