VAGO
Victorian Auditor-General's Office

Reducing Bushfire Risks

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Independent assurance report to Parliament
2020–21: 4

Reducing Bushfire Risks

The Hon Nazih Elasmar MLC
President
Legislative Council
Parliament House
Melbourne

The Hon Colin Brooks MP
Speaker
Legislative Assembly
Parliament House
Melbourne

Dear Presiding Officers

Under the provisions of the *Audit Act 1994*, I transmit my report *Reducing Bushfire Risks.*

Yours faithfully

Andrew Greaves
Auditor-General

14 October 2020

The Victorian Auditor-General's Office acknowledges Australian Aboriginal peoples as the traditional custodians of the land throughout Victoria. We pay our respect to all Aboriginal communities, their continuing culture and to Elders past, present and emerging.

Contents

Audit snapshot

Are responsible agencies effectively working together to reduce Victoria's bushfire risk?

Why this audit is important

As the devastating 2019–20 bushfire season showed, all Victorians are at risk from bushfires.

The consequences include the loss of lives, homes, businesses and community infrastructure.

Other adverse consequences can include the negative health impacts from smoke exposure, financial hardship and harm to mental health. Victoria's bushfires also damage the state's natural environment and can reduce its biodiversity.

Almost all scientists agree that climate change increases the likelihood of weather extremes, which will influence the frequency and severity of bushfires.

It is important that our strategies to reduce and manage bushfire risks are well-designed, efficiently deployed and continuously monitored and improved.

Who we examined

- Department of Environment, Land, Water and Planning (DELWP)
- Parks Victoria
- Country Fire Authority (CFA)
- Emergency Management Victoria
- City of Whittlesea
- East Gippsland Shire Council
- Murrindindi Shire Council
- Energy Safe Victoria.

What we examined

To answer our audit objective we examined:

- how DELWP informed the government's planned burn target and developed its risk-reduction strategies to protect human life, property and the environment
- how agencies deliver risk-reduction strategies
- how Victoria's land-use planning system supports risk reduction
- the Powerline Bushfire Safety Program.

We did not examine frontline bushfire response or emergency management.

What we concluded

The audited agencies, particularly DELWP and CFA, are collaborating to reduce the risks that bushfires pose to life, property and the environment, and do so with strong commitment.

However, there is insufficient information available to understand the effectiveness and impacts of their risk-reduction activities.

Current modelling limitations and lack of reporting on non-burn and private land-based risk-reduction activities:

- inhibits continuous improvement
- limits community understanding of performance in reducing risk
- constrains DELWP and government's ability to make better informed investment decisions to further reduce risk.

Reducing risk across the state also requires a stronger focus on, and allocation of resources to, treating private land, to complement that applied to public land.

What we found and recommend

We consulted with the audited agencies and considered their views when reaching our conclusions. The agencies' full responses are in Appendix A.

Victoria is one of the most bushfire-prone areas in the world. The state's extreme weather events are becoming more frequent and intense, which is leading to more severe bushfires that burn more land. The recent 2019–20 bushfire season had a devastating impact on human life, wildlife, flora and infrastructure, and adversely affected Victoria's economy.

It is not possible to eliminate the threat of bushfires. However, the government plays a key role in reducing the risks they pose to people, property and the environment.

Fuel management forms a major part of the Department of Environment, Land, Water and Planning's (DELWP) bushfire risk management strategy. Fuel management reduces the intensity of fires and makes them easier for firefighters to control. Fuel management treatments include planned burning, where agencies such as DELWP and the Country Fire Authority (CFA) set controlled fires at times of the year when bushfire risk is low; and non-burn treatments, such as grass slashing and using herbicides.

DELWP has also developed land-use planning controls to reduce bushfire risk. These controls restrict people from building in high-risk areas and set safety standards for buildings and properties.

Since 2011, the government has also aimed to reduce the risk of powerlines starting bushfires through its Powerline Bushfire Safety Program (PBSP). This program stemmed from the 2009 Victorian Bushfires Royal Commission's (Victorian Royal Commission) recommendations.

In 2015, the government released its *Safer Together: A new approach to reducing the risk of bushfire in Victoria* (Safer Together) policy in response to the Victorian Royal Commission and a 2015 Inspector-General for Emergency Management (IGEM) report. Safer Together aims to bring responsible agencies together to improve bushfire preparedness and reduce risks across private and public land.

On 1 July 2020, Fire Rescue Victoria (FRV) was established to bring career firefighters from the Metropolitan Fire Brigade and CFA together. FRV will play a key role in supporting CFA and DELWP to manage bushfire risk.

DELWP and other agencies involved in Safer Together aim to reduce the state's bushfire risk to or below 70 per cent of what it would be without risk-reduction treatments. They refer to this as the statewide residual risk target. DELWP also has a Budget Paper 3 (BP3) measure, 'to reduce statewide residual risk to 70 per cent or less'. DELWP calculates bushfire risk by modelling the number of houses that would be destroyed in extreme fire conditions and uses this also as a proxy for modelling the risk to human life.

Findings

Measuring DELWP's performance in reducing bushfire risk

Victoria's current residual risk level meets the government's target.

However, reporting against DELWP's BP3 measure to reduce statewide residual risk to 70 per cent or less does not give government agencies, government or the public a complete understanding of the impact of DELWP's fuel management activities on public land. This is because:

- DELWP's non-burn treatments are excluded from this reporting
- the reported result reflects the combined impact of DELWP's planned burn activities together with fuel reduction caused by bushfires, which is not attributable to DELWP.

The reported result is also generated from a computer modelling tool. This means that some limitations are present that may affect the result, such as the parameters used in the modelling and the currency of underlying datasets.

DELWP has only recently undertaken work to enable it to distinguish the effect of its planned burns from the effect of bushfire. DELWP agrees that its future reporting should include information about the differential contribution of its fuel management strategies, compared to bushfires, to achieving its BP3 target and other risk-reduction outcomes.

The government's Safer Together policy commits to holistically measuring the impact of burn and non-burn risk treatments across public and private land by the end of 2020. DELWP and its partner agencies are not on track to meet this commitment.

While DELWP has some projects underway to work towards this, it has now been five years since IGEM first recommended this approach. DELWP advised us that it will develop the capability to measure the impact of both burn and non-burn treatments by late 2021.

Limitations of Phoenix RapidFire and its inputs

DELWP used Phoenix RapidFire, which is the primary modelling tool used by all eastern Australian fire agencies, to advise government on the target for the statewide residual bushfire risk measure. DELWP also uses Phoenix RapidFire to calculate its performance against its BP3 target. While there is no perfect tool to model bushfire risk, Phoenix RapidFire has several limitations that impact the residual risk target and DELWP's performance reporting against it.

DELWP's use of Phoenix RapidFire has been reviewed and endorsed by independent experts. However, some of the datasets and models that inform the tool's simulations have limitations including examples where data should be more up-to-date, and where models would benefit from academic validation and peer review.

For example, DELWP completes limited fuel hazard assessments after planned burns and bushfires. This reduces its ability to validate how quickly fuel re-accumulates to hazardous levels and incorporate this information in its modelling. DELWP's modelling also relies on a range of assumptions that likely impact the results, including the application of a single extreme fire scenario.

Fuel hazard assessments determine how the structure of different vegetation types change after they are burned. These assessments can range from simple and rapid visual assessments to highly detailed measurements.

Extreme fire conditions are associated with the majority of historical fire-related deaths and modelling them is consistent with the 2012 *Code of Practice for Bushfire Management on Public Land* (the Code), which requires DELWP to give priority to human life. However, research shows that as fire intensity increases, the broad effects of planned burning decreases.

It is likely that planned burns contribute to risk reduction most in lower intensity fires and to a lesser degree in high-intensity fires. Additionally, DELWP has not systematically or comprehensively verified the effectiveness of Phoenix RapidFire's predictions against real fire events.

DELWP has publicly acknowledged the limitations of its risk modelling and has a range of projects underway to address many of these issues. It has also committed to exploring alternative modelling tools in the future. Given how central Phoenix RapidFire is to understanding bushfire risk and assessing DELWP's performance in addressing it, continuous improvement of the tool warrants significant investment of effort.

Determining the statewide residual risk target

DELWP modelled seven different scenarios in Phoenix RapidFire to inform its recommendation to government about adopting the 70 per cent residual risk target. It compared these scenarios against a hypothetical scenario where all vegetation across Victoria has grown to its maximum risk level, which represents a risk level of 100 per cent.

Some of the seven scenarios maximised the number of hectares treated, while others maximised risk reduction, which was measured by the number of houses that planned burning would save during the modelled bushfire. These scenarios also considered constraints such as DELWP's existing resourcing levels, as well as operational feasibility and different ecosystems' tolerance to fire.

Scenarios that prioritised risk reduction outperformed those that prioritised hectares burned. Four of the risk-based scenarios intersected at a point that indicated that DELWP could achieve a 30 per cent reduction in risk across the state by investing $50 million per year, which was DELWP's 2015 funding level for planned burn activity. These scenarios also matched good operational feasibility scores, indicating that DELWP would need to treat between 200 000 to 275 000 hectares each year to achieve the modelled risk reduction.

DELWP used this modelling to recommend 70 per cent residual risk as the target to government. However, DELWP's advice to government could have been more complete. It did not communicate that the modelling showed that with further investment, greater risk reduction could be achieved. Its advice also did not explain the limitations of the modelling tool and what level of risk reduction could be achieved with only one year of funding, as the modelling tool shows cumulative results achieved over many years.

Regional risk targets

In 2016, DELWP set risk targets for its regions that, if achieved, contribute to meeting the 70 per cent statewide target.

DELWP bases its regional targets on:

- the level of bushfire risk within each region based on its modelling
- each region's ability to deliver planned burns (some areas have less land that can be burned).

DELWP's approach to setting the regional targets did not consider some of the key factors that determine a region's risk level, such as how often they experience high-risk weather conditions, common ignition types and their current fuel loads.

Additionally, these targets are static. While DELWP altered them in June 2019 to reflect administrative changes to regional boundaries, it has not reconsidered the targets based on changes to its regions' risk levels since 2016.

DELWP advised that the targets are intended to be long-term, noting that regional bushfire risk levels are relatively stable because many of the contributing factors, such as population, fuel type and general climate, change gradually. However, fuel loads can change more quickly, resulting in significant changes to the risk profile in a particular region, which may mean the risk target warrants periodic reconsideration.

Planning to address risk

DELWP and CFA document their planned fuel management activities in their three-year joint fuel management plan. This demonstrates an improvement in inter-agency engagement and planning, which is consistent with Safer Together's aim to manage bushfire risk across public and private land.

However, DELWP has far greater resources and sophistication in the tools available to it to assess risk on public land, compared to the tools and resources available to CFA and councils to assess risk on private land. In addition, DELWP also uses inconsistent approaches across its regions to identify potential areas for future treatment on private land.

The comparative lack of focus on risks present on private land is evident in the joint fuel management plan. This is seen in the comparatively limited number of planned treatments on private land compared with public land. This creates a gap in understanding risk across the state, and may mean that risk-reduction efforts are not always directed to the areas of highest need.

Safer Together notes that 'no single strategy or action alone can manage bushfire risk. We must develop a multifaceted approach, using all the activities available to us'. However, DELWP's current statewide strategic planning focuses on planned burning and to a far lesser extent on non-burn treatments to reduce bushfire risk.

In the absence of a holistic approach, options may be missed that could reduce bushfire risk in areas, or at times, where planned burning is more difficult or not possible. As bushfire seasons extend and windows for planned burning reduce, there is a greater need to strategically plan alternate fuel-reduction methods.

DELWP and CFA also do not consider the cost-effectiveness of fuel management treatments and other risk-reduction activities in their strategic planning, largely due to a lack of data collection to enable this. By not using cost as an input in its decision-making, agencies may not be optimising their resources.

Fuel management

Completing planned burns

In line with its risk-based approach, DELWP identifies, and then aims to prioritise, the planned burns that have the greatest potential for risk reduction.

DELWP advised that priority burns are normally in areas close to assets and communities and are therefore harder to deliver. In 2019–20, DELWP delivered 60 priority burns (43 per cent of the planned priority burns) and 98 normal-ranked burns (30 per cent of planned normal priority burns).

DELWP has noted that the lengthening bushfire season is limiting its ability to complete planned burns. However, DELWP does not formally record the reasons why it is unable to complete specific planned burns. This prevented us from examining the extent to which weather or other factors, such as resourcing, affect if DELWP completes its planned burn program.

Impact of planned burns on public land

DELWP reports that it is currently meeting its BP3 target to reduce Victoria's statewide risk level to 70 per cent by conducting planned burns on public land. DELWP's current reporting does not differentiate between the impact of its planned burns and fuel reduction caused by bushfires.

Over the last four years, DELWP has annually treated an average of 86 744 hectares through planned burning. However, DELWP's modelling when advising on the residual risk target, indicated that to achieve the 70 per cent target, while balancing its ecological and operational requirements, it would need to treat approximately 200 000 to 275 000 hectares per year. This indicates that other factors, such as bushfire, contribute to meeting the target.

In June 2020, DELWP released new analysis that shows the relative contributions of planned burning and bushfires to risk reduction. This analysis indicates that over 11 years, from July 2009 to May 2020, planned burns accounted for an average of 66 per cent of each year's risk reduction compared to 34 per cent caused by bushfires.

The University of Melbourne reviewed and endorsed the method that DELWP used to calculate this. They noted that as the locations of planned burns are influenced by the modelling results from Phoenix RapidFire, it is unsurprising that the modelling finds the impact of planned burning is strong over time. The review suggested that DELWP would need to examine periods prior to the use of Phoenix RapidFire to determine the extent to which the model itself influences the final results. As DELWP plans to use this approach for future reporting, it would be valuable for DELWP to undertake this additional analysis to quantify any limitations.

DELWP reporting does not clearly demonstrate the impact of its planned burn program on ecosystem resilience.

DELWP reports on the number of hectares with vegetation below tolerable fire intervals (TFI) that it applies planned burning to. This gives the public some insight into this practice, which DELWP aims to minimise. DELWP also publicly reports the number of ecosystem resilience assessments it conducts in each region. However, it does not report the results or outcomes that these assessments demonstrate. It also reports on the mix of TFIs and growth stage structure (GSS) of vegetation across the

Ecosystem resilience is an ecosystem's capacity to survive natural disturbances, such as bushfires, and land management activity, such as planned burns, while retaining its basic structure, function and identity.

TFI is the minimum time between burns that species require to mature and set seed. It also measures the maximum amount of time a fire-dependent species can survive without fire.

An area's **GSS** is its mix of vegetation ages from juvenile to old. An area's growth stage structure depends on when it was last burned or disturbed and vegetation types.

state but does not compare this with the set thresholds that show desired states. This makes it difficult to understand whether the reported mix of vegetation represents a high or low level of ecosystem resilience. These metrics, like that for residual risk, also combine the effects of planned burning and bushfire.

Despite having committed to doing so, DELWP also does not publicly report on geometric mean abundance (GMA), which is an indicator of ecosystem resilience. DELWP advised that it has recently developed additional tools within its Fire Analysis Module for Ecological Values (FAME), that will enable it to report on GMA and better understand the specific effects of its activities on ecological values.

Fuel reduction on private land

Private land makes up 60 per cent of land in Victoria. Private land is generally cleared for cropping and grazing or building development, and therefore does not pose as high a risk as the types and volume of fuel loads present on public land. However, CFA's and councils' ability to assess and plan to address risk on private land is limited because of: the less sophisticated risk assessment approaches they use and have available to them; gaps in staff skill in this area; limited available resources; and, for CFA, its reliance on a largely volunteer workforce.

Councils contribute to fuel reduction by issuing fire prevention notices to private property owners and slashing vegetation. However, councils only assess the effectiveness of their interventions at the individual property level.

CFA does not monitor, evaluate or report on the effectiveness of its fuel reduction treatments and is not able to determine the impact its activities have on risk levels.

Monitoring and evaluation

The Code requires DELWP to prepare a framework for monitoring, evaluating and reporting on its bushfire management program. The framework must include objectives that link with the Code's objectives, key performance indicators and accountabilities. The Code also requires DELWP to report against its risk-reduction activities annually, its risk-reduction strategy every five years and its objectives every 10 years.

DELWP's 2015 *Monitoring, Evaluation and Reporting Framework for Bushfire Management on Public Land* (MER Framework) responds to the Code's requirements. This framework states that development of a performance management framework and regional monitoring, evaluation and reporting plans (MER plan) will support it as well as evaluation reporting every five years.

DELWP's regions have completed their own individual MER plans and are currently updating them. These plans are detailed documents that outline multiple research activities and performance metrics. Through this approach, DELWP is investing in a range of research projects in partnership with various academic institutes. These endeavours will increase knowledge about the impact of planned burns and ecosystem resilience to this activity.

However, DELWP did not develop the performance management framework outlined in the MER Framework or the outcome and output measures. Where set, measures in its regions' MER plans are also inconsistent.

While some bespoke measures are needed to account for the different landscapes and habitats across different regions, the lack of consistent measures prevents DELWP

from developing a consolidated picture of performance and from comparing performance across different regions.

As previously noted, the current statewide measures for planned burning on residual risk and ecosystem resilience do not provide DELWP or other users with sufficient information about DELWP's performance. DELWP's regional MER plans describe operational level output, activity and impact reporting as the foundation of the MER Framework and its ability to report against the objectives of the Code. Therefore, without all necessary data, collected in a consistent way, it is unclear how DELWP will report at an outcomes level in its first evaluation report due in 2020–21.

Land-use planning

Strengthening the planning system

In 2017, the government changed the Victoria Planning Provisions to improve and expand strategies for planners to better identify, assess and manage bushfire hazards. Prior to this, DELWP mapped Victoria's high-bushfire-risk areas into two categories— bushfire prone areas (BPA), which cover most of regional Victoria, and bushfire management overlays (BMO), which cover the highest risk areas.

When building in areas with a BMO, landowners must apply for a planning permit in addition to a building permit. The government introduced these requirements to ensure that bushfire protection measures are in place for new buildings and extensions in high-risk areas. These changes have resulted in a consistent statewide approach to managing bushfire risk through the land-use planning system.

However, planning and building controls, such as BPA and BMO requirements, only apply to new developments or extensions to existing properties (noting that if the extension is over 50 per cent of a building's volume, then the rest of the existing building must also be upgraded to meet the current requirements). Properties that predate contemporary bushfire planning and building standards do not benefit from the updated controls designed to reduce bushfire risk.

Identifying high-bushfire-risk areas

DELWP's BPA and BMO maps now provide a consistent way for councils to assess bushfire risk and inform land-use planning decisions. DELWP bases BPA and BMO mapping on how close an area is to continuous vegetation and the density of that vegetation.

DELWP developed its BPA and BMO hazard mapping criteria based on Australian Standard 3959:2009 vegetation types, stakeholder consultation and scientific reports. These criteria include a buffer to capture properties in proximity to areas of continuous vegetation that may be at risk from ember attack. In 2012, the ember protection buffer was increased in response to recommendations from the Victorian Royal Commission and expert advice.

Implementing planning controls in high-bushfire-risk areas

While audited councils have enforcement powers in relation to building standards, including those related to BPA, they do not enforce BMO planning requirements, such as maintaining a break between vegetation and buildings and access for fire trucks and water supplies. Additionally, not all audited councils routinely complete compliance reviews of planning permit conditions. This means that councils do not know if property owners are continuing to meet the conditions of their permits.

If councils do not implement and monitor these planning controls to ensure compliance, then the controls may not be effective at reducing bushfire risks.

The impact of planning controls on reducing bushfire risk

DELWP does not monitor, evaluate or report on how effective planning and building controls are at reducing bushfire risks. As a result, it is unclear how the 2017 changes to Victoria's planning provisions have impacted the state's bushfire risk level.

Powerline Bushfire Safety Program

Powerline faults have caused many of Victoria's major bushfires. In response to the Victorian Royal Commission's recommendations, the government announced the PBSP in 2011, which is a $750 million program of electrical safety upgrades to reduce the risk of powerlines igniting bushfires. In this audit we focused on two of the largest projects under this program—the Network Assets Project (NAP) and the Powerline Replacement Fund (PRF).

Selecting protection devices

DELWP selected two types of protection devices to make powerlines safer—rapid earth fault current limiters (REFCL) and automatic circuit reclosers (ACR). It based this selection on comprehensive research by the 2011 Powerline Bushfire Safety Taskforce (the Taskforce), which was established by Energy Safe Victoria (ESV), and technology trials by external experts.

Identifying risks and selecting treatment areas

While delivering the PBSP, DELWP has targeted areas where powerlines are more likely to start bushfires with severe consequences, such as the Dandenong Ranges. DELWP appropriately prioritised areas to achieve the greatest benefit with the available funding.

Network Assets Project delivery

The NAP, which electricity distribution businesses are delivering under DELWP and ESV's supervision, will exceed its estimated cost by almost $250 million. This cost is associated with challenges that distribution businesses have had installing the new REFCL technology. Victorian electricity customers will cover the project's costs through their electricity bills.

Electricity distribution businesses are making good progress against the ambitious legislative time frames for this project, which require them to install REFCLs that meet minimum performance standards to 45 zone substations by 30 April 2023. However, these businesses anticipate that there may be delays in areas where high-voltage customers have not completed the upgrades needed to make their equipment REFCL ready.

When the project is completed in April 2023, REFCL technology is expected to reduce the risk of powerlines starting bushfires by 33.7 per cent across the state compared with the modelled risk in 2015.

Powerline Replacement Fund delivery

DELWP used the $200 million PRF to either insulate or bury 536.4 kilometres (41 per cent) of the high-voltage bare-wire powerlines in 11 of Victoria's 33 highest

risk areas. DELWP completed this project in March 2020, ahead of its January 2021 deadline and at a cost of $188 million.

The PRF has reduced the likelihood of treated powerlines starting bushfires by 98 to 99 per cent. On completion of the NAP on 30 April 2023, all high-voltage powerlines in the 33 highest risk areas will also benefit from REFCL protection, reducing the risk level by 58.6 per cent in these areas.

In 2016, the government introduced legislation that requires electricity distribution businesses to replace high-voltage bare-wire powerlines in the remaining 22 highest risk areas. Based on their current replacement rate, DELWP and ESV estimate that this will take approximately 30 to 50 years to complete, which they consider too slow to reduce the remaining risk. When this work is finished, DELWP's risk modelling indicates that Victoria's statewide risk level from all PBSP initiatives will have been reduced by 57.3 per cent since the beginning of the program.

Monitoring and evaluating the PBSP's outcomes

DELWP and ESV have established effective governance arrangements over the PBSP, including monitoring and an evaluation framework. DELWP plans to evaluate the risk-reduction benefits and outcomes for individual PBSP projects by the end of 2020. While DELWP has comprehensive internal reporting, its public reporting on the program's cost, activities and outcomes has been limited. During our audit, in August 2020, DELWP released the *Powerline Bushfire Safety Program Report*, its first public report detailing progress from 2012–19.

Recommendations about fuel management—measurement

We recommend that:		Response
Department of Environment, Land, Water and Planning	1. in partnership with Country Fire Authority and Fire Rescue Victoria develops, implements and publicly reports on a holistic suite of performance metrics to demonstrate: • the impact that planned burning has on public and private land on bushfire risk • the impact that planned burning has on public and private land on ecosystem resilience • the impact that non-burn fuel management activities have on public and private land on bushfire risk • the impact that its activities at local and regional levels have on bushfire risk • the cost-effectiveness of its fuel management activities on public and private land (see Section 2.2)	**Accepted**
	2. enhances bushfire modelling by: • exploring multiple bushfire modelling tools to lower the uncertainty and limitations associated with using a single modelling tool • applying more detailed fire-severity data • validating and updating fuel accumulation curves • establishing and regularly updating an archive of well-documented fire events and using this to systematically test it against a broad range of burning and fuel conditions • establishing and implementing processes to routinely review and update its underlying datasets (see Section 2.2).	**Accepted**

Recommendations about fuel management—planning

We recommend that:			Response
Department of Environment, Land, Water and Planning	3.	develops more holistic bushfire-management planning that focuses on the best mix of risk treatments rather than planned burning alone (see Section 2.3)	**Accepted**
	4.	determines which elements of different regional planning approaches are the most effective and implements these across the state (see Section 2.4)	**Accepted**
	5.	improves the effectiveness, consistency and transparency of its environmental and cultural values checks by: • finalising its review of operational values checking processes and committing to an implementation plan • clarifying and formalising principles and procedures, making them publicly available where possible • improving capability and capacity among staff responsible for carrying out values checks, for example through training • developing a long-term program of work and investment to improve the quality, consistency and comprehensiveness of underlying datasets • increasing alignment in regard to values checks between agencies carrying out fuel management (see Section 2.4)	**Accepted**
	6.	increases its collaboration with Victorian Traditional Owner groups to facilitate the reintroduction of cultural burning and ensure effective support for these practices across all of its regions (see Section 2.6).	**Accepted**
Country Fire Authority (in consultation with Fire Rescue Victoria)	7.	improves planning on private land to ensure risk assessments and plans are conducted consistently across public and private land to address statewide bushfire risk based on where and how they can most effectively reduce risk (see Section 2.5)	**Accepted**
	8.	improves its values checks by providing ongoing statewide support to regional vegetation management officers and leveraging any relevant systems or capabilities from DELWP to conduct values checks through guidance, training and ongoing funding (see Section 2.4).	**Accepted**

Recommendations about fuel management—delivery

We recommend that:			Response
Department of Environment, Land, Water and Planning Country Fire Authority (in consultation with Fire Rescue Victoria)	9.	systemically documents and publicly reports reasons why it does not complete planned burns (see Section 3.2)	**Accepted**
	10.	develops financial reporting to monitor fuel management costs and estimate future costs (see Sections 2.4, 3.2 and 3.3).	**Accepted**

Recommendations about fuel management—monitoring, evaluation and reporting

We recommend that:		Response
Department of Environment, Land, Water and Planning	11. reviews its target for the number of fuel hazard assessments conducted and ensures that this measure is evidence based, accurately reflects regional performance, and that the department monitors and reports on each regions' performance against it (see Section 3.5)	**Accepted**
	12. conducts more effective ecosystem resilience monitoring by: • setting a target for regions on the quantity of ecosystem resilience monitoring assessments that they should complete annually • setting an outcomes-level target that defines desirable values for key ecosystem resilience metrics • reporting publicly against all of the metrics in its *Measuring Ecosystem Resilience in Strategic Bushfire Management Planning* policy in its fuel management reports (see Section 3.5)	**Accepted**
	13. in partnership with Parks Victoria, Country Fire Authority, Fire Rescue Victoria and councils as appropriate, collect empirical evidence after bushfire events to assess the effectiveness of different fuel management treatments, including planned burning, mulching, slashing and mineral earth breaks, and build an evidence base to the effectiveness of these treatments (see Sections 3.2, 3.3 and 3.5).	**Accepted**

Recommendation about fuel management—risk assessment

We recommend that:		Response
Department of Environment, Land, Water and Planning Country Fire Authority (in consultation with Fire Rescue Victoria)	14. in partnership with councils, provide advice to government in line with the *Safer Together: A new approach to reducing the risk of bushfire in Victoria* policy on options to better resource the assessment of risk on private land, its treatment and activities to enforce compliance of land owners with risk-reduction treatments. (see Section 3.3).	**Accepted**

Recommendation about land-use planning

We recommend that:		Response
Department of Environment, Land, Water and Planning	15. provides advice to government, in consultation with Country Fire Authority, Fire Rescue Victoria and councils, on options to improve owner and occupier awareness of and accountability for bushfire management overlay planning controls (see Section 4.3).	**Accepted**

Recommendations about the Powerline Bushfire Safety Program

We recommend that:		Response
Department of Environment, Land, Water and Planning	16. investigates incentives and advises government on options to accelerate burying and insulating the remaining high-voltage bare-wire powerlines in the 33 highest risk areas (see Section 5.4)	**Accepted**
	17. improves the Powerline Bushfire Safety Program's transparency by publicly reporting on activities, costs and risk-reduction outcomes (see Section 5.5).	**Accepted**

1.
Audit context

Bushfires are a naturally occurring feature of Australia's landscape and can significantly impact people, property and the environment.

Australia's southern states, including Victoria, are the most bushfire-affected areas in the country.

This chapter provides essential background information about:

- Victoria's bushfire history and trends
- The Victorian Royal Commission
- Factors that influence how bushfires start and spread
- How DELWP defines bushfire risk
- Fuel management approaches
- The land-use planning system
- The Powerline Bushfire Safety Program

1.1 Bushfire history and trends

Since European records began in the mid-1800s, Victoria has had regular bushfires. Some of the state's most catastrophic fires include Black Thursday in 1851, Black Friday in 1939, Ash Wednesday in 1983, Black Saturday in 2009 and the recent 2019–20 bushfire season.

Impact and losses

Figure 1A shows the impact and losses from Victoria's worst bushfire seasons since 1939. It shows the numbers of lives lost, properties destroyed and hectares burned. It also shows that despite advances in our preparedness strategies and firefighting technology, bushfires continue to threaten lives, property and the environment.

FIGURE 1A: **Significant losses from Victorian bushfires between 1939 and 2020**

1939
2m hectares
71 deaths
650 homes lost

1969
250k hectares
23 deaths
230 homes lost

1977
103k hectares
4 deaths
116 homes lost

1983
210k hectares
47 deaths
2k homes lost

1985
102k hectares
3 deaths
180 homes lost

2003
1.3m hectares
0 deaths
41 homes lost

2005–06
160k hectares
4 deaths
57 homes lost

2006–07
1.2m hectares
1 death
51 homes lost

2009
430k hectares
173 deaths
2k homes lost

2013
190k hectares
5 deaths
46 homes lost

2019–20
1.5m hectares
5 deaths
396 homes lost

✝ deaths x 10

🏠 homes lost x 100

▨ hectares burnt

Source: VAGO.

1.2 The 2009 Victorian Bushfires Royal Commission

The 2009 Black Saturday bushfires significantly affected Victorian communities and resulted in the loss of 173 lives and 2 133 properties.

Figure 1B shows a timeline of key events from the Black Saturday bushfires leading up to this report.

FIGURE 1B: **Timeline of key events from the Black Saturday bushfires to this report**

Black Saturday bushfires
–
Victorian Bushfires Royal Commission

2009

2015
IGEM releases its *Review of Performance Targets for Bushfire Fuel Management on Public Land*
–
Safer Together policy introduced

2019 –20
2019–20 bushfires

2020

31 July
IGEM issued its report on phase one of its Inquiry into the 2019–20 Victorian Bushfire Season

31 August
Royal Commission into National Natural Disaster Arrangements issued *Interim observations* to the Australian Government

Source: VAGO.

Scope and outcomes

The government asked the Victorian Royal Commission to assess the state's bushfire preparedness, response and recovery to minimise the risk of a future catastrophic bushfire occurring.

In the resulting report, the chair and commissioners said that it would be a mistake to treat Black Saturday as a one-off event. They noted that 'with populations at the rural–urban interface growing and the impact of climate change, the risks associated with bushfire are likely to increase'.

Recommendations

The Victorian Royal Commission made recommendations to government about the state's bushfire preparedness. The recommendations focused on three specific areas:

- fuel management
- land-use planning
- powerlines.

We discuss the government's responses to these recommendations throughout this report.

1.3   Factors that influence how bushfires start and spread

Four main factors determine if a bushfire will start and how it will spread:

- ignition sources
- weather conditions
- available fuel, including fuel loads, moisture, density and structure
- topography.

Weather conditions

Specific weather conditions can trigger a bushfire to start and exacerbate its spread. However, responsible agencies also need to consider broader climate factors when planning their risk-reduction treatments.

Climate change and extreme weather

In 2018, the Bureau of Meteorology (BoM) published research that links earlier starts to the bushfire season with climate change and weather patterns, such as El Niño. This research, which draws on 40 years of data, shows that weather conditions in spring and summer are becoming more dangerous across southern Australia.

The timing and severity of the 2019–20 bushfire season supported this finding. In December 2019, BoM issued its *Special Climate Statement Report 72—dangerous bushfire weather in spring 2019*. The report noted that across Australia, spring 2019 had the highest fire danger weather on record, with record high values observed in all states and territories.

Drought

Very dry conditions can contribute to the likelihood of bushfires starting. Drought conditions also directly impact DELWP and CFA's ability to conduct planned burns. When vegetation dries out and water availability decreases, the risk of a planned burn escaping increases. This can also endanger staff who conduct planned burns. Planned burning during drought conditions may also negatively impact ecosystems.

As Figures 1C and 1D show, south-eastern Australia experienced above-average to highest-on-record temperatures and below-average to lowest-on-record rainfall in 2019.

FIGURE 1C: **Australia's maximum temperature between 1 January and 31 December 2019**
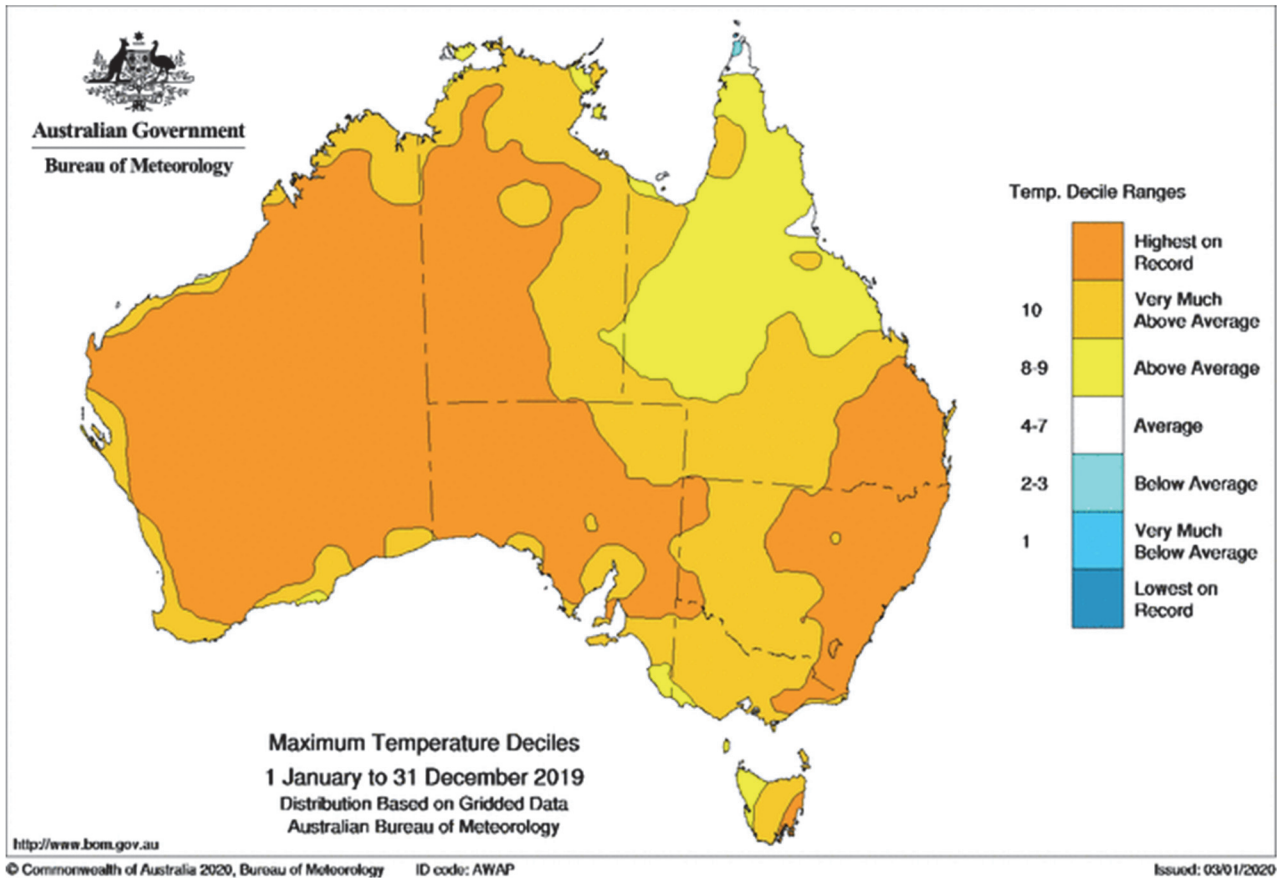
Source: BoM.

FIGURE 1D: **Australia's total rainfall between 1 January and 31 December 2019**
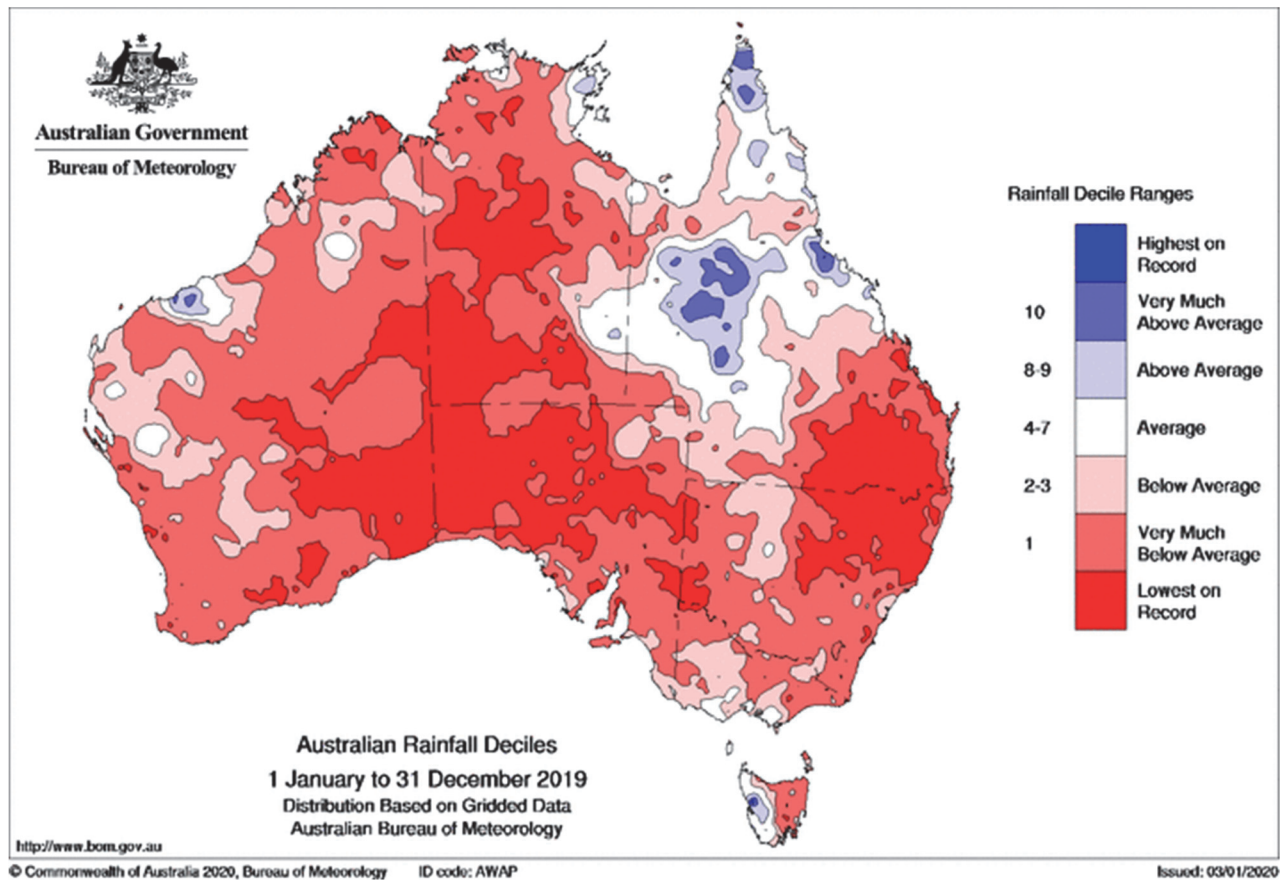
Source: BoM.

Available fuel loads

Anything that can burn has the potential to increase a bushfire's spread and intensity. This includes vegetation, ground litter and houses.

While the volume of fuel can influence a fire's spread and intensity, how fuel is arranged is more important. When conducting planned burns, responsible agencies focus on burning ground cover and bark from tree trunks to reduce the chance of flames igniting the tree canopy.

We look at responsible agencies' roles regarding fuel management later in this chapter.

Ignition sources

For a bushfire to start, there must be a source of ignition. Ignition sources include natural causes, such as lightning, or human causes, such as arson or fires escaping from campsites.

DELWP and CFA collect data on the ignition source of Victorian bushfires on land that they are responsible for. Figure 1E compares the most common ignition sources over a 30-year period to ignition sources in 2018–19.

FIGURE 1E: **Bushfire ignition sources in Victoria**

In the last 30 years only seven bushfires were caused by power distribution. However, one of those bushfires (Ash Wednesday) caused 47 deaths, 2 000 homes lost and burnt 210 000 hectares.

Planned burns can escape. In 2015, one of DELWP's planned burns near Lancefield in central Victoria broke containment lines and destroyed four homes and burnt more than 3 000 hectares of farmland and state forest.

Number of fires—2018–19 season

Number of fires—prior 30-year average

Source: VAGO, using DELWP data.

1.4 Defining and managing bushfire risk

Elements of bushfire risk

DELWP defines bushfire risk as a combination of:

- the likelihood of a fire igniting and spreading
- the consequences a fire would have on people, property and the environment.

Roles and responsibilities

Managing bushfire risk is a shared responsibility between:

- multiple agencies across different levels of government
- communities
- individual landowners.

While it is not possible to eliminate the risks associated with bushfires, government agencies play key roles in reducing the likelihood of them starting and lessening their impact.

Figure 1F shows the factors that contribute to the likelihood of bushfires starting and their possible consequences. It also shows the strategies that exist to reduce these consequences.

FIGURE 1F: **Elements of bushfire risk and risk-reduction strategies**

**Risk =
likelihood x consequence**
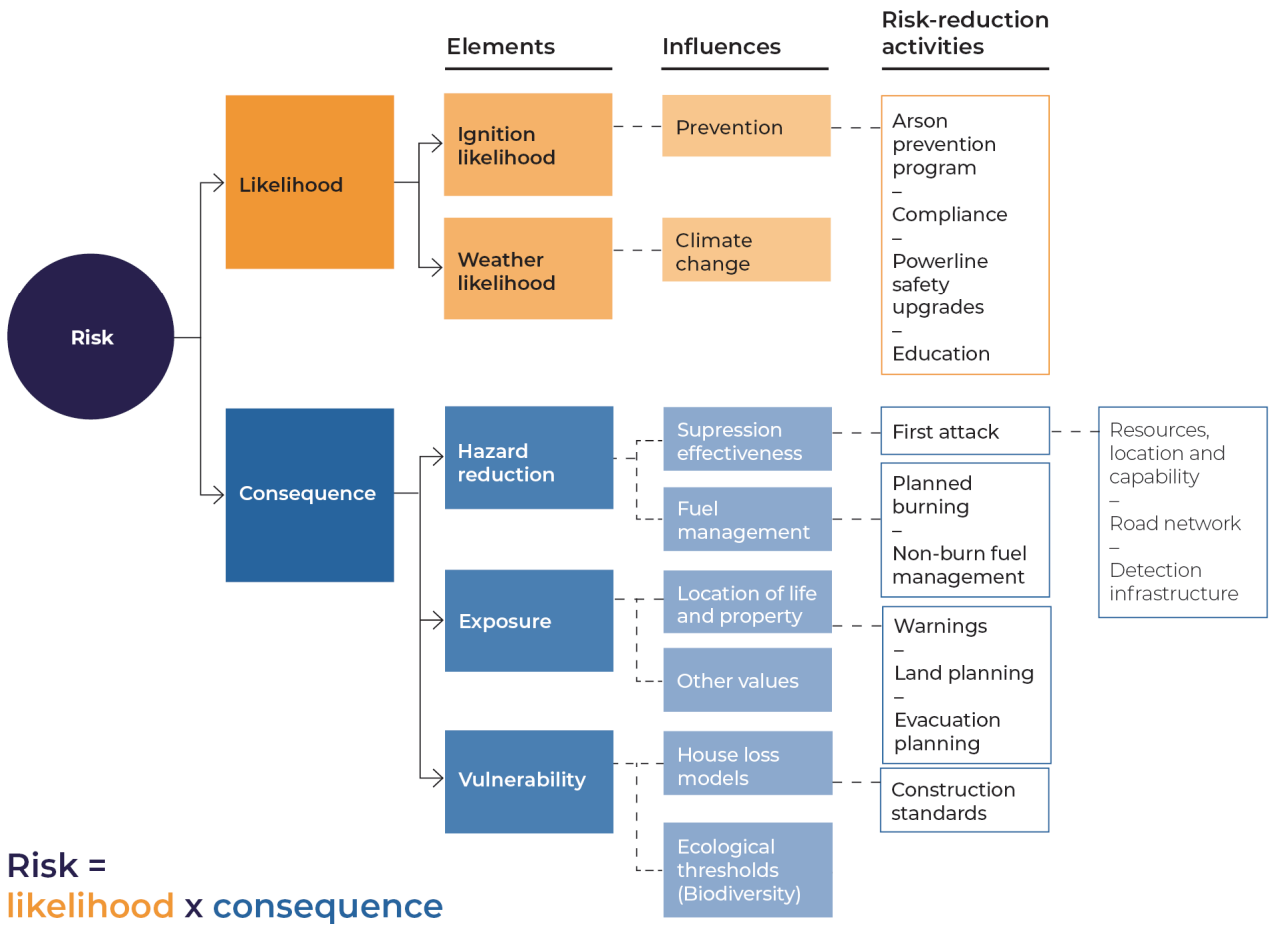
Source: DELWP.

Risk-reduction treatments

We looked at three of the main risk-reduction treatments in this audit:

• fuel management
• land-use planning
• powerline safety upgrades.

1.5 **Fuel management**

Fuel management involves reducing the volume of leaves, bark, shrubs and twigs that can fuel a bushfire. Fuel management treatments include mulching, grass slashing and planned burning. When conducting these treatments, responsible agencies often focus on reducing fine fuel loads.

Managing fine fuel loads can reduce a bushfire's spread and intensity. This makes it easier for firefighters to control the fire and reduce its impact on the community and environment.

Fine fuel is plant material that is less than six millimetres in diameter. Fine fuels dry out quickly, ignite easily, release energy rapidly and can be carried as embers.

Fuel management methods

There are a number of methods to manage fuel loads. These methods include planned burning as well as a range of non-burn approaches, such as:

- ploughing
- mulching
- herbicide application
- grazing
- mowing
- slashing.

Planned burning is the main method that responsible agencies use to manage fuel loads.

Roles and responsibilities

Land ownership determines who is responsible for reducing an area's bushfire risk. In Victoria, 40 per cent of land is public land, which government agencies are responsible for. Private landowners are responsible for managing fuel across the rest of the state with support from CFA and councils.

DELWP, Parks Victoria (PV), Melbourne Water and VicForests work together under the name Forest Fire Management Victoria. Forest Fire Management Victoria works with CFA, councils and the community to plan for, respond to and recover from bushfires.

On 1 July 2020, FRV was established to bring career firefighters from the Metropolitan Fire Brigade and CFA together. Moving forward, CFA will continue as a community-based volunteer-run firefighter organisation that supports Victorians during emergencies. CFA will continue to provide day-to-day support as well as vital surge capacity for major fire events, particularly bushfires. FRV will cover existing Metropolitan Fire Brigade boundaries and serve metropolitan Melbourne, outer suburban areas and larger regional centres across Victoria.

Figure 1G shows who is responsible for managing bushfire risk on public and private land.

FIGURE 1G: **Roles and responsibilities for managing bushfire risk on public and private land**

Public land		Private land
State forests, national parks, and protected public land	*Other public land*	*Private land*
Forest Act 1958	*Country Fire Authority Act 1958*	*Fire Rescue Victoria Act 1958*

Public land — State forests, national parks, and protected public land (Forest Act 1958)

Secretary of DELWP

↓

Must:
Carry out works for the prevention and suppression of fire
Have regard to the Code of Practice for Bushfire Management on Public Land

↓

Delivered through
Forest Fire Management Victoria

↑

Contribute resources to

DELWP	PV	Melb. Water	Vic Forests	Other agencies

Other public land / Private land (Country Fire Authority Act 1958 / Fire Rescue Victoria Act 1958)

Obligations and powers for the prevention of fires

Public authorities (e.g. DoT) Municipal councils	Country Fire Authority Fire Rescue Victoria	Owners/occupiers of private land
	↓	
	CFA brigades / FRV units	
↓	↓	↓
Take all necessary steps to prevent fires on land or roads under their control	May carry out fire prevention work at request of owner/land manager	Comply with obligations of CFA/ FRV Acts and municipal laws, including fire prevention notices

Note: DoT is the Department of Transport.
Source: VAGO.

DELWP's Code of Practice for Bushfire Management on Public Land

The Code outlines how DELWP plans to manage the state's bushfire risks to meet its two objectives. Figure 1H outlines these objectives.

FIGURE 1H: **The Code's two objectives**

Objective 1
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.

Objective 2
Maintain or improve the resilience of natural ecosystems and their ability to deliver services such as biodiversity, water, carbon storage and forest products.

Source: The Code.

Fuel-reduction targets

Following the Black Saturday bushfires, the Victorian Royal Commission made a number of recommendations for managing fuel loads.

One of these recommendations was for DELWP to implement a planned burning program using a hectare-based target. As a result, the government planned for DELWP to build towards a goal of delivering 390 000 hectares of planned burns each year from 2009, which is 5 per cent of the state's public land.

In February 2015, the government asked IGEM to:

> '… provide recommendations regarding the form of future performance targets for the Bushfire Fuel Management Program, specifically the continuation of a hectare-based target or the adoption of a bushfire risk reduction target, such as that developed by DELWP as part of its risk-based approach to bushfire management.'

Following the 2015 IGEM review, DELWP's key BP3 performance measure relating to bushfire prevention changed from the hectare-based target to a residual risk-based target.

DELWP monitors and reports against a number of BP3 measures related to bushfire management, including risk reduction. Other BP3 measures are discussed in Section 3.2. Figure 1I shows how DELWP's planned burning target has changed from 2009 to present.

FIGURE 1I: **DELWP's bushfire prevention metrics and targets 2009–10 to 2019–20.**

	BP3 measure—Fuel reduction burning completed to protect key assets (hectares)	BP3 measure—Statewide bushfire risk is maintained at or below the target (%)
Pre-Royal Commission		
2009–10	130 000	
2010–11	200 000	
Post-Royal Commission—towards 5% target		
2011–12	225 000	
2012–13	250 000	
2013–14	260 000	
2014–15	275 000	
2015–16	275 000	
70% residual risk target		
2016–17		70
2017–18		70
2018–19		70
2019–20		70

Source: VAGO.

IGEM's 2015 Review of Performance Targets for Bushfire Fuel Management on Public Land

In its 2015 *Review of Performance Targets for Bushfire Fuel Management on Public Land*, IGEM made four recommendations to government. As shown below, two of these recommendations focus on the future form of performance targets for bushfire fuel management on public land.

Recommendation number	Description
1	IGEM recommends a risk-reduction target as the most effective form of performance target for bushfire fuel management on public land to protect life and property and guide investments in fuel reduction burning.
2	In the event that government adopts a risk reduction target: • DELWP transitions to this target through a defined program of activities and milestones. Effective transitioning will require DELWP to enhance its capacity and capability to implement risk-based planning and needs to be supported by appropriate performance measures and dedicated monitoring, evaluation and review. • government supports DELWP in making this transition.

In relation to the recommended risk-reduction target, IGEM stressed the following:

'The expression of a risk reduction performance target:

- needs to be easy to comprehend
- needs to adequately communicate the extent to which the fuel management program had reduced risk, while supporting shared responsibility by conveying that planned burning and other fuel-reduction activities only reduce risks— they do not eliminate it
- needs DELWP to be held to account for its performance
- should be able to be aggregated, enabling the combined effect of planned burning and other actions taken by government to reduce risk to be communicated.'

IGEM made two further recommendations on complementary measures of performance:

Recommendation number	Description
3	IGEM recommends that DELWP:
	• continues to develop and employ its capability to predict the smoke effects of planned burning, ensuring its planned burning processes remain consistent with the State Smoke Plan
	• adopts performance measures to monitor the quality and effectiveness of community engagement activities
	• continues to develop the reliability of its estimates of unit risk reduction costs. The availability of such estimates will be required to enable comparison and prioritisation of options for bushfire risk reduction across the areas of prevention, preparedness, response and recovery, and would involve contributions of other emergency management agencies.
4	IGEM recommends that:
	• DELWP report clear, publicly accessible information on bushfire risk and ecosystem resilience, and report on the key activities required to achieve outcomes for the community in these areas
	• DELWP's transition to risk-based planning and performance measurement be supported by a program of internal and external reviews.

The Safer Together policy

The 2015 Safer Together policy states that the government accepted all of IGEM's recommendations. As shown in Figure 1J, the policy also outlines the government's pathway for how it intends to address them.

FIGURE 1J: **Safer Together policy commitments**

2016/17
Firstly, government will use a risk reduction target to guide fuel management on public land, maintaining bushfire risk at, or below 70%.

2017/18
Then, land and fire agencies will combine their efforts to manage fuel loads on private and public land, based on where and how we can most effectively reduce risk.

2020
Ultimately, working as one fire management sector, we will measure all of our bushfire management strategies against risk reduction, so we can invest in the most effective ways to reduce risk.

Source: the government's 2015 Safer Together policy.

Safer Together is both a government policy, delivered by DELWP, PV, CFA and Emergency Management Victoria (EMV), and the name of the program that the government is using to implement the policy. DELWP and other agencies receive government funding through the program.

The Safer Together program received $23.4 million to fund its first two years of operation (2017–19). It received a further $25.7 million to fund another two years in the 2019–20 state budget.

Safer Together establishes a statewide residual risk target of 70 per cent residual risk. The aim of this target is to reduce the risk that bushfires pose to life and property in Victoria through planned burning to 70 per cent of what it would be (100 per cent) if no fuel reduction occurs.

Delivery costs

In the 2018–19 financial year, DELWP spent around $430.5 million on fire management. Of this, it spent $121.7 million on fuel management. The remaining balance relates to fire response and recovery activities.

DELWP divides its fuel management costs between:

- direct costs to deliver planned burns ($18.2 million)
- indirect costs of strategic and operational planning, resource management, equipment and infrastructure ($103.5 million).

Figure 1K shows DELWP's overall fuel management costs between 2015–16 and 2018–19. Labour, and therefore cost, remains fairly static regardless of the number of burns it delivers.

FIGURE 1K: **DELWP's fuel management costs between 2015–16 and 2018–19**

($) millions
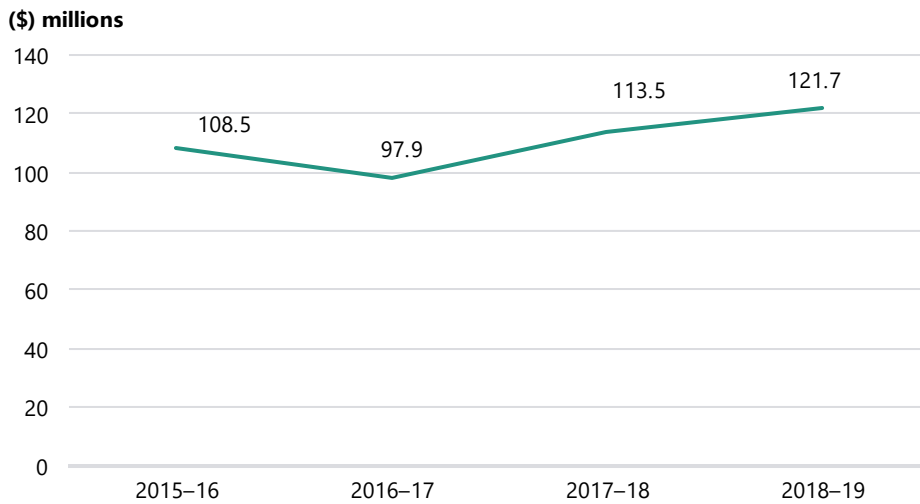
Source: VAGO, using DELWP data.

1.6   Land-use planning

The Council of Australian Governments' 2004 *National Inquiry on Bushfire Mitigation and Management* found that land-use planning was the single most important mitigation measure to prevent losses from bushfires. The report stated that this is because planning can reduce the number of people living in high-bushfire-risk areas.

Nearly one third of the Victorian Royal Commission's recommendations also related to the Victorian planning system.

The Victorian planning system

Victoria has a statewide planning system. Government planning policies determine where to locate urban growth and development and how to build.

The planning system in Victoria controls land use, or how people use land for particular purposes such as housing or shops, and development.

The *Building Act 1993* and *Building Regulations 2018*, which incorporate the National Construction Code and relevant Australian standards, address how people can construct, alter or demolish a building.

Roles and responsibilities

DELWP, councils and CFA have different responsibilities under Victoria's planning and building systems.

Agency	Responsible for ...
DELWP	• managing the regulatory framework and providing advice on planning policy, strategic planning, building policy and legislation • managing the ongoing development and maintenance of the *Planning and Environment Act 1987*, its regulations and the Victoria Planning Provisions on behalf of the Minister for Planning • managing the ongoing development and maintenance of the *Building Act 1993* and its regulations on behalf of the Minister for Planning • maintaining the mapping of the BPA for the building system and the BMO mapping for planning schemes.
Councils	• implementing state policy through local planning decisions • issuing planning permits for developments or buildings in high-bushfire-risk areas when required • issuing building permits for developments or buildings in high-bushfire-risk areas where required (the vast majority of building permits are issued by private building surveyors) • referring planning applications to CFA for advice and recommendations.
CFA	• reviewing or making decisions about planning applications from councils to provide advice about bushfire risks and how to reduce them to an acceptable level • providing advice on changes to the BPA (building) and BMO (planning scheme) mapping • providing advice during the building permit process.

Victorian legislation and policies

The *Planning and Environment Act 1987* establishes Victoria's planning system based on a statewide framework of planning provisions.

In December 2017, the Minister for Planning updated Clause 13.02 of the *State Planning Policy Framework*. This clause relates to bushfires.

Victoria Planning Provisions Clause 13.02—Bushfire

The 2017 changes to Clause 13.02 strengthened strategies to help planners better identify, assess and manage bushfire risks through the planning process. This clause now prioritises protecting human life:

• over all other policy considerations
• by directing population growth and development to low-risk locations
• by ensuring that people have safe access to areas where they can shelter from bushfires
• by considering bushfire risks during all stages of the planning process.

Clause 13.02 applies to all planning and decision-making processes carried out under the *Planning and Environment Act 1987* involving land that is:

• within a designated BPA
• subject to a BMO
• proposed to be used or developed in a way that may create a bushfire hazard.

Bushfire prone areas and bushfire attack levels

In response to the Victorian Royal Commission's recommendations, the Minister for Planning declared high-bushfire-risk areas as BPAs under the *Building Amendment (Bushfire Construction) Regulations 2011* and the *Building Act 1993* was later amended to solidify this power under section 192A.
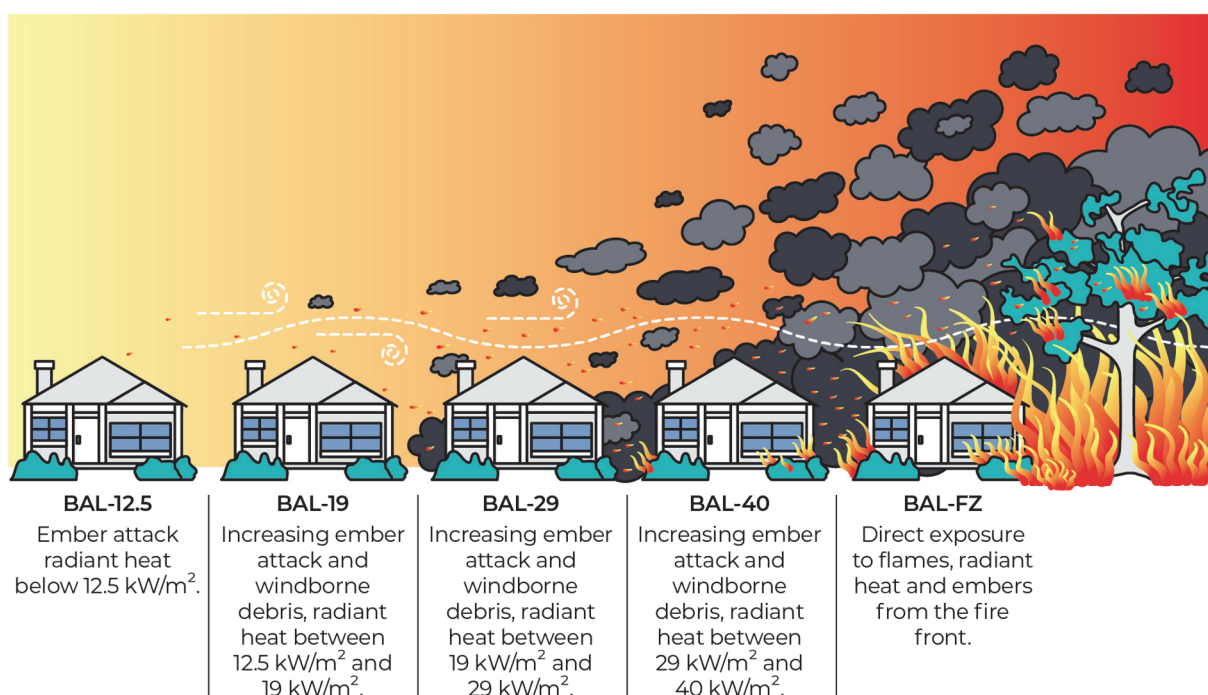
Under Australian Standard 3959:2018 *Construction of Buildings in Bushfire Prone Areas* (AS 3959:2018), a minimum construction standard now applies to all new building work, including work on existing buildings in a BPA.

Victorian building regulations require a bushfire attack level (BAL) assessment for construction in BPAs. The outcome of the BAL assessment determines the construction standard required to protect a property from bushfire.

BAL rankings measure a building's potential exposure to ember attack, radiant heat and direct flame contact. The BAL is assessed and set according to AS 3959:2018. The assessed BAL must be met. The *Building Regulations 2018* specify that for certain buildings, including dwellings, the minimum BAL that must be applied is BAL-12.5.

There are six BALs, Figure 1L shows the highest five.

FIGURE 1L: **Bushfire attack levels**

BAL-12.5	BAL-19	BAL-29	BAL-40	BAL-FZ
Ember attack radiant heat below 12.5 kW/m².	Increasing ember attack and windborne debris, radiant heat between 12.5 kW/m² and 19 kW/m².	Increasing ember attack and windborne debris, radiant heat between 19 kW/m² and 29 kW/m².	Increasing ember attack and windborne debris, radiant heat between 29 kW/m² and 40 kW/m².	Direct exposure to flames, radiant heat and embers from the fire front.

Note: BAL-LOW is the lowest level. At this level, radiant heat exposure is insignificant, risk is rated as very low and specific construction requirements are not necessary. Under AS 3959:2018, a building can be assessed as LOW. However, in Victoria, if a property is in a BPA and its BAL is assessed as LOW, then the minimum standard the building must be constructed to is BAL-12.5.

kW/m² is kilowatts per metre squared.

Source: CFA.

Bushfire management overlays

Developments and extensions in BMO areas are subject to planning controls related to:
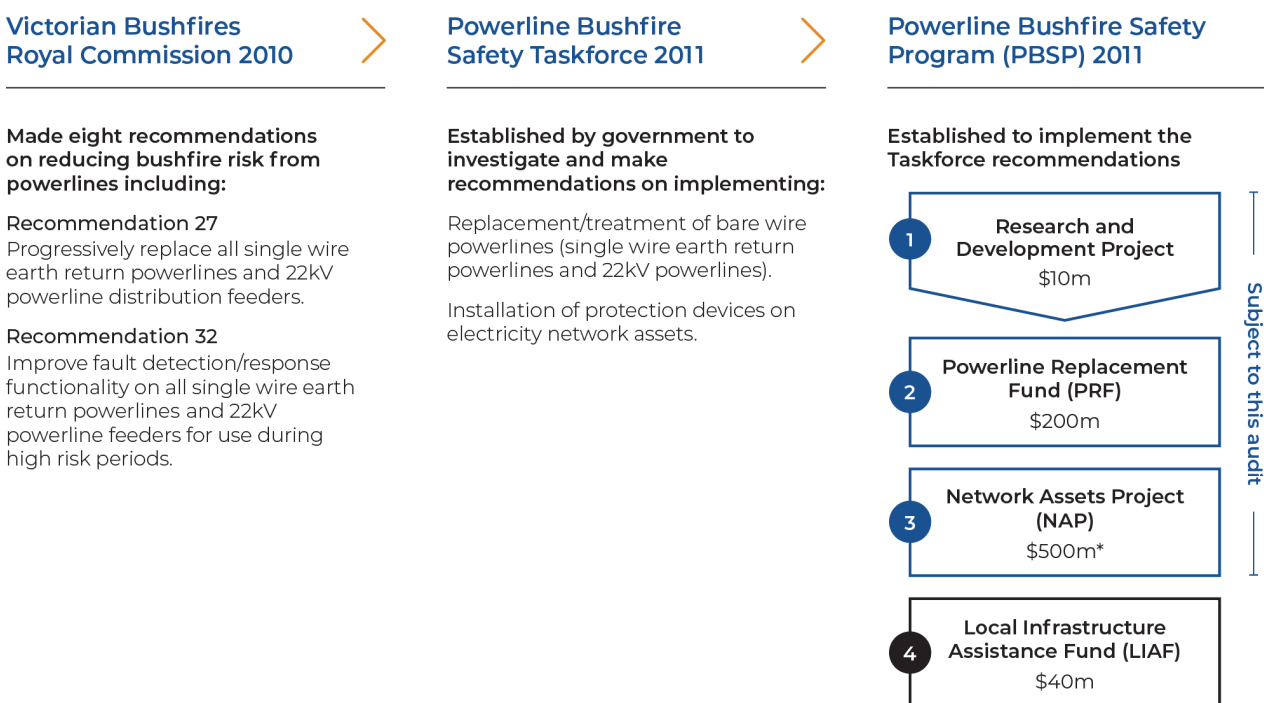
- the required BAL rating
- building siting
- site access
- water supply
- defendable space requirements.

1.7 Powerline Bushfire Safety Program

As shown earlier in Figure 1E, powerlines do not cause many bushfires. However, they have caused a disproportionately high number of catastrophic bushfires in extreme weather conditions. Powerlines caused major Victorian bushfires in 1969, 1977, 1983 and 2009.

The PBSP is a 10-year, $750 million program to make Victoria's powerlines safer. The Victorian Government funds all of the projects under the PBSP, except for the NAP, which customers of participating electricity distribution businesses fund through additional costs on their bills. As shown in Figure 1M, the PBSP stemmed from the Victorian Royal Commission's recommendation to reduce the risk of powerlines starting bushfires.

FIGURE 1M: **Timeline of events that led to the PBSP**

Victorian Bushfires Royal Commission 2010

Made eight recommendations on reducing bushfire risk from powerlines including:

Recommendation 27
Progressively replace all single wire earth return powerlines and 22kV powerline distribution feeders.

Recommendation 32
Improve fault detection/response functionality on all single wire earth return powerlines and 22kV powerline feeders for use during high risk periods.

Powerline Bushfire Safety Taskforce 2011

Established by government to investigate and make recommendations on implementing:

Replacement/treatment of bare wire powerlines (single wire earth return powerlines and 22kV powerlines).

Installation of protection devices on electricity network assets.

Powerline Bushfire Safety Program (PBSP) 2011

Established to implement the Taskforce recommendations

1. Research and Development Project
$10m

2. Powerline Replacement Fund (PRF)
$200m

3. Network Assets Project (NAP)
$500m*

4. Local Infrastructure Assistance Fund (LIAF)
$40m

Subject to this audit

Note: Cost to electricity customers.
Source: VAGO.

Of the five electricity distribution businesses that own and operate electricity distribution networks in Victoria, only three are affected by the PBSP—Powercor in the state's west, AusNet Services in the east and Jemena, which has small number of rural powerlines on the outskirts of Melbourne.

The Taskforce

ESV established the Taskforce to investigate how the government should implement the Victorian Royal Commission's recommendations about powerlines. It found that while burying or insulating all of the regional powerlines in Victoria would be the most effective risk-reduction option, it would be too expensive. In particular, it calculated that it would cost $40 billion to bury all of the state's regional powerlines or $20 billion to insulate them.

The Taskforce concluded that the most cost-effective solution was widespread deployment of the latest network protection technology packages and targeted replacement of single-wire earth return networks and 22 kilovolt (22kV) high-voltage powerlines.

22kV high-voltage powerlines

There are 60 902.7 kilometres of 22kV high-voltage powerlines in Victoria. The Taskforce focused on these powerlines because they found that in Victoria, they have caused:

- 70 per cent of all faults
- 67 per cent of all powerline-related fire starts—the remaining 33 per cent have been caused by single-wire earth return powerlines and low-voltage private overhead electric lines (POEL).

Additionally, on total fire ban days 22kV high-voltage powerlines have caused:

- four times as many fires than single-wire earth return powerlines in Powercor's network
- nineteen fires for each fire started by a single-wire earth return powerline in AusNet Services' network.

Powerline Replacement Fund

The PRF funds Powercor and AusNet Services to cover, insulate, bury or remove their high-voltage bare-wire powerlines in the state's highest risk areas. This funding is accelerating the rate that Powercor and AusNet Services normally replace or upgrade infrastructure. The PRF is also being used to place POELs underground.

Figure 1N shows the two of the three types of bare-wire powerlines that the PRF is addressing.

POELs are privately owned lines, or a combination of poles and lines, that carry less than 1 000 kV. There are over 43 000 POELs in Victoria. Most supply electricity to rural properties and sheds. Owners must keep their POELs in a safe working condition. Electricity distribution businesses are responsible for conducting periodic inspections. Defective POELs may be disconnected by electricity distribution businesses on total fire ban days.

FIGURE 1N: **Bare-wire powerlines addressed by the PRF**

High-voltage bare-wire powerlines
Owned and operated by Powercor and AusNet Services

22kV Three-wire powerlines.

12.7kV Single-wire earth return powerlines. These single-wire powerlines run across regional Victoria and were installed when the network was first built. They are cheaper to construct and maintain than multi-wire powerlines.

Source: ESV and Powercor.

Network Assets Project

The NAP is a program of electrical safety upgrades designed to reduce the likelihood of powerline faults starting bushfires.

Three electricity distribution businesses that operate in non-urban high-bushfire-risk areas are implementing the NAP—Powercor, AusNet Services and Jemena. These businesses pass the cost of this work onto customers through their electricity bills.

When a powerline fault occurs, the power supply to that part of the line needs to be shut off almost instantly.

On Black Saturday, powerline controls did not operate fast enough to prevent faults from starting some fires. New protection devices are now available that can detect faults with greater sensitivity and turn off power faster. These devices can reduce the risk of fires starting across thousands of kilometres of high-voltage powerlines.

Under the NAP, electricity distribution businesses are installing two types of new devices in high-bushfire-risk areas:
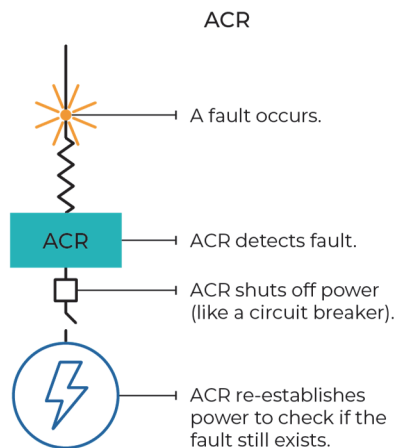
- ACRs
- REFCLs.

Automatic circuit reclosers

ACRs are devices that protect high-voltage powerlines (22kV three-wire powerlines and 12.7kV single-wire earth return powerlines) in high-bushfire-risk areas.

FIGURE 1O: **How ACRs work**

ACR

A fault occurs.

ACR

ACR detects fault.

ACR shuts off power
(like a circuit breaker).

ACR re-establishes
power to check if the
fault still exists.

Source: VAGO.

Victorian electricity distribution businesses have used ACRs extensively for years. On total fire ban and code red days, they set ACRs to limit the number times powerlines attempt to re-establish a connection after a fault to reduce the risk of a fire starting. However, these older ACRs, which are mainly on single-wire earth return powerlines, need to be manually adjusted to limit the number of times an ACR attempts to re-establish power. Under the NAP, electricity distribution businesses are replacing manual ACRs with automatic devices.

Electricity distribution business can remotely set new-generation ACRs to maximise fire safety on high-fire-risk days and customer supply reliability on other days.

Electricity distribution businesses are installing new-generation ACRs to all 30 000 kilometres of Victoria's single-wire earth return networks.

Rapid earth fault current limiters

REFCLs are network protection devices that are used on larger 22kV polyphase electric lines, which connect smaller powerlines to zone substations.

REFCL technology was developed in Europe and has been used there for decades to improve the reliability of electricity supply. Victoria's decision to use REFCLs to reduce bushfire risks is a world first.

REFCLs operate like a safety switch. When a wire-to-earth fault occurs on a powerline, the REFCL lowers the voltage on the faulty wire almost instantaneously.
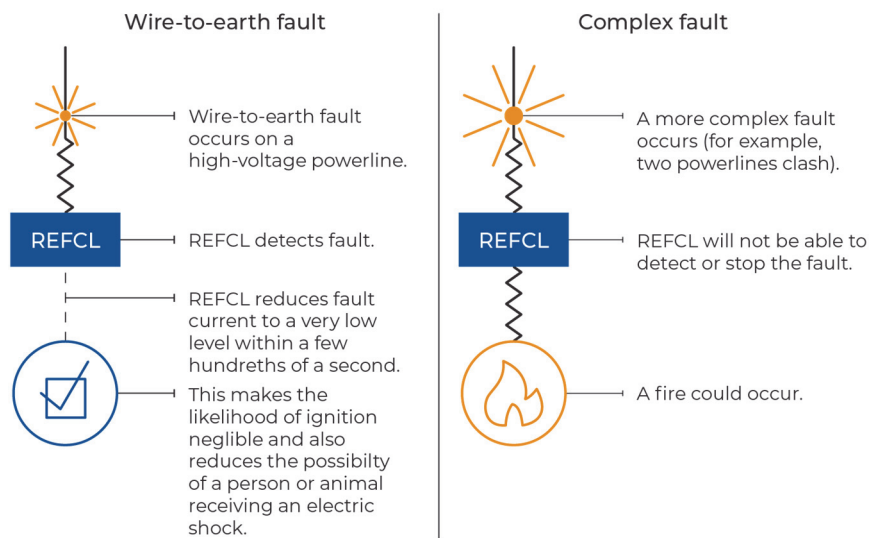Seventy per cent of all high-voltage faults are wire-to-earth faults. However, REFCLs cannot prevent all ignition types. They can only prevent ignition for slightly more than half (51 to 56 per cent) of all faults that occur. Other protection devices, such as ACRs, are also deployed widely across the network to protect against different ignition types, including some of those that REFCLs cannot prevent.

Code red is the highest level of fire danger rating in Victoria. Fire danger ratings predict fire behaviour should a fire start and how hard it will be to put out. Code red signifies the worst conditions for grassfires or bushfires.

Zone substations are control points between different voltage levels in the electricity network. They lower sub-transmission electricity voltage levels, which are carried by larger powerlines between towns and suburbs, to distribution voltage levels, which are carried by smaller powerlines on streets.

A **wire-to-earth fault** occurs when a connection is made between a powerline and the ground. These faults can be caused by fallen powerlines, a tree falling against a powerline or wildlife touching the pole and powerline at the same time.

FIGURE 1P: **How REFCLs work**

Wire-to-earth fault

Wire-to-earth fault occurs on a high-voltage powerline.

REFCL detects fault.

REFCL reduces fault current to a very low level within a few hundreths of a second.

This makes the likelihood of ignition neglible and also reduces the possibilty of a person or animal receiving an electric shock.

Complex fault

A more complex fault occurs (for example, two powerlines clash).

REFCL will not be able to detect or stop the fault.

A fire could occur.

Source: VAGO.

Electricity distribution businesses are installing REFCLs to 45 zone substations in three legislated tranches. They completed tranche one on 30 April 2019 and are currently rolling out tranche two, which is due by 30 April 2021. The final tranche will be rolled out by 30 April 2023.

Roles and responsibilities

Department of Environment, Land, Water and Planning

DELWP's program control board oversees the delivery and performance of all government-funded PBSP projects. DELWP engages with ESV, electricity distribution businesses and the Australian Energy Regulator to monitor and report on the NAP and PRF's delivery.

Energy Safe Victoria

ESV regulates electricity and gas safety and technology in Victoria. It is responsible for ensuring that electricity is safely generated and supplied.

ESV is helping DELWP to deliver the PRF and NAP. In 2016, ESV established its Powerline Bushfire Safety Committee (the PBS Committee) under Section 8 of the *Energy Safe Victoria Act 2005*. The PBS Committee gives ESV's director of energy safety expert advice to help them administer the *Electricity Safety (Bushfire Mitigation) Amendment Regulations 2016* (the Regulations).

In the PBS Committee's meetings, electricity distribution businesses report their progress with the NAP, PRF and bare-wire powerline upgrades as well as any issues they are experiencing. The PBS Committee has the expertise to assess technical issues and provide advice about requests for timeline extensions.

Legislation and regulations

ESV regulates Victoria's electricity supply, safety and efficiency under the *Electricity Safety Act 1998* (the Electricity Act). Section 6(a) of this act requires ESV to promote strategies that prevent and reduce the risk of powerlines starting bushfires.

Bushfire mitigation plans

Under the Electricity Act, electricity distribution businesses must prepare a bushfire mitigation plan to outline how they will operate their equipment to reduce bushfire risk. They must update these plans when changes occur or at a minimum of every five years. ESV approves these plans.

Legislated powerline upgrades

In 2016, the government amended the *Electricity Safety (Bushfire Mitigation) Regulations 2013* to make electricity distribution businesses upgrade powerlines in Victoria's highest risk areas. The Regulations now cover:

- burying and insulating bare-wire powerlines—from 1 May 2016, electricity distribution businesses must cover or bury any new or substantially replaced powerlines within the highest risk areas
- REFCLs—in conjunction with the NAP, electricity distribution businesses must install REFCLs that meet minimum performance standards to 45 zone substations within set time frames.

The Electricity Act also requires electricity distribution businesses to install new-generation ACRs to every single-wire earth return powerline in their supply networks before 1 January 2021.

Penalties

In 2017, the government amended the Electricity Act to introduce additional bushfire risk-reduction requirements and civil penalties for electricity distribution businesses. Electricity distribution businesses can now receive penalties of up to $10 million for failing to meet REFCL installation time frames. Additionally, daily penalties of $5 500 apply for each day a distribution business remains non-compliant.

2.
Assessing and planning to address bushfire risk

Victoria is the first state in Australia to use a risk-based target and measures to drive its bushfire risk-reduction activities.

Planned burning is the one of the main treatments that DELWP uses to reduce bushfire risk.

In this part, we assess how:

- DELWP set its risk baseline
- DELWP advised on the residual risk target
- DELWP assesses and plans to reduce risk on public land
- CFA and councils assess and plan to reduce risk on private land
- DELWP and CFA engage with high-bushfire-risk communities

2.1 Conclusion

Collectively, responsible agencies' assessments and plans to address Victoria's bushfire risk are not as comprehensive as they could be. Some limitations are inevitable as bushfire risk is complex, and modelling tools cannot include all variables. However, there are opportunities for DELWP, CFA and councils to improve their risks assessments, and thereby their planning to address bushfire risk.

At the state level, DELWP's understanding of bushfire risk significantly relies on the results it models with Phoenix RapidFire. DELWP relied on this modelling tool to advise government on the statewide residual risk target, and uses it to report its performance against DELWP's BP3 measure and to allocate resources to its regions for their planned burn activities. As such, the quality of Phoenix RapidFire's data inputs is vital.

We identified numerous limitations with Phoenix RapidFire, which DELWP is aware of and, in some cases, is working to address. It is imperative that DELWP prioritise updating the data that underpins the modelling tool and addresses limitations, such as how it excludes variables such as ignition risk, that the model can accommodate. This will allow DELWP to continuously improve how it targets resources to where they can best address risk.

At present, reporting against DELWP's BP3 measure, 'statewide bushfire risk is maintained at or below the target', does not provide the community with a good understanding of DELWP's performance in achieving risk reduction. The measure excludes any impact from non-burn treatments and combines the impact of planned burning and bushfire activity, the latter which cannot be attributed to DELWP. However, as a result of analysis undertaken by DELWP in the course of this audit, DELWP now intends to separately report on the impact of its planned burn activity on bushfire risk in its future reporting.

In addition, while DELWP is working to develop a more holistic measurement approach that reflects risk reduction achieved by all treatment types and across public and private land, it will not meet government's Safer Together target to implement this by the end of 2020.

At a regional level, while DELWP regions meet guidance requirements for regional planning, we found that some regions incorporate various additional risk assessment factors in their planning. While the regions share this information through statewide planning presentations, DELWP has not evaluated these additional methods to consider whether they should be more widely adopted.

Regional planning also does not consider burn costs to optimise resources. In addition, outdated environmental data that informs planning and capacity gaps for environmental assessments, risk unintended environmental consequences.

CFA and councils experience challenges in assessing and planning to address risk on private land associated with a lack of data and staff capacity and capability. There is more limited strategic planning to address bushfire risk on private land, undertaken by DELWP and CFA, compared with that conducted for public land. This reflects, to an extent, the more limited legislative powers and tools available to address bushfire risk on private land. This means that DELWP, CFA and councils have not yet met the Safer Together policy's intent for land and fire agencies to combine their efforts to manage fuel loads on private and public land, based on where and how they can most effectively reduce risk, by the end of 2018.

While DELWP, CFA and stakeholders, in March 2020, began making additional efforts to identify areas of private land for future risk treatment when updating regional bushfire management strategies, DELWP advise that a fully comprehensive strategic approach cannot be achieved in the absence of amendments to the statutory framework.
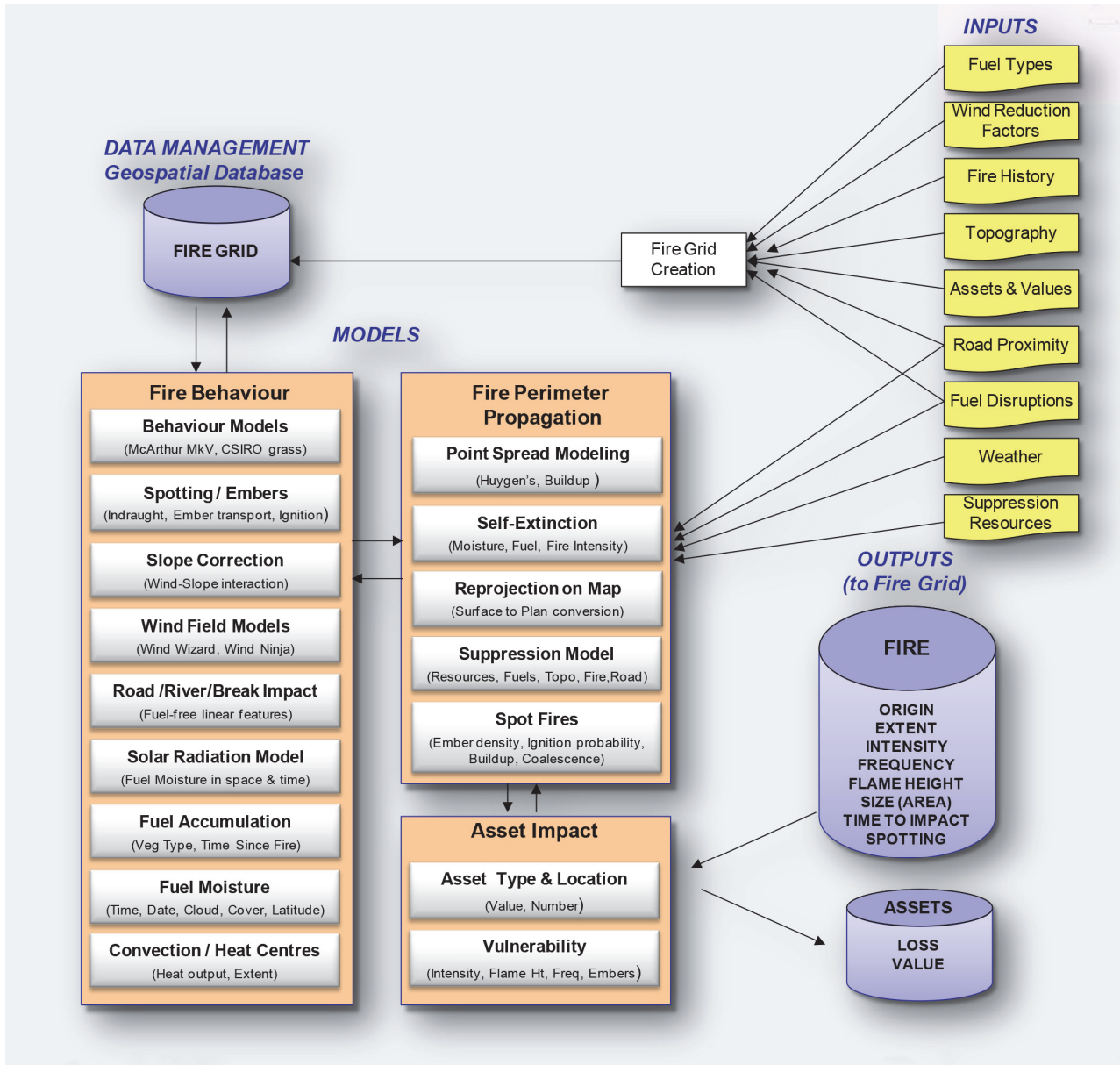
2.2 How DELWP set the risk baseline

To inform the statewide residual risk target, DELWP needed to determine the baseline from which the risk-reduction should occur.

DELWP used Phoenix RapidFire to determine the risk baseline and advise on the target. Phoenix RapidFire uses data (such as vegetation type and condition, terrain and weather) to estimate key fire properties (such as intensity, rate of spread and flame height) and then calculate the number of houses across the state that would be destroyed if that modelled scenario occurred. While house loss is an important consequence in itself, it can also indicate how many lives may be lost in a bushfire.

Figure 2A shows Phoenix RapidFire's inputs and fire behaviour scenario outputs.

FIGURE 2A: **Phoenix RapidFire inputs and outputs**

Source: DELWP.

Establishing the risk baseline

DELWP used the conditions present during the Black Saturday bushfires to model its 100 per cent risk scenario.

Statewide bushfire conditions	Modelled consequence	DELWP set this as ...
Extreme fire conditions (FDI 130) with maximum possible fuel loads	1.7 million houses lost	The 100 per cent risk scenario

DELWP then modelled multiple scenarios and used them to recommend a target in relation to the risk baseline.

Statewide bushfire conditions	Modelled consequence	DELWP set this as ...
Extreme fire conditions (FDI 130), but with reduced fuel loads due to planned burn treatments	1.19 million houses lost (70 per cent of 1.7 million)	The 70 per cent risk scenario

To understand DELWP's baseline and target, we considered if Phoenix RapidFire and its inputs are fit for purpose.

Phoenix RapidFire

Phoenix RapidFire is the primary tool used operationally by fire agencies in all eastern Australian states including Victoria, Queensland, New South Wales, the Australian Capital Territory, Tasmania and South Australia. DELWP uses it as a tool to inform its planning and operational decision-making in conjunction with the local knowledge of fire planners, risk analysts and operational staff.

There is no perfect tool to model bushfire risk. However, as DELWP used Phoenix RapidFire to recommend the statewide residual risk target and continues to use it to measure its performance against its BP3 metric, it is important that users of that information, such as the government and the public, are aware of its limitations. DELWP highlights many of these limitations in its 2015 document, *Measuring Bushfire Risk in Victoria*.

In 2017, BoM conducted an independent assessment of the four bushfire modelling tools outlined in Figure 2B.

FIGURE 2B: **Bushfire modelling tools assessed by BoM**

Modelling tool	Developed by	In	Used in
Phoenix RapidFire	University of Melbourne	2006	Victoria, Queensland, New South Wales, the Australian Capital Territory, Tasmania and South Australia
Prometheus	Alberta Government	2003	Canada
Australis	University of Western Australia	2008	Western Australia and USA

The **McArthur Forest Fire Danger Index (FDI)** measures the chance of a fire starting, the rate of its spread and how difficult it would be to control based on air temperature, humidity, wind speed and fuel dryness. The FDI is widely accepted and used by rural fire authorities in Australia.

FDI 130 represents extreme bushfire conditions. For example, the Black Saturday bushfires occurred in FDI 130 conditions, where there had been a severe drought, temperatures were higher than 40 degrees Celsius, the relative humidity was less than 10 per cent and there were strong to gale-force winds.

Modelling tool	Developed by	In	Used in
Spark	Commonwealth Scientific and Industrial Research Organisation (CSIRO)	2015	Tasmania and Queensland

Source: VAGO.

BoM found that overall, no one modelling tool was superior to the others because none performed well across all case studies. All modelling tools, including Phoenix RapidFire, over-predicted some fires and under-predicted others. For example, when Phoenix RapidFire modelled a catastrophic forest fire with an FDI of over 100 based on a real New South Wales fire, it slightly over-predicted the extent of the fire. When the tool modelled an extreme forest fire scenario with an FDI of 75 to 99 based on a real Victorian fire, it slightly under-predicted the fire's extent.

In 2018, the University of Melbourne published a peer reviewed study *Conditional Performance Evaluation: Using Wildfire Observations for Systemic Fire Simulator Development*, which compared two different versions of Phoenix RapidFire against nine different bushfires that occurred in Australia. It found that both Phoenix RapidFire models under-predicted the fires' spread, although the degree of under-prediction was not consistent across all fires. This study highlights that using a large number of well-documented fires would be necessary to calibrate or improve the model. It suggests the development of a data collection process for bushfires that is integrated into existing fire management systems so that information is consistently collected to a minimum standard to support regular and systematic model evaluation.

DELWP's assessment of Phoenix RapidFire

The only way to verify a modelling tool's effectiveness at predicting bushfire spread and impact is to assess its performance against real events. DELWP reconstructed the eight most significant Black Saturday bushfires as part of its Black Saturday Fire Reconstruction Project to understand how accurately Phoenix RapidFire predicts real bushfires. The draft report is currently undergoing scientific review and editing and is yet to be finalised.

Consideration of other modelling tools

One way to address the limitations of a single modelling tool is to overlay the results of multiple tools. Queensland and Tasmania have trialled this approach using both Spark and Phoenix RapidFire.

DELWP advised us that Phoenix RapidFire is currently the only modelling tool available for operational use in eastern Australia. However, DELWP is contributing to the development of other tools through its investment in Fire Prediction Services. Fire Prediction Services is currently developing a national modelling tool and conducting a detailed assessment of Spark.

Fire Prediction Services has not decided which tool will form the basis of the new national modelling tool yet. DELWP advised us that it has not invested in other modelling tools because it is waiting for the outcome of this project.

DELWP, Australasian Fire and Emergency Service Authorities Council, University of Melbourne and the New South Wales Rural Fire Service established **Fire Prediction Services** to maintain and develop Phoenix RapidFire.

Limitations of Phoenix RapidFire's modelling inputs

There are a range of limitations in Phoenix RapidFire's modelling inputs that further impact DELWP's performance reporting against its BP3 target. Figure 2C shows the

limitations of the inputs that DELWP uses to inform its Phoenix RapidFire modelling. DELWP has acknowledged many of the current limitations and advised us that it intends to address these issues through Risk 2.0, which is one of its Safer Together projects.

FIGURE 2C: **Limitations of Phoenix RapidFire's modelling inputs**

Limitation	Assumption	Result	Planned improvements through Risk 2.0
DELWP used a single statewide fire scenario to recommend the residual risk target and uses this to measure its performance against its BP3 target	Black Saturday conditions (FDI 130)	DELWP's modelling to calculate the residual risk level does not consider the likelihood of these conditions occurring in all geographic locations. For example, these conditions are less likely in alpine and coastal regions	DELWP will consider additional weather scenarios (not just the worst-case FDI 130 scenario) and include weather likelihood when modelling risk scenarios
The modelling tool uses the same thresholds to assess if houses will be destroyed when exposed to modelled fire behaviour	All properties across the state have the same fire intensity and ember density thresholds	The tool does not account for some factors known to contribute to the likelihood of houses being destroyed, such as age or construction type	DELWP will include the probability of house loss and predictive variables such as distance to vegetation
The modelling tool does not consider the likelihood of fires starting in different areas, which is not equal across the state	The likelihood of a fire starting is equal across the whole state	The tool does not accurately model the likelihood of fires starting in different areas. DELWP captures data on ignition sources, such as lightening, arson, campfires and powerlines, but does not use it when modelling fire scenarios	DELWP will include ignition likelihood when modelling scenarios
The modelling tool does not consider the likelihood of fires starting in different areas, which is not equal across the state	All fires start five kilometres apart	The tool may underestimate risk because this distance between fires is too widely spaced in some parts of the state to be relevant. For example, in the Mornington Peninsula, where some houses are interspersed with pockets of forest, this assumption could potentially underestimate risk	DELWP will reduce the distance between simulated fire starts
The modelling tool uses address points (based on Vicmap's address dataset) as proxies for house locations	Each address point represents one house	Some address points will include multiple homes and buildings at that address	Improving property location data by using actual building locations

Source: VAGO.

Variable quality of DELWP's datasets

In addition to the issues shown in Figure 2C, the datasets that DELWP uses for its modelling have limitations. This further impacts the reliability of its risk baseline and reported performance against the target.

DELWP's 2015 *Measuring Bushfire Risk in Victoria* document, which explains the process it uses to measure risk, publicly acknowledges that its fire datasets vary in accuracy and need continuous improvement. Without complete and accurate data on how fuel loads influence the spread and severity of fires, DELWP may be inaccurately predicting the impact of bushfire behaviour.

Modelling fuel hazard levels

Phoenix RapidFire calculates fuel hazard levels based on fuel types, DELWP's burn extent and severity monitoring, which shows when an area was last burnt, and fuel accumulation curves.

However, DELWP's fuel type maps and fuel accumulation curves have not undergone any broadscale verification. As a result, their accuracy and precision are not known. This means that DELWP may be overestimating or underestimating risk levels when using Phoenix RapidFire to simulate bushfires.

Modelling fuel hazard levels—Fuel types

Phoenix RapidFire draws on information from a dataset that defines fuel types across Victoria. Each fuel type represents a broad vegetation community. The fuel types used are derived from the 2015 mapping of ecological vegetation classes. While there are in excess of 1 000 different ecological vegetation classes used in Victoria to represent natural vegetation, these were condensed into 23 classes using expert opinion for use in fuel representation.

According to the University of Melbourne's 2019 *Review of Approaches Used for Mapping Fuels for the Determination of Bushfire Risk* report, DELWP did not verify or calibrate the original fuel type dataset before it adopted it. The report specifies a range of potential errors in the fuel type dataset that might impact DELWP's modelled results. It also states that some of these issues could be addressed through the use of data measured in the field. To date, DELWP has collected a large amount of fuel hazard monitoring data but has no process for using it to verify its fuel type dataset.

Modelling fuel hazard levels—Burn extent and severity monitoring

Each year, DELWP plans to map the severity and extent of all bushfires and planned burns in Victoria. Burn severity monitoring documents how severely a fire has impacted vegetation using five fire severity classes ranging from no burn to canopy burn. Burn extent monitoring only documents whether an area was burned or not.

DELWP maps burn extent and severity through on-ground assessments, aerial photography, remote sensing and Google Earth. The University of Melbourne's 2019 report, commissioned by DELWP, states that this approach is best practice. DELWP is not always able to capture quality aerial photos to inform severity data due to the lack of suitable weather conditions, size and location of each burn and variations in vegetation types. This means that DELWP may not be able to collect this information in the same financial year that the planned burn was conducted.

DELWP uses burn extent and available severity data to inform the fire history layer used by Phoenix RapidFire. The fire history layer maps the amount of time since an area was last burned as one of the inputs in its residual risk calculation. DELWP has recognised the need to address regional inconsistencies in the timely capture and quality of fire history data to support accurate and timely reporting across the state. In August 2020, it released a standard operating procedure, post-fire mapping and

Fuel accumulation curves are models in Phoenix RapidFire that predict the amount of time it takes for groups of similar plants to regrow to their maximum hazard levels after a fire.

assessment of extent and severity, to improve the availability and quality of the data used to inform the fire history layer.

Modelling fuel hazard levels—Fuel accumulations curves

DELWP uses fuel accumulation curves in Phoenix RapidFire to inform its modelling. Fuel accumulation curves were determined using a combination of expert opinion and measurements. However, there has been limited evaluation of the accuracy of these curves.

The University of Melbourne's 2018 report, *Fuel Accumulation Pilot Project: An investigation into mapped fuel classifications used for fire risk modelling*, commissioned by DELWP, collated historically collected fuel hazard data and compared observed data with the values that are being used in Phoenix RapidFire. It selected 21 000 fuel hazard assessments, which had been collected in the Midlands fire district over a 20-year period. Each record had information about surface, elevated and bark fuels. It found that the data collected did not match the modelled fuel accumulation curves in Phoenix RapidFire. It suggested that one possible reason for this result may be DELWP's use of untrained seasonal workers to conduct these assessments.

The University of Melbourne undertook further work and used contractors to systematically collect additional data and re-evaluate two fuel types in the study area. However, it found that it could not replicate Phoenix RapidFire's existing fuel accumulation curves. The results indicate that the current approach to modelling fuel hazard levels in the Midlands fire district is likely to be overestimating the amount of fuel present (and the consequent fire risks) and overestimating the efficacy of burning to reduce fuels. The report suggests DELWP's current fuel hazard assessments are not suitable for validating the fuel accumulation curves. This suggests that further work is necessary to establish the appropriate fuel accumulation rates.

Modelling fire behaviour

Phoenix RapidFire also uses nine sub-models that help it model fire behaviour. While the development of Phoenix RapidFire is a significant contribution to bushfire management, given how central the tool is to the assessment and management of bushfire risk in the state, the quality and continual improvement of its underpinning models is essential. We note that as yet, four of the nine key fire behaviour sub-models within Phoenix RapidFire have not been validated through peer reviewed published scientific research. Such research would assist in formally identifying and addressing current limitations, which include:

Sub-models	Description
Fire behaviour model—McArthur MkV model component	Phoenix RapidFire uses this model to determine the rate of spread for all non-grass vegetation types. However, the application of this model to vegetation types other than dry eucalypt species has not been tested or validated. The model also modifies wind inputs through a wind reduction factor, but this has not been validated. The former Department of Sustainability and Environment (now DELWP) conducted a 2012 study that showed the model underpredicts by a factor of three or more, particularly in forests with significant shrubby understorey.

Sub-models	Description
Fire behaviour model—CSIRO grass model component	Although the original CSIRO grassland fire spread model (used for open grasslands and pastures) was validated, changes made to the model, in which fuel load is used instead of the model's original fuel attribute of pasture condition, have not been. In 2018, CSIRO conducted published research showing that fuel load is not important for fire rate of spread over the ranges of fuel load commonly found in southern Australia and the changes make the model inaccurate.
Spotting/ember model	DELWP advised us that Phoenix RapidFire includes models for ember dispersal that no other modelling tool does. The spotting model was calibrated with a single fire.
Convection/heat centres models	These models amplify how fire behaves when it reaches a certain intensity. For example, the way that a fire starts to create its own weather by sucking oxygen up from the ground and creating winds capable of snapping even strong trees in half. These models have not been validated or peer reviewed.

Addressing modelling limitations

DELWP acknowledges the limitations of its existing datasets and agrees that model outputs and its prediction of risk is only as good as its data inputs. It has work underway to improve priority datasets but notes that development and maintenance of datasets is a costly process and requires investment according to the relative importance of datasets to improve model accuracy. It advised us that it intends to address these issues through Risk 2.0 projects shown in Figure 2C and by:

• commissioning an external review of the data, models and assumptions it uses to model bushfire risk

• enhancing fuel datasets by including information such as fuel type, fuel accumulation curves and treatability.

DELWP is also delivering a number of projects to improve its fuel hazard assessments, which will improve the key datasets that underpin Phoenix RapidFire. These projects include:

• using remote sensing technology trials to update and validate fuel accumulation curves

• trialling on-ground and aerial light detection and ranging scanners to collect fuel hazard data and using this data to validate and update fuel accumulation curves.

2.3 How DELWP determined its risk-reduction target recommendation

DELWP's advice to government

In 2015, the government requested advice from DELWP about its risk-reduction target options. In response, DELWP explored the effect of seven scenarios on risk reduction, as calculated against the risk baseline. DELWP used the results from these scenarios to inform its advice to government about implementing a risk-based target.

Scenarios modelled by DELWP to determine the risk-based target

Figure 2D outlines the seven scenarios that DELWP modelled in Phoenix RapidFire to determine the risk-based target.

FIGURE 2D: **Scenarios DELWP modelled to determine the risk-based target**

Scenario	Description
Status quo	Based on what DELWP was able to achieve with its 2015 funding levels and distribution of resources for planned burn activity.
Maximise hectares burned (constrained)	Using bushfire behaviour modelling to show the risk level if the maximum number of hectares of public land were treated with constraints applied. The constraints were: • allocating no more than 50 per cent of funding to any one bushfire risk landscape • treating at least 0.5 per cent of treatable public land in each bushfire risk landscape • treating no more than 10 per cent of treatable public land in each bushfire risk landscape.
Maximise risk reduction (unconstrained)	Using bushfire behaviour modelling to show the maximum potential level of risk reduction achievable without resourcing or other constraints applied.
Maximise risk reduction (constrained)	Using bushfire behaviour modelling to show the maximum potential risk reduction achievable with constraints applied as per the maximise hectares treated (constrained) option.
Hybrid A	25 per cent risk reduction and minimise hectares treated.
Hybrid B1	Treat between 200 000 and 275 000 hectares and maximise risk reduction with constraints applied as per the maximise hectares treated (constrained) option.
Hybrid B2	Treat between 250 000 and 300 000 hectares and maximise risk reduction with constraints applied as per the maximise hectares treated (constrained) option.

Source: VAGO.

Scenarios included inputs that varied the available funding in a range between $20 million and $100 million per year, and parameters that were used as modelling constraints as described in Figure 2D. The outputs produced by the modelling for each scenario included:

• achievable statewide residual risk percentage

• hectares burned below minimum TFI

• hectares burned below mid TFI

• total hectares treated (which includes hectares burned to higher TFI levels than the first two inputs)

• and an operational feasibility score, which was based on the most hectares that DELWP had been able to treat in previous years (255 000 hectares).

When modelling the impact of these scenarios, DELWP assumed no burning had ever occurred in the landscape. It then modelled each scenario over 100 years to understand the long-term risk-reduction benefits of treatment levels within each

scenario. It is important to note that this modelling does not show how much risk reduction DELWP can achieve for one year of spending.

DELWP randomly selected burn units to complete different levels of treatment. For example, 1 per cent or 2 per cent of public land. It then ran 10 random simulations for each treatment level. DELWP used the average of these to plot the cost and risk-reduction relationship curves, which Figure 2E shows.

Regions divide their landscape into fuel management zones. Within each zone there are smaller geographic areas for conducting planned burns, called **burn units.**

FIGURE 2E: **Relationship between cost and risk reduction**
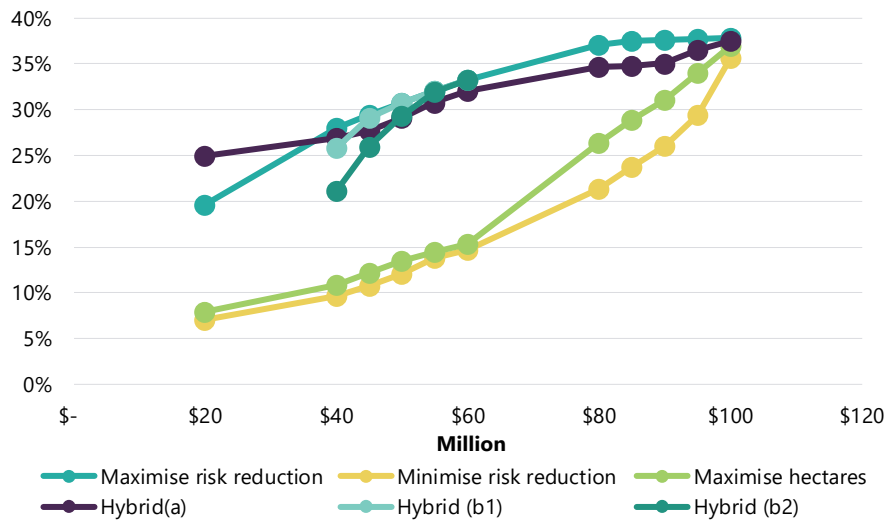
Source: VAGO, based on DELWP data.

One of the scenarios that DELWP modelled aimed to maximise the number of hectares treated. As Figure 2E shows, its modelling of this scenario achieved less risk reduction than the maximise risk reduction, hybrid (a), hybrid (b1) and hybrid (b2) scenarios. This supports the move away from a purely hectare-based target to a risk-reduction approach, where the model effectively assigns reduced fuel loads (mimicking planned burn activity) to places where they will have the greatest impact on reducing house loss. Figure 2E also shows that four of the scenarios intersect at around 30 per cent risk reduction and $50 million, which was DELWP's 2015 funding levels for planned burns. This point also aligned with a good operational feasibility score for DELWP, which indicated that it could realistically complete that level of work. DELWP explained that this was how it selected 70 per cent to recommend to government as the residual risk target.

After modelling these scenarios, DELWP convened an expert reference group that included similar membership as the Victorian Royal Commission's expert reference panel to propose modelling a risk-based target using Phoenix RapidFire instead of using the hectare-based burn target. The reference group agreed that this approach would be more effective, but it did not review or endorse DELWP's recommended residual risk target.

DELWP's advice to government about the risk-based target could have been more complete as:

- While DELWP assessed what the maximum risk reduction would be without funding constraints, it did not communicate the impact of these results. It did not compare what it would cost to achieve alternative targets and identify funding gaps. For example, it was not communicated that the modelling also indicates that a 33 per cent residual risk reduction may be achieved with a $60 million spend. DELWP advise that this level of activity had a lower operational feasibility score. However, we note that DELWP's operational feasibility scoring was based on past performance, which while in part may have been limited by available burn windows, would also largely be a function of funding levels.

- By basing the target on modelling over a 100-year period, DELWP did not provide the government with information on what a year's worth of funding should achieve.

- DELWP did not identify that its recommended approach did not yet fully address IGEM's recommendation to incorporate all fuel management activities.

- DELWP did not estimate the benefit–cost ratio of the relationship between the cost of planned burns and the benefits of their risk reduction to rank and assess options and support its recommendation.

- DELWP did not explain the limitations of Phoenix RapidFire.

Meeting IGEM's recommendations for measuring risk reduction

IGEM's risk target recommendations intended that the measure incorporate the risk reduction impact of all fuel management activities, not just planned burning. As yet, the statewide residual risk measure includes planned burns, but does not incorporate other fuel management activities. Safer Together commits to doing this by the end of 2020.

DELWP is currently undertaking a range of projects to achieve this. In 2019, DELWP announced a project to measure the impact of its mechanical treatments on residual risk levels by October 2020. In addition, DELWP and CFA are completing a research project to examine how they can use Phoenix RapidFire to model the impact of roadside vegetation management, which includes roadside burning and slashing. By December 2021, DELWP also aims to:

- develop an updated residual risk measure
- recommend a new risk target for measuring the efficiency of its fuel management program
- develop additional measures that will model residual risk to additional values, such as critical infrastructure, water catchments and fire size.

This work supports IGEM's recommendation for a more holistic measure for bushfire risk reduction. However, this will take longer than the 2020 time frame aimed for in Safer Together.

Limitations of the 70 per cent residual risk target

The statewide 70 per cent residual risk target is operationally useful to DELWP in making informed decisions about where planned burning should occur to achieve the greatest risk reduction. This represents a significant improvement against the prior hectare-based target, which could be achieved by undertaking planned burning in areas where it may contribute little to actual risk reduction. However, the current DELWP BP3 measure and target still have limitations for holding DELWP accountable

for its performance in reducing bushfire risk, and providing a comprehensive understanding of the impact of bushfire risk reduction activities. This is because reported results against the measure:

- represent a modelled risk reduction of 30 per cent, not an actual achieved risk reduction. While this is necessary, unlike most BP3 measures, it requires the user to understand the caveats of the modelling tool and methods that generate the result
- are achieved through a combination of planned burns and naturally occurring bushfires
- exclude the effectiveness of other fuel management and risk-reduction strategies in reducing the statewide risk level.

Due to analysis DELWP commenced during this audit, as of 30 June 2020, DELWP can use its modelling to separate the impact of its planned burn program from naturally occurring bushfires. It intends to report results in this way in its future reporting.

Regional targets

Achieving an average 70 per cent residual risk level does not mean that everywhere in the state is at or below the target. While the statewide residual risk level may be 70 per cent or lower, some local areas may still have a much higher residual risk level, even after treatment. DELWP communicates regional risk levels on its website.

DELWP sets regional targets that contribute to it meeting the 70 per cent statewide target. DELWP based its regional targets on:

- the level of modelled bushfire risk within each region
- the ability of each region to deliver planned burns (some areas have less land that can be burned).

Figure 2F shows DELWP's regional targets.

FIGURE 2F: **DELWP's regional residual risk targets**

Region	Residual risk target (%)
Barwon South West	60
Gippsland	71
Grampians	70
Hume	69
Loddon Mallee	75
Port Phillip	85

Source: VAGO, based on DELWP data.

Figure 2G shows the number and percentage of at-risk houses that would be hypothetically saved if each region meets its target. DELWP based this estimate on modelling in Phoenix RapidFire.
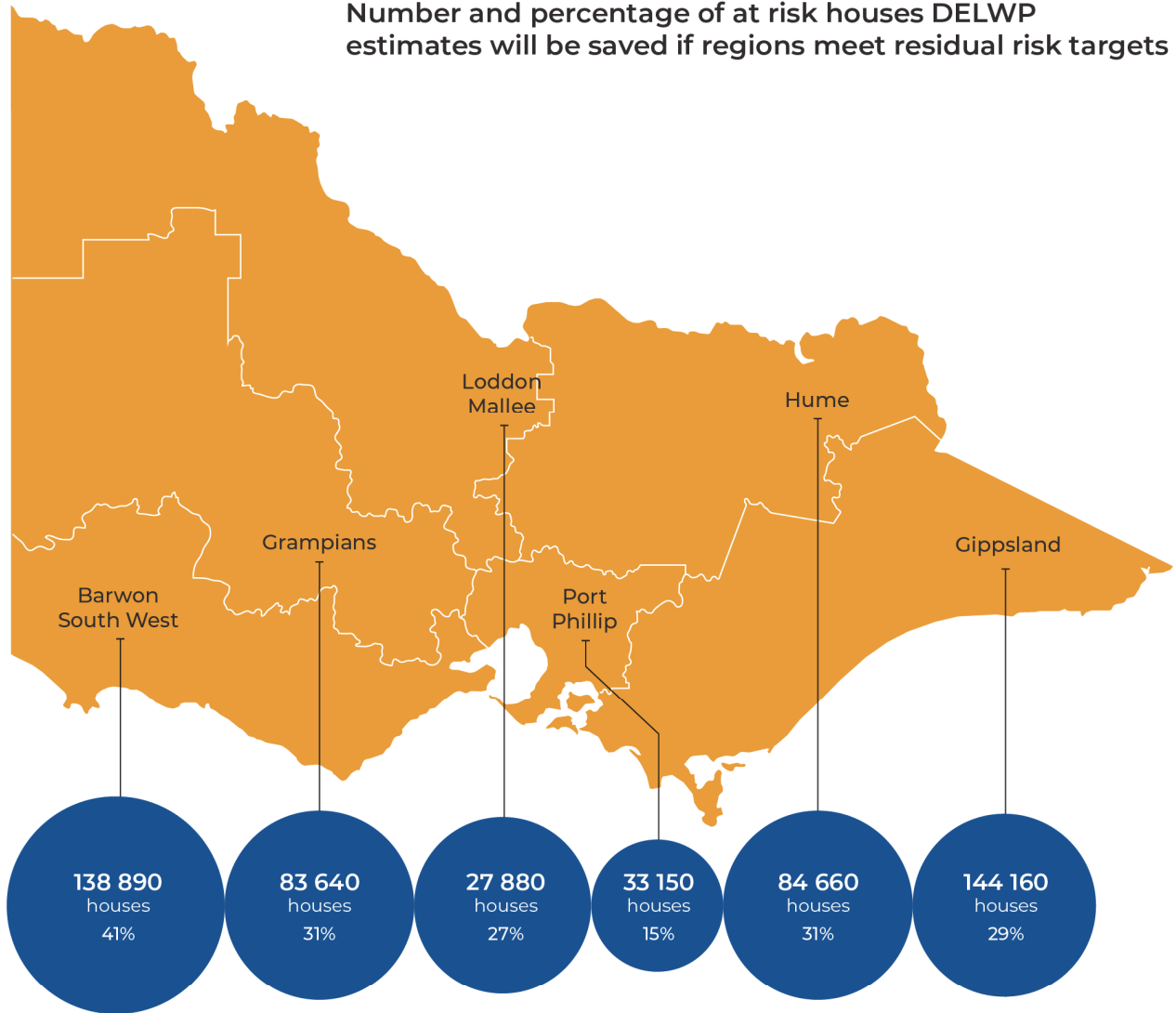
DELWP distributes fuel management resources to regions based on the number and locations of planned burns they need to conduct to achieve their specific targets. Each region uses these resources to develop their long-term fuel reduction plans.

DELWP set these targets in 2016 and has updated them only once in June 2019 for the purpose of realigning its previous seven bushfire risk landscapes to its six administrative regions. DELWP advised that the targets are intended to be long-term, noting that regional bushfire levels are relatively stable as many of the contributing factors for bushfire risk, such as population, fuel type and climate change gradually. However, fuel loads can change more quickly, resulting in significant changes to the risk profile in a particular region, and regional risk targets were also set without consideration of ignition likelihood, which is not equal in all areas. For these reasons, risk targets may warrant more periodic reconsideration.

FIGURE 2G: **Number and percentage of 'at-risk' houses saved**

70%
statewide residual risk target

= 510k
houses **saved** in simulation

Number and percentage of at risk houses DELWP estimates will be saved if regions meet residual risk targets

Loddon Mallee

Hume

Grampians

Gippsland

Barwon South West

Port Phillip

| 138 890 houses 41% | 83 640 houses 31% | 27 880 houses 27% | 33 150 houses 15% | 84 660 houses 31% | 144 160 houses 29% |

Contribution of effort by region to 30% risk reduction

Region	Percentage
Barwon South West	8.17%
Gippsland	8.48%
Grampians	4.92%
Hume	4.98%
Loddon Mallee	1.64%
Port Phillip	1.95%

Source: VAGO.

2.4 Reducing risk on public and private land

At an operational level, DELWP manages planned burns on public land for which it is accountable under the *Forests Act 1958* and CFA manages them on private land.

As shown in Figure 2H, DELWP and CFA use three levels of fuel management planning to meet their planned burn target and protect life, property and environmental values.

FIGURE 2H: **Three levels of fuel management planning**

1. Strategic — Bushfire management strategies direct regions' fuel management strategies

2. Operational — Joint fuel management plans set out the planned burn program for the following three years

3. Tactical — Individual burn plans are prepared for each burn listed in joint management plans
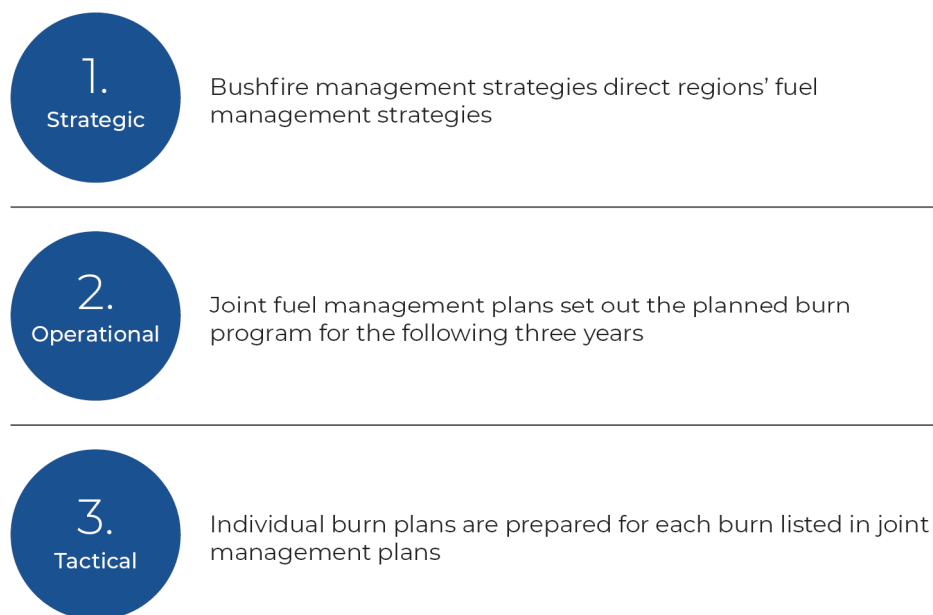
Source: VAGO.

Strategic planning—bushfire management strategies

DELWP and CFA, in partnership with local government, updated each region's bushfire management strategy in March 2020 in consultation with the community.

Each region's management strategy outlines the long-term fuel management approach they will undertake to:

• minimise the impact of major bushfires on people, property, infrastructure and economic activity

• maintain and improve the resilience of natural ecosystems.

Protecting one value can damage another, so these objectives are sometimes competing.

At a statewide level, DELWP's strategic planning is incomplete.

DELWP's strategic planning …	As a result …
• focuses on planned burning and to a far lesser extent on other available treatments to reduce bushfire risk.	DELWP misses out on a suite of solutions that could reduce bushfire risk in areas where planned burning is more difficult or not possible.
• for private land is constrained by current legislative powers • uses less sophisticated tools to plan to address bushfire risk on private land • identifies engagement areas to prioritise potential areas of private land for future treatment without specifying objectives.	DELWP's mitigation planning is more developed for public land, which represents 40 per cent of the state. DELWP advised us that this approach is intended to start a conversation about fuel management with landowners by prioritising areas.

There are also inconsistencies in DELWP's approach at a regional level:

DELWP's regions …	As a result …
• inform DELWP's bushfire management strategy priorities and planned burn activities through their own regional risk assessments, but use inconsistent processes to do this • used different selection methods to identify engagement areas to prioritise potential areas for treatment on private land.	all regions may not be using the most optimal process.

Regional risk assessments and priorities

In each region, EMV, DELWP, CFA and local government have collaborated with communities to conduct risk assessments and tailor their bushfire management strategies to reflect local knowledge and community values. For example, Barwon South West's priority to protect red-tailed black cockatoos is driven by values specific to the community and local environment and impacts their fuel management actions.

While the variation in approach reflects adaptations made by regions to suit specific landscape characteristics as well as the piloting of local innovations, it has resulted in each region using different factors to identify areas of high bushfire risk.

Figure 2I compares different factors that DELWP's regions use to complete their risk assessments.

FIGURE 2I: **Various additional risk-assessment approaches across DELWP regions**

DELWP region	Ignition likelihood	BMO and BPA	FAME
Barwon South West	✓	✗	✗
Gippsland	✓	✗	✓
Grampians	✓	✗	✗
Loddon Mallee	✓	✗	✓
Port Phillip	✓	✗	✓
Hume	✗	✓	✓
Regional total	**5/6**	**1/6**	**4/6**
Statewide	✗	✗	✗

Source: VAGO.

In addition, while all regions consider FDI likelihood and regional weather data in their risk assessments, some use the statewide DELWP guidance when applying these factors and others use regionally developed products.

DELWP reviews its regions' bushfire management strategies to ensure they meet the minimum standards in the strategic planning guidance before the chief fire officer approves them. However, DELWP has not assessed the additional risk assessment approaches regions are using to determine which are optimal. Adopting a more structured evaluation process to identify the optimal approach to regional risk assessment would help drive continuous improvement.

Innovations and improvements

We observed some good regional innovations that have informed better planned burn treatments. For example, DELWP Barwon South West applies a tessellated risk score across each geographical burn unit to highlight which parts pose the highest risk. In some cases, they found that only a small part of a burn unit posed risk. This knowledge allows the region to better target its planned burns to maximise risk reduction.

Tessellation is the process of breaking down the surface of a 2D image into simpler polygons, such as triangles or quadrilaterals.

In another innovation, DELWP Gippsland uses a traffic light tool to ensure that its bushfire management strategy objectives flow into their operational joint fuel management plan.

DELWP's Safer Together programs are also improving other risk treatments. Gippsland and Loddon Mallee are piloting a risk-based approach to identifying priority areas for ignition prevention and suppression programs as part of their current strategic planning processes.

DELWP shares regional innovations through statewide workshops.

Prevention of Ignition Pilot

A key feature of this pilot is the development of priority prevention areas using Phoenix RapidFire to estimate bushfire spread and consequence, ignition and weather likelihood, resource availability and travel time of resources to attend a fire and

likelihood of successful suppression. Phoenix RapidFire identifies where the highest consequence fires are most likely to occur due to human activities, such as areas prone to regular incidences of campfire escapes and arson. This means that DELWP can target these areas with programs to reduce the likelihood of future ignitions.

First Attack Suppression Pilot

This project included classifying all tenures in each region into priority suppression areas using the same factors as the prevention of ignition pilot. The pilot focused on identifying the most successful strategies for fire detection time, identifying, maintaining or constructing priority strategic access roads, placement of firefighting resources across the region, and aircraft and water availability to maximise the effectiveness of first attack suppression.

This is the first time a risk-based approach has been used to identify priority areas for fire suppression or ignition prevention programs. These pilots will assess the effectiveness of new tools and processes before DELWP implements them statewide.

Environmental considerations in strategic planning

As part of DELWP and CFA's strategic planning, regions must make complex decisions and trade-offs to manage multiple competing values and objectives. To support this complex decision-making, there are opportunities to continue to improve DELWP and CFA's understanding of the environmental impacts of their planned burns.

To support both of its objectives in the Code, DELWP needs to ensure that its planned burns avoid adverse impacts on environmental values wherever possible, and minimise these impacts where it is not possible to avoid them altogether.

While developing their current bushfire management strategies, all DELWP regions modelled outcomes for both flora and fauna under alternative fire management scenarios. To assist regions in making these decisions, DELWP's Arthur Rylah Institute, the University of Melbourne and La Trobe University collaborated to develop FAME. This module integrates existing ecological data and models it in a single platform.

DELWP advised us that the module will help regions to more effectively and transparently consider ecological values when developing their bushfire management strategies. So far, DELWP's Gippsland, Port Phillip, Loddon Mallee and Hume regions have trialled this module to understand the environmental risks of their planned burns.

Environmental considerations in strategic planning—Conservation action plans

PV has developed conservation action plans that define and prioritise conservation strategies for important Victorian landscapes. However, DELWP's bushfire management plans do not refer to these. As a result, its operational joint fuel management plans do not identify how specific regions can avoid conflicting with a conservation action plan's objectives. DELWP advised us that the timing of the conservation action plans has prevented it from explicitly considering them in its current strategic planning process.

Environmental considerations in strategic planning—Tolerable fire intervals

DELWP also risks its planned burns hindering its environmental goals as its assessment of environmental risk relies on outdated data about the TFI of various native flora.

If vegetation is repeatedly burned below minimum TFI, it is at risk of permanent change in species composition or eventual vegetation type. DELWP considers TFI when deciding where and when it burns. However, DELWP does not have a process to ensure that it has the most up to date TFI data. In 1998, DELWP established a fire ecology working group, which included DELWP and PV staff and academic experts. It made recommendations to DELWP about using scientific research to update key datasets, such as the TFI of plant species. In 2016, DELWP disbanded the working group. In 2018, it established the Statewide Ecosystem Resilience Monitoring program that will enable it to update the TFI of 11 priority vegetation types by 2029. DELWP has allocated a budget to deliver the program for three of the 11 priority vegetation types but needs to secure funding for the remaining six (see Section 3.5 for further details). Without up-to-date data, DELWP risks further damaging already vulnerable vegetation.

Figure 2J describes research into the TFI of the Hairpin Banksia, which demonstrates the need for updated TFI data.

FIGURE 2J: **Research into the minimum TFI of Hairpin Banksia case study**

In June 2017, DELWP's Arthur Rylah Institute, DELWP and PV issued a report on fire planning for *Banksia Spinulosa var. cunninghamii* (Hairpin Banksia).

This research found that Hairpin Banksia need at least 14 years to reach reproductive maturity and develop seed. However, DELWP currently has a minimum TFI of eight years assigned to this species.

Despite these findings, DELWP has made no changes to the minimum TFI for Hairpin Banksia.

Source: PV.

Operational planning—joint fuel management plans

In 2018, each DELWP region, in consultation with CFA, developed a rolling three-year joint fuel management plan. These plans document the priority fire management operations that CFA and DELWP's regions plan to conduct on public and private land. They update their plans annually and share them with the public. The joint fuel management plans demonstrate an improvement in inter-agency engagement and planning, which is consistent with Safer Together's aims.

DELWP and CFA's joint fuel management plans do not include all burns on private land. This is because CFA is responsive to requests by landowners and therefore cannot always put all its burns on its forward plan. It is often approached by private landowners or other land managers, including VicRoads, VicTrack and water authorities, to help them conduct risk-reduction treatments.

Cost considerations

At this operational level, the selection of burns on DELWP and CFA's joint fuel management plans are not determined on a cost–benefit basis. Some burns are more expensive than others. For example, burns close to assets are more expensive than those in uninhabited bushland. DELWP advised us that its reasons for planning particular burns vary and are not cost-driven. However, by not using cost as an input in its decision-making, DELWP may not be optimising its resources. While DELWP records the cost of completed burns, it does not use this cost data to inform its future burn program.

Flexibility

DELWP has contingency arrangements in the event that planned burns are unable to go ahead due to unforeseen weather conditions and moisture levels. DELWP will bring forward planned burns from years two or three of the joint fuel management plans to substitute for planned burns in year one that could not go ahead, for example due to unsuitable weather conditions.

Testing the planned risk reduction

Each DELWP region models the expected risk reduction from its full joint fuel management plan to predict whether its planned burning activities will achieve its regional risk target. Regions include this in their annual fuel management reports.

DELWP's state risk team then models all planned burns from the six regional joint fuel management plans using Phoenix RapidFire to predict if it will achieve the statewide residual risk target.

DELWP publicly reports the modelled risk reduction it expects to achieve if it delivers its joint fuel management plans through its residual risk reporting, which shows maximum and minimum risk outcomes (excluding future bushfires). This gives the public an understanding of the expected impact DELWP's planned burn program will have, if delivered, on risk levels.
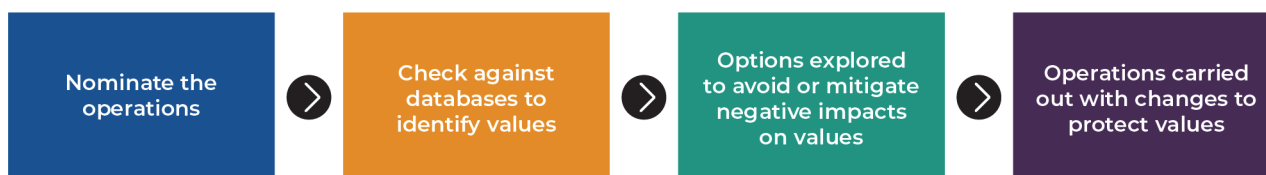
Tactical planning—individual burn plans

Regions develop a burn plan for each planned burn in their joint fuel management plan.

Values checking on public land

As part of their tactical planning process, DELWP's regional and district teams have specialist officers with environmental or cultural heritage credentials who conduct values check (see Figure 2K). They check areas where burns are planned to identify what values exist that may be impacted by the proposed activity and what measures should be applied to protect these assets.

FIGURE 2K: **DELWP's values-checking process**

| Nominate the operations | ❯ | Check against databases to identify values | ❯ | Options explored to avoid or mitigate negative impacts on values | ❯ | Operations carried out with changes to protect values |

Source: VAGO.

In September 2019, DELWP surveyed its own staff involved in its values-checking processes and produced a report on its findings.

The survey responses showed that some respondents lacked confidence in the process due to challenges with the consistency and availability of DELWP's data, unrealistic workloads and time frames, and variations across the state. Other themes included DELWP's lack of capacity to complete onsite assessments and not monitoring areas after burns to assess the effectiveness of its mitigation measures. Staff we interviewed echoed these survey findings.

The report also found that DELWP's lack of a clear public-facing narrative about its values-checking process has resulted in a significant lack of public trust in its ability to protect and manage values.

The report includes 21 recommendations with seven priority areas for DELWP to invest in. The report notes that five of the seven priority areas have significant resource implications. However, if resourced appropriately, they would create greater efficiencies and certainty in the values-checking process. DELWP has developed a draft values-checking legislation handbook, which shows that it has made progress on one recommendation. However, it has not identified timelines for the other six priority recommendations or outlined when it plans to implement the remaining 14.

Without a clear plan, the issues identified in DELWP's environmental values checks will remain unaddressed. Consequently, its fuel management activities may have negative environmental impacts. DELWP advised us that it is yet to review and endorse the values-checking report. It will develop an implementation plan once it has done this.

Values-checking process on private land

CFA's capacity to conduct environmental and cultural heritage values checks and harm mitigation is limited. CFA has vegetation management officers, who are responsible for conducting values checks. As they are not specialist environmental or cultural officers, CFA has two state environmental officers and one cultural heritage officer to support them if required and has developed detailed guidance for them to follow.

CFA's burn planning and approval process involves the planner referring the burn proposal to the state environment or cultural heritage officers if they need specialist advice. However, CFA staff stated that these specialists do not always have the capacity to assist them. Additionally, only one environment officer position is ongoing across the state—the other two staff are only funded until 2021 through a Safer Together project.

CFA acknowledges that its values-checking capability is limited and needs to be expanded. It advised us that it is preparing a business case to transition the two additional officer positions to fixed roles.

2.5 How CFA and councils assess risk on private land

CFA has access to Phoenix RapidFire. However, it does not have enough skilled staff who can use it to identify high-bushfire-risk areas and prioritise risk-reduction treatments.

Councils do not use a modelling tool like Phoenix RapidFire. However, Murrindindi Shire Council (Murrindindi) advised us that DELWP's Port Phillip region team provide modelling on request.

Victorian Fire Risk Register—Bushfire

Instead of a modelling tool, CFA and councils use CFA's Victorian Fire Risk Register— Bushfire (VFRR-B) to calculate bushfire risk on private land. The VFRR-B is a useful asset register to help agencies prioritise risk-reduction treatments.

Using the VFRR-B, CFA and councils map assets, such as human settlements and economic, cultural or environmental values, using location points. They can then assign each point with a risk level and plan treatments to reduce the risk.

This tool supports and informs bushfire planning and decision-making for several agencies, including:

- the Department of Education and Training, who uses it to identify schools that are vulnerable to bushfire risk
- councils, who use it to inform their emergency management plans and municipal fire management plans
- EMV—the State Control Centre uses it when responding to bushfires to identify important community assets to protect.

Data limitations

CFA contacts each municipal fire management planning committee annually to encourage them to review their VFRR-B data. However, these committees are not required to do this. Municipal fire management planning committees are made up of representatives from each municipality including, but not limited to, council or alpine resort management board, Victoria Police, Victoria State Emergency Service, and regional CFA, PV and DELWP offices.

The municipal fire management planning committee associated with each audited council has updated its VFRR-B data on human settlement and economic assets in the last two years, but CFA advised that other committees do not prioritise these updates. For example, CFA reported that one council in a high-bushfire-risk area has not updated its asset data since 2015.

Further, municipal fire management planning committees inconsistently identify cultural and environmental assets. CFA recently decommissioned the environmental assets data component of the VFRR-B because councils do not use it. In the tool's 10-year life, only 90 environmental assets had been registered. Instead, CFA intends to rely on other sources of environmental data, such as the Victorian Biodiversity

The **Victorian Biodiversity Atlas** maps the locations of recorded species in Victoria and provides information, including their conservation status. It currently contains more than seven million records collated from many different data providers.

Atlas. This is consistent with the way that DELWP conducts its environmental values checks.

In 2012, CFA added cultural heritage assets to the VFRR-B using a central cultural risk register, which is held by the Department of Premier and Cabinet (Cultural Heritage Victoria). CFA has not updated the cultural data component of the VFRR-B since 2012 due to concerns of the Victorian Aboriginal Heritage Council regarding public access to heritage databases. The Victorian Aboriginal Heritage Council informed CFA in 2015 that its preference is for organisations to engage with local registered Aboriginal parties to discuss their activities. CFA is now developing working relationships with these groups to discuss its activities so brigades are aware of culturally significant sites within their areas.

Risk assessment limitations

CFA has developed guidance to help councils identify and assess risks to assets using the VFRR-B. However, this guidance does not provide enough detail for municipal fire management planning committees to assess the bushfire risk to specific assets. Rather, it broadly explains which components assessors should consider when undertaking risk assessments, such as bushfire likelihood and consequence.

While municipal fire management planning committees have access to guidance on how to assess components that contribute to consequence, such as slope and hazard, they do not have guidance on how to assess components that contribute to likelihood, such as ignition and frequency. CFA advised us that Phoenix RapidFire has the capacity to provide a finer scale analysis of consequence than VFRR-B.

Audited councils advised that even with guidance, their risk assessments are subjective. Consequently, each municipal fire management planning committee assesses risk levels for similar assets across their local council areas differently.

Combined, these data quality and risk assessment issues mean that the VFRR-B lacks completeness and currency. This reduces its usefulness, and means that CFA, councils and other agencies who use it potentially lack some understanding of risk while planning their risk-reduction treatments.

Benefits of on-ground inspections

The audited councils conduct the required on-ground inspections to assess bushfire risk levels. The benefits of these on-ground inspections include:

- each council's municipal fire prevention officer (MFPO) gains a clear understanding of actual vegetation types and growth in their local council area
- the ability to assess individual properties' risk levels, which is something that modelling tools such as Phoenix RapidFire cannot do.

CFA runs an annual voluntary three-day course for MFPOs, which covers risk-assessment training. However, CFA acknowledges that more could be done to help councils build their capacity and limit the subjectivity of their assessments.

The audited councils' on-ground inspections vary in regard to the extent of properties inspected as shown in Figure 2L.

FIGURE 2L: **Properties inspected by audited councils in 2019–20**

Council	Properties inspected	Properties in council as at June 2020
Whittlesea	94 333	96 992
East Gippsland	18 342	32 086
Murrindindi	2 000	10 230

Note: All audited councils inspect individual properties twice a year.
Source: VAGO, using council data.

City of Whittlesea's (Whittlesea) MFPO advised us that they drive down every street twice during the bushfire season to assess property fuel loads. The first inspection is in October and the second in January.

East Gippsland Shire Council (East Gippsland) and Murrindindi undertook far fewer inspections compared to Whittlesea. They explained that this is because their council areas are larger, populations are lower and property sizes are bigger, so inspecting each property takes much longer. They also advised us that they prioritise inspecting high-risk rural properties over lower risk houses within townships and the properties they do inspect are inspected biannually.

2.6   Agency engagement with high-bushfire-risk communities

Safer Together's Community First initiatives are helping DELWP, CFA, councils and other responsible agencies better engage with communities to reduce risks. These initiatives are funded until June 2021.

FIGURE 2M: **Community First initiatives**

Initiative	Description	Outcomes
Community Based Bushfire Management	This initiative encourages communities to take the lead in bushfire risk reduction in their locality. All bushfire stakeholders are invited to come together to discuss local values, experiences and strengths and to determine means by which to reduce risk at a community scale. Twenty-one communities are currently participating in this initiative, with successful examples including Daylesford/Hepburn and Briagolong. Four of these communities commenced the initiative in 2016 and are in their sixth year of the program.	An external consultant's review in July 2019 highlighted that this initiative has been successful at: • building community resilience • connecting and establishing relationships between community members, agency personnel, local government and others • building an understanding of, and incorporating community values, in localised bushfire management.
Community Risk Understanding	This project supports DELWP, CFA and councils to communicate complex fire science concepts to better communicate risk to communities. The outcomes from this project aim to enable communities to better prepare, respond to and	This project has not finished yet, so DELWP has not evaluated it. Its progress so far includes completing a literature review of behaviour change work in emergency management around the world. This

Initiative	Description	Outcomes
	recover from fire events, and encourages communities to change their personal behaviour and strengthen connections within their communities which lead to a decrease in personal and community risk.	review found that engagement issues relate to how much a community trusts the agency who is delivering the message rather than the information it communicates. Next steps include selecting two specific behaviour changes to implement in a selection of communities and then testing their effectiveness.
Building Capacity and Capability	This project aims to train agency, local government and volunteers in how to effectively engage with their communities, with a view to decreasing risk and assist in place-based planning processes.	This project is in the final stages of impact evaluation.
Strengthening Local Government Partnerships Project	This project focused on supporting Victorian councils to be more involved with community engagement and strengthening partnerships with agencies to allow for greater council involvement in risk reduction activities.	Eight councils received funding to test news ways of working with communities and agencies to reduce bushfire risk. On the basis of project outcomes, the project was extended to a second funding round.

Source: VAGO.

As these initiatives progress, more communities will be participating and making decisions about managing their bushfire risk.

Other agencies regularly engage with high-risk communities through programs such as:

- Community Fireguard, which is run by CFA
- Melbourne Fire and Emergency Program, which is run by PV.

Cultural burning

Cultural burning on public land

In May 2019, the Minister for Energy, Environment and Climate Change officially launched *The Victorian Traditional Owner Cultural Fire Strategy* (the Strategy). Victorian Traditional Owners authored the Strategy with the support of a partnership between the Federation of Victorian Traditional Owner Corporations, DELWP, PV and CFA. The Strategy calls for Traditional Owners to play a greater role in managing Victoria's bushfire risk and outlines a framework for effective Traditional Owner-led cultural fire management. It states that using fire to realise culturally meaningful objectives will also reduce bushfire risk. Historically, Traditional Owners in Victoria used fire to manage and care for Country. However, European colonisation disrupted and restricted this practice.

Cultural burns have a range of social and ecological benefits. They help Traditional Owners reconnect with Country and ancestral practices. Cultural burns are also good land-management practices because they promote fire-dependent species, which rely on fire to establish, grow, persist, or regenerate.

By definition, cultural burning is an activity that is led at all stages by Traditional Owners. It gives Aboriginal groups the opportunity to practice their culture in a contemporary context, through holistic management of Country. Fire is therefore the

tool used to manage Country rather than a historical prescription that can be applied for general fuel management purposes. Accordingly, careful consideration must be given to traditional ecological knowledge and intellectual property rights.

As shown in Figure 2N, the Loddon Mallee region actively promotes and prioritises cultural burns on its joint fuel management plan.

FIGURE 2N: **Woolshed Swamp cultural burn case study**

As part of this audit, we observed a cultural burn performed by the Dja Dja Wurrung and Barapa Barapa Traditional Owner groups at Woolshed Swamp near Boort.

To conduct this burn, DELWP and PV relied on the expertise of two existing employees from the Dja Dja Wurrung community, and contracted other Dja Dja Wurrung and Barapa Barapa community members to conduct the burn. All burn participants have done their burn qualifications with DELWP. They wore protective gear and followed DELWP's burn guidelines. The objective of this burn was to kill an invasive grass species while encouraging rare and culturally important native vegetation to grow.

Source: VAGO and DELWP (image).

The strong personal relationships between the Loddon Mallee region, PV and the Dja Dja Wurrung and Barapa Barapa people has encouraged the region to prioritise

cultural burns. DELWP's Barwon South West and Grampians regions are also working with Traditional Owners.

There is growing recognition in Victoria of both the value of and need for Traditional Owners' expertise to manage Country. The practice of Traditional Owners leading and partnering in land-management activities, including fire management, is increasing in certain parts of the world.

The 2017 *Government Response to the Environment and Planning Standing Committee's Inquiry into Fire Season Preparedness* states that the Victorian government supports the Strategy's development as well as using cultural burning practices under the Safer Together program. The government has committed to increase its collaboration and partnership with Traditional Owners across the state to support cultural fire in line with the principles and strategic priorities set out in the Strategy.

Cultural burning on private land

CFA provided two key examples of brigades that assist Traditional Owners to reintroduce fire into the landscape. However, this is not a common practice across the state.

Since 2014, CFA annually sends staff and volunteers to fire workshops in Victoria and interstate to learn about Aboriginal and Torres Strait Islander cultures and their use of fire to care for Country. CFA's Little River brigade has been involved in supporting the Wathaurong people, who have been using fire to protect cultural values, by removing non-native plant species using fire at Wurdi Youang.

In the state's north-east, CFA staff and local brigades have been involved in piloting burning in cool moist conditions in conjunction with the Taungurung people at the Euroa Arboretum and at a Trust for Nature property at Gobur. Both projects aim to restore and protect native grasslands, which include fire dependent species.

3.
Impacts of fuel management

Responsible agencies rely on complex planning and operational expertise to design and deliver their planned burn programs and other fuel management activities. They dedicate significant resources to these programs with the aim to reduce bushfire risk while also protecting ecosystems.

This chapter discusses:

- DELWP's planned burn delivery on public land
- DELWP's non-burn treatments on public land
- CFA's planned burn delivery on private land
- Tenure-blind burning across public and private land
- Councils' delivery of non-burn risk treatments on private land
- How responsible agencies monitor and evaluate the impact of fuel management activities on bushfire risk reduction and the environment

3.1 Conclusion

There is a clear and established link between fuel reduction, particularly through planned burns, and reducing bushfire risk. However, DELWP's methods for assessing, monitoring and reporting on the impact of its planned burn program and non-burn treatments do not allow the community to know the impact of these efforts.

DELWP does not currently differentiate between the impact of its planned burns from that of bushfires in its public reporting, but intends to do so in the future based on recent analysis it conducted that separates these impacts. This analysis found that over 11 years from 1 July 2009 to 30 June 2020, planned burns accounted for 66 per cent of annual risk reduction on average, compared to 34 per cent due to bushfires.

With the exception of some isolated case studies, DELWP does not know the effect of its burns on native flora and fauna. It also cannot compare the cost-effectiveness of different types of burn approaches with other non-burn treatments because it does not collect the necessary data to do so.

More broadly, there is a limited focus on strategically managing risk on private land compared to public land, and more limited resources available to support fuel reduction on private land. This means that there is not a truly consistent approach to addressing bushfire risk across the state.

While all agencies are committed to and working towards improving bushfire risk reduction, these issues in combination show that there is much to do to ensure an approach to fuel management that is commensurate with the very significant and increasing risk that bushfire poses to Victoria.

3.2 Fuel reduction on public land

DELWP's prioritisation process

DELWP has an effective process to identify and prioritise burns with the greatest potential for risk reduction. However, because DELWP does not systemically document why it does not complete some planned burns, it is not possible to determine if DELWP's actual burn activity consistently reflects this prioritisation.

Once a region has completed its joint fuel management plan, DELWP identifies which burns to prioritise. DELWP's prioritisation process combines two key elements—burn importance and burn opportunity.

Burn importance is informed by an assessment of how much a burn will reduce risk levels, as well as local knowledge, community input and other operational factors.

Burn opportunity refers to the window of time that DELWP has to conduct each burn, which is influenced by constraints such as weather conditions, soil moisture levels and specific smoke trajectories.

To prioritise a burn, DELWP combines its importance and opportunity factors to rate it as:

- very high
- high
- normal.

DELWP uses burns rated as very high and high to make up its statewide priority burn list. DELWP notes that delivery of priority burns is often more difficult as these areas are generally close to homes and community assets.

Final selection and delivery of burns

During the planned burn season, DELWP's chief and deputy chief fire officers meet daily to prioritise burn delivery. They use the burn priority ratings in joint fuel management plans to allocate resources.

The following factors also influence DELWP's final selection of which burns to deliver:

- state prioritisation
- current and future weather forecasts
- fuel condition and availability
- resources
- safety considerations.

DELWP introduced its prioritisation process in 2017–18. This process prioritises fuel reduction burns on its joint fuel management plans. Figure 3A shows how many planned burns DELWP delivered over the past three years.

FIGURE 3A: **Delivery of planned burns by priority for the 2017–18 and 2019–20**

Burn by priority	2017–18	2018–19	2019–20
Priority burns			
Planned	71	76	139
Ignited	43	31	60
Normal burns			
Planned	460	329	327
Ignited	192	145	98
Total planned burns	**531**	**405**	**466**
Total ignited burns	**235**	**176**	**158**
Total percentage of burns completed	**44%**	**43%**	**34%**

Note: The priority burn program does not include all burns included on the joint fuel management plans. Regeneration and heap burns are excluded.
Source: VAGO, based on DELWP data.

Public reporting of area treated compared to area burned

DELWP develops a burn plan for each planned burn on its joint fuel management plan. This outlines the fuel treatment objective for the area of land DELWP intends to treat using planned burning. DELWP frequently targets only part of the burn unit rather than the whole unit because specific parts may:

- pose the highest risk
- be the only area that is treatable, for example, the vegetation type in other parts may be too wet to burn
- be protecting an environmental or cultural value within the area from fire.

DELWP states that if it achieves its fuel treatment objective, it considers the entire burn unit treated. An area may be treated a number of times over several years before the fuel treatment objective is met. Once the fuel treatment objective has been met, DELWP reports the total number of hectares that the treated burn unit covers in its fuel management report, not the actual number of hectares burned. This practice is not unreasonable, as partial treatment of an area can achieve risk reduction across the whole site, however, DELWP does not make this distinction clear in its public reporting.

In contrast, DELWP records the actual hectares burned in the fire history layer it uses in Phoenix RapidFire to calculate its BP3 statewide residual risk result.

Figure 3B shows the hectares DELWP has treated and the actual hectares burned within those sites. DELWP publicly reports the treated area in its annual fuel management reports and separately reports area burned through DELWP's online database, Spatial Datamart.

A **fuel treatment objective** specifies:
• the fuel hazard outcome—the desired impact on the fuel hazard after treatment
• the area outcome—the extent of the planned area over which the fuel hazard outcome must be achieved.
For example, to remove elevated fuels to a height of 3 metres (fuel hazard outcome) for a depth of 20 metres over a distance of 500 metres along boundary fence X (area outcome).

FIGURE 3B: **Hectares treated compared to hectares burned by DELWP using planned burning between the 2008–09 and 2019-20**
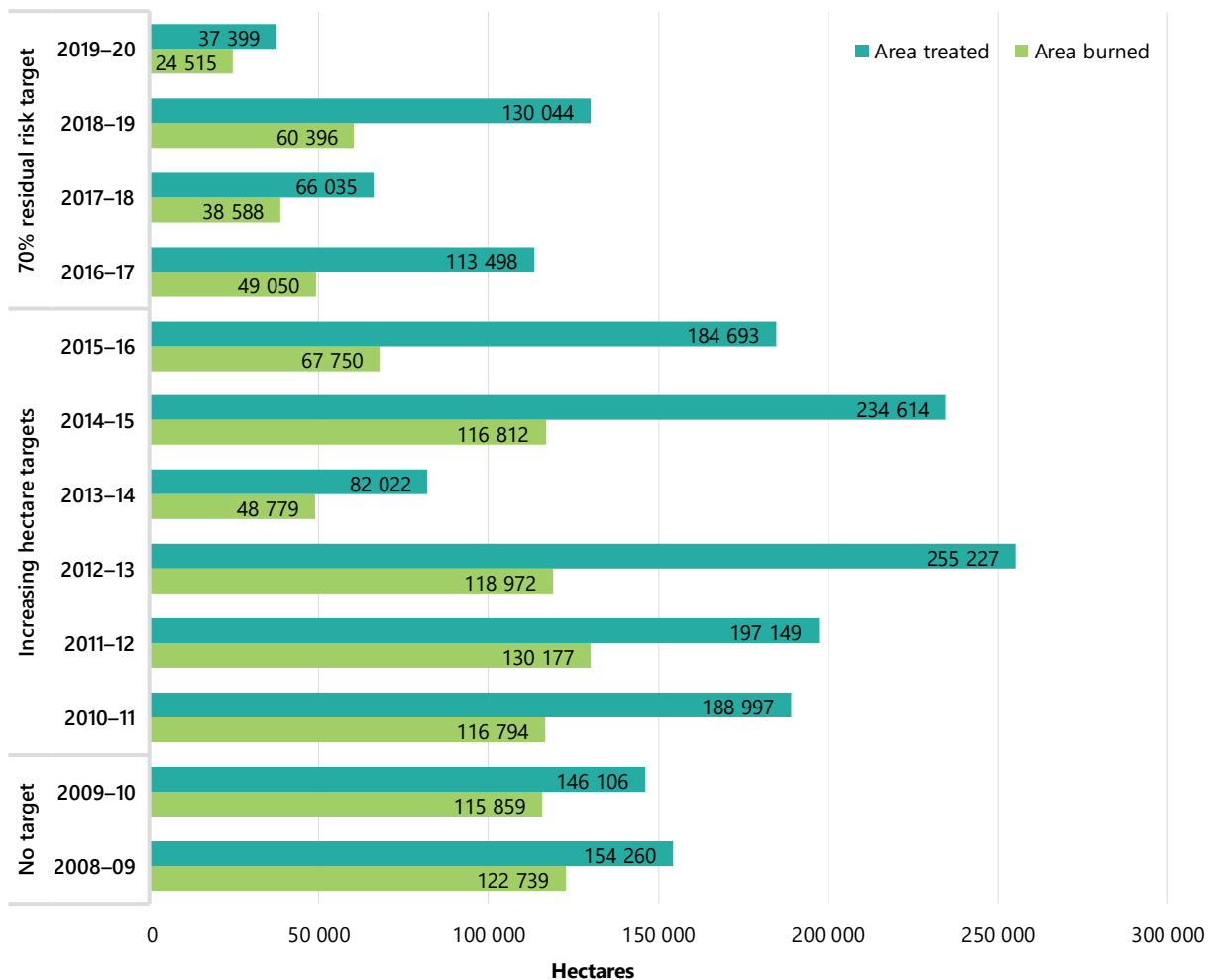
Source: VAGO, using DELWP data.

DELWP's modelling undertaken to recommend the residual risk target indicated that it could achieve 70 per cent residual risk across the state and balance ecological and operational requirements by treating approximately 200 000 to 275 000 hectares each year (the model assumes not all hectares within a burn unit are burned), assuming no other fire in the landscape. DELWP's scenario modelling did not include anticipated bushfire activity. Figure 3B shows that over the last four years since the introduction of the new target, DELWP has not annually treated between 200 000 to 275 000 hectares through planned burning.

DELWP notes that in practice, given the hectares that are burned through bushfire activity, it is not always necessary to undertake burning to the level indicated in the modelling. However, the intent of the modelling was to assess the cumulative effect of different levels of planned burning on bushfire risk. As such, the cumulative impact of significantly fewer hectares of planned burning treatment over time would reduce the risk reduction achieved and therefore the effectiveness of the planned burning

program. For example, under the 'maximise risk reduction (constrained)' option, as shown in Figure 2D, the modelling indicates that a hectare range of 68 000 to 156 000 would achieve a risk reduction of 20 to 28 per cent.

Limitations of public land burns

DELWP's ability to deliver its joint fuel management plans can be limited by weather conditions, smoke impacts and the lengthening bushfire season. However, while DELWP can broadly explain why it did not complete some planned burns, it does not formally record the reasons for cancelling burns. As such, we were unable to assess the extent to which these conditions and other potential causes, such as resource availability, impact DELWP's ability to complete its planned burn program.

Extended bushfire seasons

Victoria's bushfire season is lengthening, which means that DELWP has a smaller window of opportunity to deliver planned burns.

BoM and CSIRO's report *State of the Climate 2018* notes a long-term increase in extreme fire weather and in the length of the bushfire season across large parts of Australia. Figure 3C shows trends of worsening fire weather conditions in south and east Australia in the annual FDI from 1987 to 2017. Positive trends, shown in yellow to red, indicate an increasing length and intensity of the bushfire season.

FIGURE 3C: **Trends from 1987 to 2017 in the annual sum of daily FDIs across Australia**
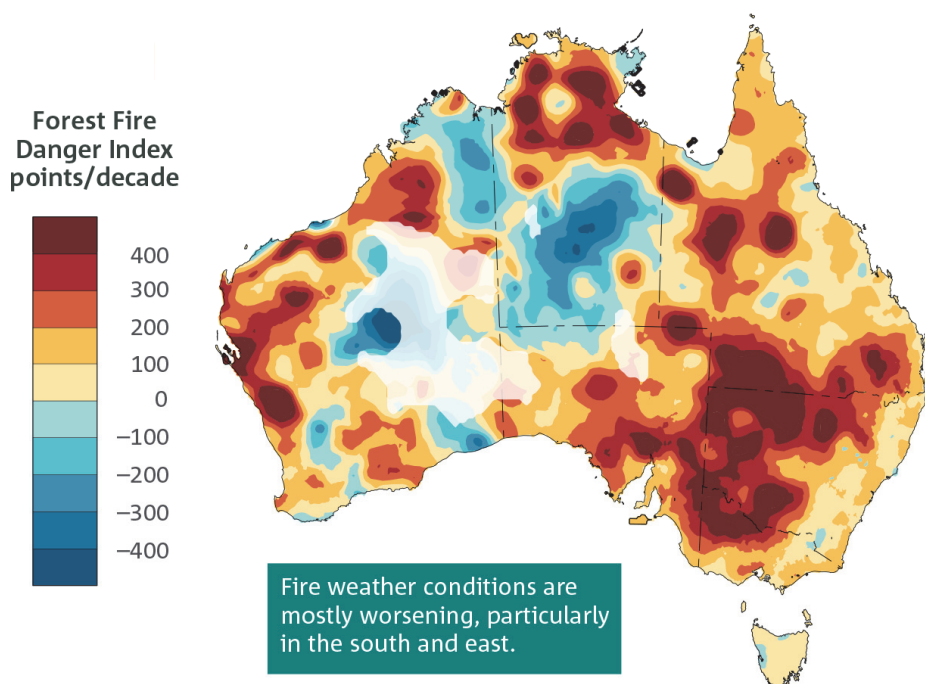
Source: BoM and CSIRO's, *State of the Climate 2018*.

Potential smoke impacts

Smoke from planned burns can have environmental, health and economic impacts. DELWP is effectively managing these impacts by:

- using BoM's Australian Air Quality Forecasting System to review daily levels of smoke in the landscape and communicate results to regional staff
- notifying the community about smoke in the environment prior to planned burns through its website, mobile video boards and Air Watch app and by distributing letters to surrounding properties
- engaging with regional wine and tourism industries, flower and fruit growers and beekeepers to manage the negative impacts of smoke.

DELWP will consider postponing a burn until more suitable weather conditions exist or cancelling the burn if smoke levels are too high or are likely to impact a community.

Impact of public land burns on residual risk levels

Statewide risk

In the 2019–20 BP3, DELWP reported its expected performance against the output measure 'statewide bushfire risk is maintained at or below the target', where the target is 70 per cent, as 67 per cent for 2018–19. DELWP's latest *Fuel Management Report 2018–19* states that the current statewide residual risk level is 69 per cent.

Figure 3D shows DELWP's modelling of how bushfires and its planned burn treatments have impacted the state's residual risk level over the last 40 years. It shows that reductions in fuel loads due to bushfires in populated areas have had the greatest impact on the modelled risk reduction, in regard to predicting houses saved, which is what determines the risk level. Sudden drops in the state's residual risk level correspond with major bushfire events that impacted lives and properties. For example, Ash Wednesday in 1983, Black Saturday in 2009 and the 2019–20 bushfire season.

In contrast, the 2003 Alpine fires burned 1.3 million hectares and the 2006–07 Great Divide fires burned 1.2 million hectares, but neither events reduced the risk curve because they were far away from properties.

FIGURE 3D: **Victoria's residual risk level from 1980 to 2020**
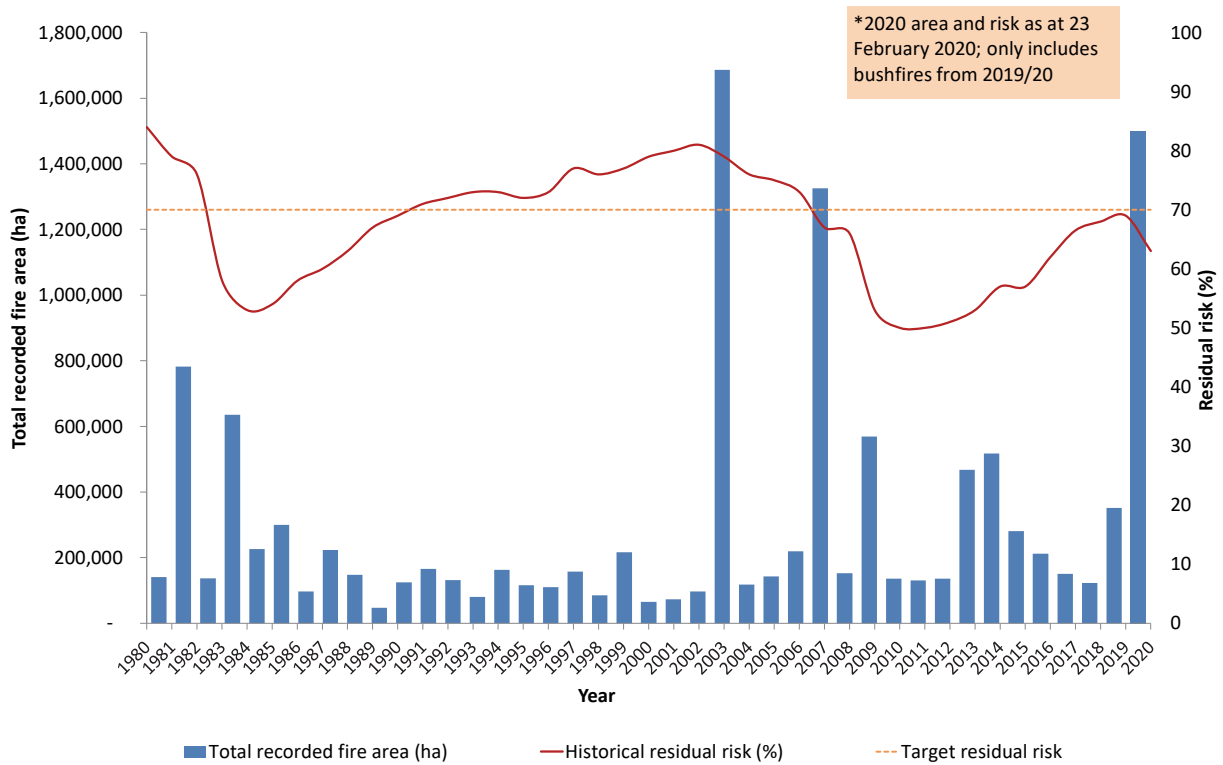
Note: 2020 results are interim.
Source: DELWP.

Effectiveness of planned burning

In June 2020, DELWP presented new analysis that shows it can now separate the relative contribution of planned burning and bushfires to risk reduction. The analysis shown in Figure 3E indicates that over the 11 years from 1 July 2009 to 30 June 2020, planned burns accounted for 66 per cent of risk reduction each year on average, compared to 34 per cent due to bushfires.

DELWP used two different methods to estimate risk reduction from planned burning and bushfires.

Method	Description
Method one: all disturbances combined	This approach extrapolates scenarios from a point in time. It considers all planned burning and bushfires since 1 July 2009. It then models residual risk for the following four scenarios: • a combination of bushfires, planned burning and logging occur • only planned burning occurs • only bushfires occur • no disturbances occur.
Method two: annual approach	This approach models year on year risk changes. It then models residual risk for the same four scenarios used in method one.

DELWP found that both methods demonstrate that planned burning accounts for the greatest amount of risk reduction. Its analysis using method one shows that the risk reduction is large and relatively stable over time. In contrast, its analysis using method two shows yearly variations that largely relate to the total area burned by planned burning or bushfire.

FIGURE 3E: **DELWP's modelling of the effects of planned burning and bushfires on residual risk from 2008 to 2020**

	Planned burn treated area (ha)	Bushfire area (ha)	Residual risk (end of financial year)	Modelled risk with no fire at end of year	Residual risk reduction—planned burning	Reduction from planned burning	Residual risk reduction—bushfire	Reduction from bushfire
Year								
2008-09[1]	154 260	437 389	52.48	69.54	2.72	15%	14.87	85%
2009-10	146 106	37 238	49.71	55.13	5.01	88%	0.68	12%
2010-11	188 997	14 135	50.16	55.54	5.34	98%	0.12	2%
2011-12	197 149	4 890	51.82	56.06	4.06	100%	0.00	0%
2012-13	255 227	201 704	53.96	57.77	3.09	76%	0.98	24%
2013-14	82 022	414 048	57.23	59.79	1.46	51%	1.38	49%
2014-15	234 614	57 249	59.07	64.16	5.05	100%	0.00	0%
2015-16[2]	184 693	25 676	62.52	65.40	1.28	44%	1.62	56%
2016-17	113 498	13 525	66.09	67.81	1.32	100%	0.00	0%
2017-18	66 035	64 134	67.79	70.76	2.85	94%	0.19	6%
2018-19	130 044	218 499	68.88	70.91	1.00	43%	1.31	57%
2019-20[3]	32 070	1 506 353	62.63	72.54	0.70	7%	9.64	93%
Period								
2010–19	1 598 385	1 051 098	**10 years**		**30.46**	**83%**	**6.28**	**17%**
2010–20[2]	1 630 455	2 557 451	**11 years**	**Interim 2020**[2]	**31.16**	**66%**	**15.92**	**34%**
2009–20[2]	1 784 715	2 994 840	**12 years**	**Interim 2020**[2]	**33.88**	**52%**	**30.79**	**48%**

Note 1: Residual risk level at 30 June 2008 (before Black Saturday) was 67 per cent.

Note 2: In 2015–16, 25 676 hectares land burned by bushfires resulted in 1.86 per cent of residual risk reduction (55 per cent of the risk reduction for that year). This was primarily due to the Wye River fire.

Note 3: This analysis is based on bushfire history data as at May 2020. Bushfire history data is subject to change as updated mapping becomes available and results will vary depending on what version of the data is used. This has resulted in differences between some figures shown in this report from figures reported at that point in time.

Source: DELWP.

The University of Melbourne reviewed DELWP's work and endorsed the two methods DELWP used. The review noted that method one is stronger at looking at long-term trends but is influenced by the start date and extent of the analysis. While method two captures the single year influence of planned burning or bushfires it does not capture the full period and therefore the longer-term benefit of fuel reduction from planned burning or bushfires. The review noted that if method two was adopted it would be necessary to sum the values over a long period. DELWP's preferred approach is method two using a ten year rolling average. The University of Melbourne also highlighted that any approach to measure risk will have limitations and that results should be interpreted with caution. They noted that as the locations of planned burns are influenced by the modelling results from Phoenix RapidFire, it is

unsurprising that the modelling finds a strong effect of planned burning over time. They note that it is therefore unclear whether the results are genuine, or an artefact of the modelling, and that to distinguish this, DELWP would need to analyse planned burns undertaken prior to the use of Phoenix RapidFire modelling. They note that this does not preclude the use of this method, but should be understood as a limitation when interpreting results.

DELWP only measures the impact of planned burns against the BP3 target at FDI 130

The modelling that DELWP used to determine the residual risk target, which it also uses to calculate performance against it, assumes extreme fire conditions, as these are the conditions associated with the majority of historical fire-related deaths. This is consistent with the Code, which requires DELWP to give priority to the protection of human life over other objectives. However, research shows that as fire intensity increases, the broad effects of planned burning decreases. It is likely that planned burns contribute to risk reduction most in lower intensity fires and to a lesser degree in high intensity fires, which while rarer, claim the most lives. As such, the measure is likely insensitive to some extent to the activity it is intended to assess—planned burning.

DELWP uses other FDI conditions as part of its strategic planning for planned burning. However, current DELWP performance reporting does not demonstrate how effective planned burns are at reducing risks in mid to low FDI conditions. The majority of fires that DELWP responds to are in more moderate conditions, where planned burning helps firefighters to successfully contain them. DELWP's current reporting is consistent with the Code's objective of minimising the impact of major bushfires given its focus on calculating risk reduction in the most extreme fire events. However, this means that DELWP is not reporting the impact that its planned burns have under more common bushfire conditions.

Other Budget Paper 3 measures

DELWP has two other BP3 measures that have a relationship to planned burning. Figure 3F shows that DELWP met or exceed its targets for these measures in the 2017–18 and 2018–19 financial years.

FIGURE 3F: **DELWP's performance against further fire management BP3 measures**

BP3 targets 2019–20	Target	2017–18 performance	2018–19 performance
Fires contained at less than five hectares to suppress fires before they become established, minimising impact.	80%	91%	94%
Fires contained at first attack to suppress fires before they become established, minimising impact.	80%	92%	90%

Source: DELWP and 2017–18 and 2018–19 Budget Papers.

The 2018–19 BP3 papers advise that DELWP's performance against these measures reflects the effectiveness of its planned burn program combined with rapid first attack operations and early identification of fires through patrols. However, while we sighted DELWP's case studies between 2014–15 and 2019–20 that supported the link

between its planned burn program and its ability to supress bushfires, DELWP does not routinely collect data to support its claim in the BP3 papers.

Regional risk

As shown in Figure 3G, Gippsland and Barwon South West were slightly above their regional targets for 2018–19. The other regions were below the targets.

FIGURE 3G: **Regional residual risk against informal regional targets 2018–19**

Region	Residual risk	Residual risk target
Barwon South West	62%	60%
Gippsland	72%	71%
Grampians	67%	70%
Hume	67%	69%
Loddon Mallee	66%	75%
Port Phillip	80%	85%

Source: VAGO, based on DELWP data.

Figure 3H compares DELWP's regional risk levels with regional targets between the 2015–16 and 2017–18 bushfire seasons (where there were seven regions with different boundaries).

FIGURE 3H: **Regional risk levels compared to regional targets between the 2015–16 and 2017–18**

	Alpine and Greater Gippsland	Alpine and North East	Barwon Otway	East Central	Mallee and Murray Goulburn	South Western	West Central
2015–16	45	60	65	70	85	75	70
2016–17	52	64	67	79	90	79	77
2017–18	52	59	59	80	44	55	69
Target	60	60	60	80	90	80	70

Source: VAGO, using data from DELWP's 2015–16 and 2017–18 fuel management reports.

Figure 3H shows that the Alpine and Greater Gippsland, East Central, Mallee and Murray Goulburn and South Western regions have consistently met or been below their residual risk targets. Alpine and North East, Barwon Otway and West Central exceeded their targets in one or more years.

In the 2017–18 bushfire season, changes in Mallee and Murray Goulburn, where the risk level almost halved, emphasises the need for periodic reconsideration of regional risk targets (as discussed in Section 2.3).

Non-burn treatments

In addition to planned burning, DELWP and PV use non-burn treatments to reduce bushfire risk on public land. However, because DELWP and PV do not systematically assess the effectiveness of planned burning compared to non-burn treatments at reducing risk, it is not possible to know which is better. DELWP and PV advised us that professional judgements are made by their staff regarding the relative benefits of different treatment options in different places.

DELWP advised us that mechanical treatments are likely to be more costly than planned burns. Additionally, mechanical treatments treat smaller areas and carry a greater potential for negative environmental and cultural heritage impacts, such as increased ground disturbance.

The Melbourne Fire and Emergency Program

PV initiated the Melbourne Fire and Emergency Program to reduce Melbourne's bushfire risk and improve its preparedness following the Black Saturday bushfires. The program focuses on directly protecting houses across Melbourne by using mechanical fuel treatments, such as slashing, mulching and building fuel breaks.

PV conducts a significant part of the program in areas that it cannot burn. A benefit of mechanical fuel treatments is that they can be conducted at any time of the year.

Risk 2.0

DELWP has received funding under the Risk 2.0 Safer Together project to include mechanical treatments in its risk modelling by December 2021. This will help DELWP compare results and improve its ability to effectively and accurately report on these treatment options. DELWP has not yet announced its intention to bring other risk treatments into its modelling against its target in line with IGEM's recommendations or its Safer Together commitments.

3.3 Fuel reduction on private land

Under the *Country Fire Authority Act 1958*, CFA and councils are responsible for helping the community reduce fuel loads on private properties and roadside reserves.

Country Fire Authority

Compared to DELWP's activities on public land, CFA conduct limited risk-reduction treatments on private land due to capability and capacity constraints. Additionally, CFA cannot demonstrate that its treatments effectively reduce bushfire risk because of the difficulty of modelling risk based on small-scale burns.

Figure 3I shows the quantity and volume of burns that CFA delivered between 2014–15 and 2018–19.

FIGURE 3I: **Quantity and size of planned burns that CFA completed between 2014–15 and 2018–19**
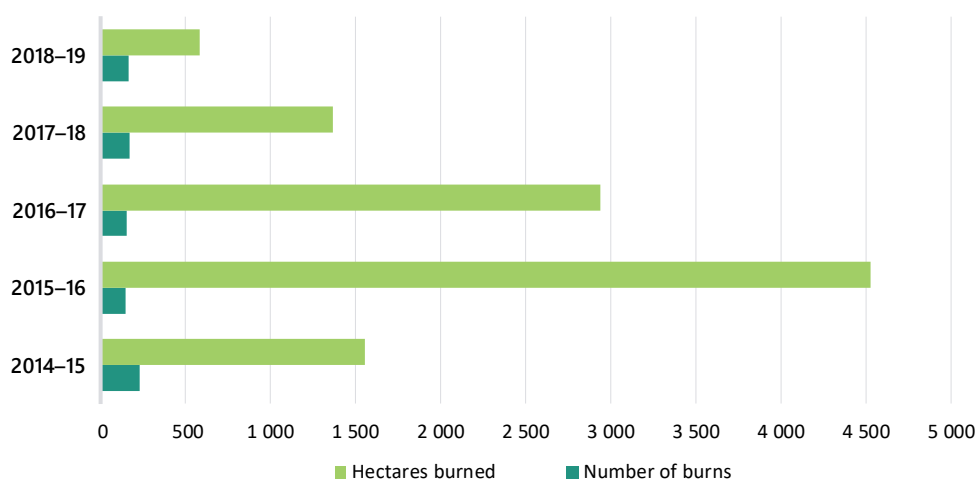
Source: VAGO, using CFA data.

CFA advised us that the variation in the quantity and volume of its burns is due to a combination of factors, including:

• weather and fuel conditions

• availability of volunteers

• the number of requests and incidents it needs to respond to, which divert resources away from planned burns

• changes in planning and operational staff's capacity to support a fuel management program due to other work.

CFA's capability and capacity constraints

CFA's capability and capacity constraints limit its ability to undertake planned burns. These constraints are caused by four key factors:

• lack of staff who are skilled to conduct complex burns

• limited availability of volunteers to conduct burns at short notice when weather conditions are suitable

• falling brigade numbers and an ageing volunteer population

• lack of ongoing funding for burns on private land.

There are many CFA volunteers who are keen to undertake fuel management burning in their local areas. Where local resources are insufficient, the Safer Together Planned Burn Taskforce project has the potential to address a local shortfall. This Safer Together project facilitates deployment of volunteers to planned burns outside their local area.

CFA does not have ongoing funding to conduct risk-reduction work on private land. Historically, CFA's role has been as a response agency. It has only assisted with fuel management treatments through small-scale planned burns, which are mainly on roadsides.

In comparison, DELWP receives annual funding for its public land treatments.

To put CFA's planned burning capacity into perspective, Figure 3J compares the burns that DELWP and CFA delivered during 2018–19.

FIGURE 3J: **DELWP and CFA's planned burn delivery during the 2018–19 burn season**

Planned burns—public land (DELWP)			*Planned burns—private land (CFA)*		
Number of burns	Area burned (hectares)	Kilometres of roadside	Number of burns	Area burned (hectares)	Kilometres of roadside
251	60 396	0	168	584	681

Note: CFA's delivery shows the kilometres of roadside that they burned in addition to hectares.
Source: CFA and DELWP data.

Three projects under the Safer Together program, which were commenced in 2018, aim to build CFA's capacity and capability for bushfire prevention activities. These projects included funding for additional planning staff, volunteer training programs (such as burn camps) and fuel management works. CFA expects that the area of planned burns it undertakes will increase over time as a result of these initiatives.

Delivery costs

CFA does not monitor its fuel management costs, but estimates that it spends:

- $300 per kilometre for roadside burning
- $300 per hectare for other burns.

CFA advised us that it is difficult to determine costs because:

- it recoups some costs from agencies, such as VicTrack and other rail managers that fund CFA to conduct burns on rail corridors
- it does not track regional fuel management costs from its total budget
- its burns are conducted by a volunteer workforce, and costs are absorbed into brigade costs.

Prior to 2018, CFA did not consistently coordinate and record its regional planned burning program achievements and costs. It is now centrally coordinating the program and its budget and requires CFA regions to report their costs.

Audited councils

All audited councils inspect private properties during the bushfire season. However, only two of the three of the audited councils always issue fire prevention notices when they identify bushfire risks.

Fire prevention notices and enforcement

Councils' MFPOs inspect private properties before and during the bushfire season. They issue fire prevention notices to properties that have unacceptable risk levels. Follow-up inspections are carried out on properties that have been issued a fire prevention notice. If the prescribed works have not been completed to the satisfaction of the MFPO by the due date (no set time frame), then the notice is considered outstanding and the MFPO will appoint a contractor to do the works. The owner or occupier will have to pay all associated costs in carrying out the works specified in the notice plus an administration fee. If landowners or occupiers do not pay, the council can take them to court.

However, not all audited councils issue notices when they identify risks.

FIGURE 3K: **East Gippsland case study**

In East Gippsland in the early 2000s, smaller investors established significant areas of 99-hectare blue gum plantations as part of managed investment schemes.

For example, a finance company established 4 105 hectares of mostly blue gums in Gippsland between 2003 and 2007 under managed investment schemes.

There have been no newly released managed investment schemes to fund plantations on new forestry land in Gippsland since 2008. This has resulted in a decline in this sector in the area. Most of the forestry-managed investment schemes have gone into administration or new ownership since 2008.

East Gippsland advised us that many of these plantations are a high bushfire risk because they are not managed properly after being logged. This is because blue gums sprout multiple trunks after being cut down if the stumps are not treated or burned.

East Gippsland does not always issue fire prevention notices to the smaller plantations because enforcing them is costly. These plantations have often been abandoned, which makes it difficult for the council to recoup clean-up costs from owners. It also advised us that if it issues a fire prevention notice and the owner does not remove the hazard themselves (usually due to cost), then the council becomes liable for the bushfire hazard.

East Gippsland considers it inappropriate to shift the cost of bushfire risk-reduction from private plantation owners to the community through the council.

Source: VAGO.

In 2016, Whittlesea, issued 3 per cent of inspected properties with fire prevention notices. This was the lowest issue rate of the three audited councils. Its MFPO advised us that this was because:

- the council proactively sends letters to residents before the bushfire season begins to remind them to reduce their property's risk
- their approach is to work with farmers to develop a plan to reduce the risks related to long grass instead of issuing a notice, as long grass must cure before it can be baled for livestock feed
- the area has a large number of new residential developments, which do not have risky vegetation on their blocks.

Despite this, in 2016 Whittlesea also had 10 per cent of its notices outstanding, which corresponded with the highest clean-up costs of the three audited councils, totalling $46 423. This shows how councils are negatively affected when private landowners do not comply with fuel management requirements.

Slashing

Councils also manage bushfire risks on roadsides by slashing. All audited councils advised that they slash to meet road safety and amenity objectives as well as to reduce bushfire risk. Whittlesea noted that while the costs of its slashing program outweigh the risk posed by roadside vegetation, there is a community perception that the work increases safety.

The impact of CFA and councils' risk treatments

CFA treatments

CFA has no systematic process to assess the effectiveness of its treatments or their risk-reduction outcomes. This is because it cannot accurately model risk reduction from small-scale burns, such as on roadsides, and other non-burn treatments. CFA advised us that it uses observation, such as post-burn assessments of coverage and burn completeness, to determine if a planned burn has had a risk-reduction effect.

DELWP and CFA are currently completing a research project funded through Safer Together to examine how they can use Phoenix RapidFire to model the impact of roadside vegetation management, including roadside burning and slashing. This improvement will contribute to DELWP and CFA moving to a more holistic performance measure.

Council treatments

The audited councils do not assess how their risk treatments, including vegetation removal and slashing, impact risk levels overall or on private land at a landscape level. However, they do check to make sure that landowners address bushfire hazards identified in fire prevention notices at an individual property level. Councils do this via on-ground checks, which allow them to determine which properties are still high risk.

While this method of assessing risk reduction has a high level of accuracy at an individual property level, it does not measure risk reduction at a landscape level. DELWP and the CFA could assist councils to do this to ensure that residual risk levels are assessed across public and private land. This would further contribute to a more holistic statewide risk assessment.

3.4 Tenure-blind burning

Since the Safer Together policy launched, DELWP, CFA and other public land managers have been working more collaboratively to reduce bushfire risk across public and private land. Figure 3L describes an example of this.

FIGURE 3L: **Tenure-blind burn in Colac Otways case study**

In February 2019, DELWP's Barwon South West region delivered a tenure-blind fuel reduction burn across public and private land in the Colac Otways.

DELWP had identified the private land as high risk and engaged with the landowner by issuing a fire prevention notice under section 65(1)(a) of the *Forests Act 1958*. DELWP can issue fire prevention notices on private land within 1.5 kilometres of a public land boundary. These notices give landowners options on how to undertake the work.

While DELWP was the lead agency on the burn, it was assisted by PV, CFA, the Surf Coast Shire Council and the landowner.

The landowner was happy with the outcome and positive about DELWP and other responsible agencies' engagement throughout the process. They also noted they would not have been able to manage the risk on their own.

Source: VAGO.

This example illustrates the value of a fully integrated fuel reduction program across public and private land, as envisaged by Safer Together. However, these types of collaborative burns only make up a small part of the state's overall planned burn program.

Roles and responsibilities

Safer Together's focus on a tenure-blind approach has resulted in DELWP increasingly planning and managing burns with CFA on private land within 1.5 kilometres of public land. The benefits of a tenure blind approach include:

• both agencies focus on the highest risk parts of the landscape, irrespective of land ownership

• CFA members and DELWP staff are able to share their expertise in different types of fire prevention and firefighting skills.

While agency roles and responsibilities are well defined for public land, they are not for private land. Consequently, tenure-blind burning has exposed some uncertainty that did not previously exist. DELWP and CFA have worked together to resolve initial

concerns about liability regarding tenure-blind burns. Following a project to identify policy and legislative enablers to support tenure blind burning, the agencies updated their cooperative arrangement and communicated outcomes to staff.

However, they are yet to resolve issues about how tenure-blind burns are funded. DELWP and CFA advised us that while tenure blind burns are crucial for risk reduction, they cost more because they:

- are generally close to assets
- involve high levels of community engagement
- require more staff resources due to the increased risk to human life
- include paid DELWP staff, not just CFA volunteers.

This issue requires resolution to support more of this work to occur.

3.5   Monitoring and evaluation for public land

Statewide monitoring, evaluation and reporting frameworks

The Code of Practice for Bushfire Management on Public Land

The Code establishes the need for DELWP to prepare a framework for monitoring, evaluating and reporting on its bushfire management program. The Code states that this framework must include:

- objectives for monitoring, evaluating and reporting on bushfire management. DELWP must also explain how these objectives link with the Code's two primary objectives for managing bushfire risk on public land
- key performance indicators, which the monitoring objectives will be assessed against
- key accountabilities for monitoring, evaluations and reporting.

The Code also requires DELWP to deliver activity reporting annually, strategy reporting every five years and objectives reporting every 10 years.

Monitoring, Evaluation and Reporting Framework for Bushfire Management on Public Land

DELWP's 2015 MER Framework responds to the Code's requirements. It stresses the importance of performance monitoring, research and evaluation to understand and address bushfire risk. The framework outlines a performance management framework and regional MER plans that will support it, and states that DELWP will deliver an evaluation report every five years. DELWP aims to develop its first evaluation report by the end of the 2020–21 financial year.

As yet, DELWP does not have a performance management framework that sets out the measures that it will use to monitor and report on its achievements against its bushfire risk-reduction objectives.

DELWP completed regional MER plans and is currently updating these. In totality, the regional MER plans, which were released in 2016, outline an ambitious range and scope of research, evaluation, and performance measures. If these measures are achieved, they will contribute a significant level of knowledge on the impact of fuel

management activities on both risk reduction and ecosystem resilience. In particular, the regional MER plans demonstrate a number of partnerships with academic institutions to undertake studies, particularly around elements of ecosystem resilience.

Each regional MER plan includes the diagram shown in Figure 3M, which demonstrates how operational-level output, activity and impact reporting is the foundation for strategy and outcome-level reporting.

FIGURE 3M: **The elements of the MER Framework and how they are related**
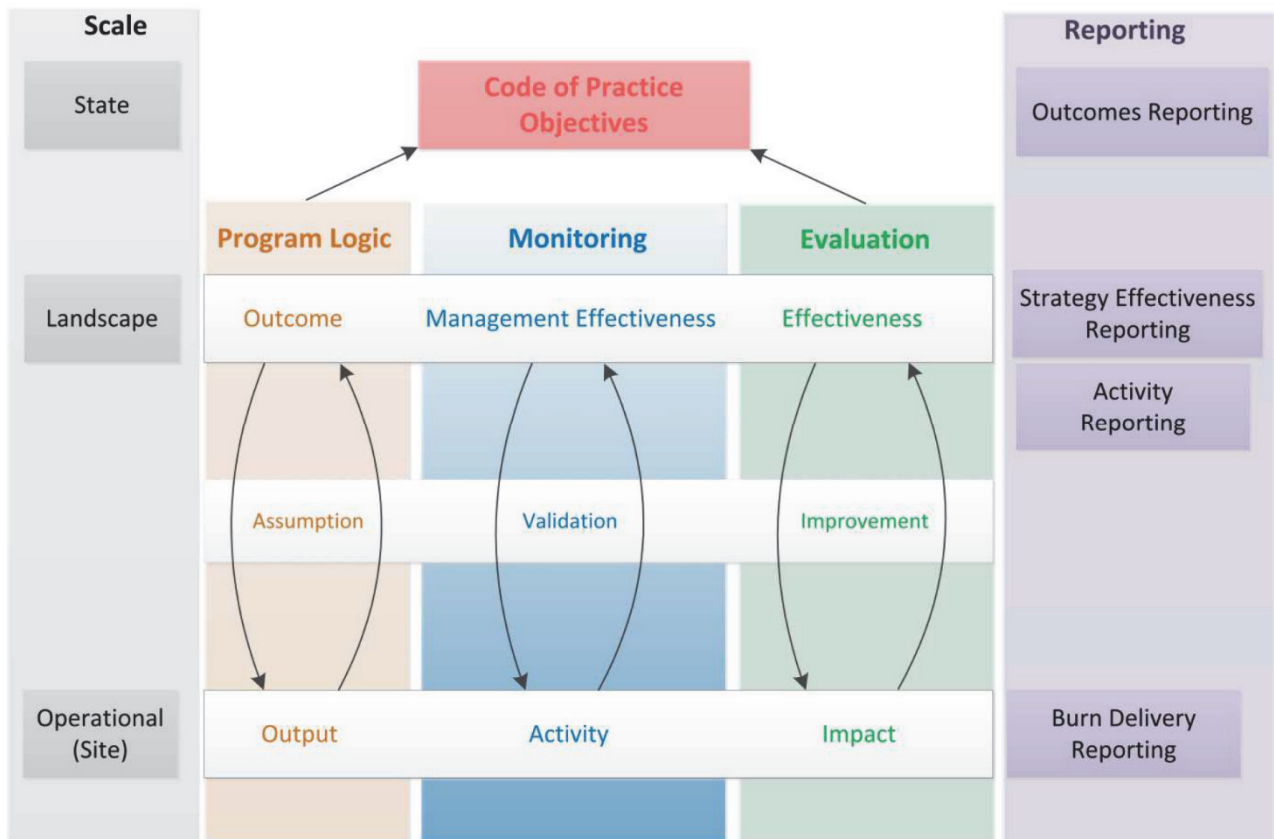
Source: DELWP's regional MER plans.

However, the regional MER plans include many output and outcome measures and targets that vary significantly across regions. This prevents DELWP from consolidating and comparing results. It therefore is unlikely that data collected with regional MER plans will be able to support a state-level evaluation. Consequently, DELWP is unable to demonstrate that it is progressing to meet its commitment to deliver a full evaluation report by the end of the 2020–21 financial year.

Further, DELWP advised us that it does not systematically monitor or report on the implementation of its regional MER plans. It has no assurance that regions are implementing the plans as intended.

In 2019, DELWP released its *Safer Together Monitoring and Evaluation Framework* to combine the results from the various projects under the Safer Together program. It is

unclear how this work relates to the MER Framework or the regional MER plans as these documents do not reference each other.

Despite the regional MER plans including measures relating to planned burn impact, DELWP does not routinely and consistently collect, collate and assess information on the impact of planned burns. While its regional staff collect ad-hoc anecdotal evidence, this cannot support systematic measurement of the effectiveness of the planned burn program. This is a significant missed opportunity to:

• better understand the circumstances that planned burning is more or less effective in

• compare the impact of planned burns with other fuel management and risk-reduction activities

• more directly understand the relationship between planned burning and ecosystem resilience

• acquire more knowledge to improve modelling and operational planning.

DELWP also states that non-burn treatments are more expensive and less effective than planned burns. However, it has not assessed the cost effectiveness of different approaches to planned burning or alternative fuel management treatments and regional MER plans do not consider assessment of cost effectiveness at all.

Responsible agencies invest significant resources to reduce the impacts of bushfires. For this reason, DELWP would benefit from having better information about the cost-effectiveness of various treatments to optimise its resources.

Monitoring fuel levels

DELWP uses overall fuel hazard assessments to understand how a fuel hazard has changed pre and post-burn. This occurs in addition to its assessment of whether each burn has met its objectives.

Monitoring target

DELWP has a statewide monitoring target that requires it to complete pre and post-burn fuel hazard assessments for 20 per cent of the fuel reduction burns it annually conducts. DELWP determined the target based on what it thought staff could deliver with existing resources, and not what it might need to allow for scientific statewide assessment. As a result, the aggregated results from this monitoring would not necessarily allow DELWP to extrapolate a broader view of the impact of its entire planned burn program.

Further, DELWP publicly reports the number of monitoring points rather than the number of burns monitored. As there are multiple monitoring points within a single burn site, this reporting method does not accurately relay to the public the actual number of planned burns monitored. Further, DELWP does not publicly report whether it is meeting its target to conduct pre and post-burn fuel hazard assessments for 20 per cent of its annual fuel reduction planned burns.

Monitoring and reporting ecosystem resilience

DELWP's ecosystem resilience monitoring does not enable it to understand how its planned burns affect the environment. Like its measurement of residual risk, DELWP's measures for ecosystem resilience combine the impacts of planned burns and

bushfires, which means that the outcomes are not entirely attributable to DELWP. Reported results also do not clearly inform the user of what 'good' performance looks like.

DELWP's *Measuring Ecosystem Resilience in Strategic Bushfire Management Planning* policy describes the three measures that DELWP uses to measure the impact of its fuel management activities on ecosystem resilience—TFI, GSS and GMA.

The policy refers to TFI and GSS thresholds set by expert opinion for each priority vegetation type. It notes that these thresholds will be reviewed periodically and may change as new information becomes available. However, as discussed in Section 2.4, DELWP does not currently have a process to update its TFI dataset based on new information. Further, DELWP reports on the mix of GSS and TFI for vegetation across the state in its fuel management reports, but does not compare this with the set thresholds. This makes it difficult to understand whether the reported mix of GSS and TFIs represents a high or low level of ecosystem resilience.

Figure 3N shows the mix of GSS for vegetation on Victorian public land from 1980 to 2019.

FIGURE 3N: **GSS status of vegetation on public land from 1980 to 2019**
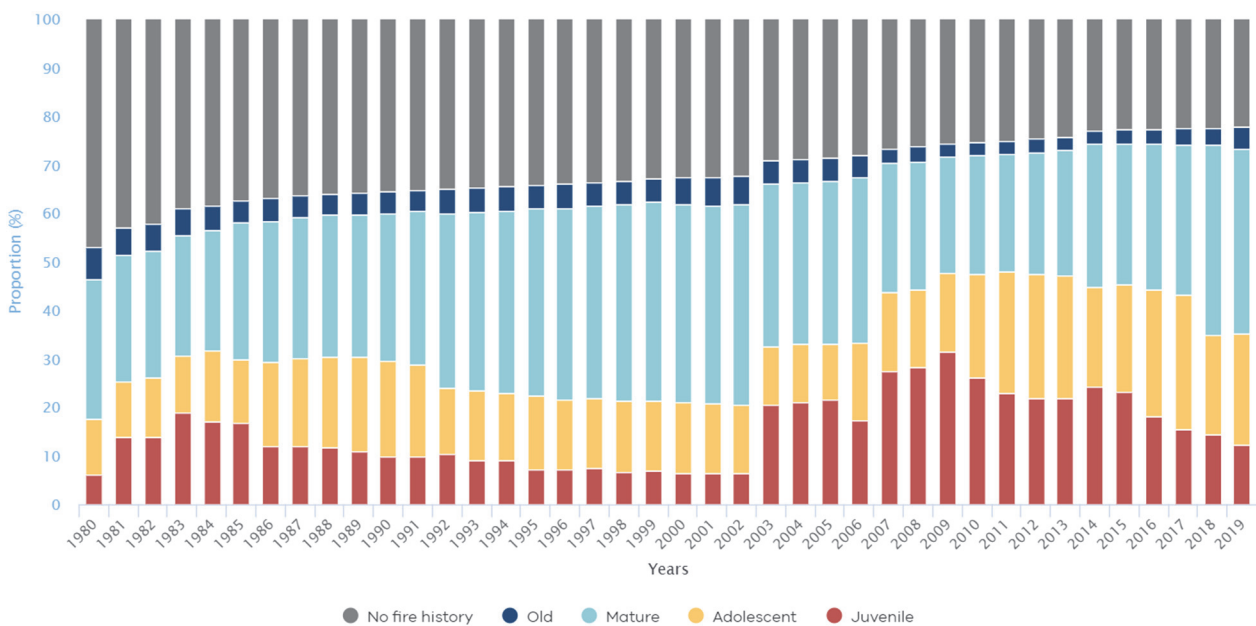
Source: DELWP's 2018–19 *Fuel Management Report.*

Figure 3O shows the TFI status of vegetation on Victoria public land from 1980 to 2019.

FIGURE 3O: **TFI status of vegetation on public land from 1980 to 2019**
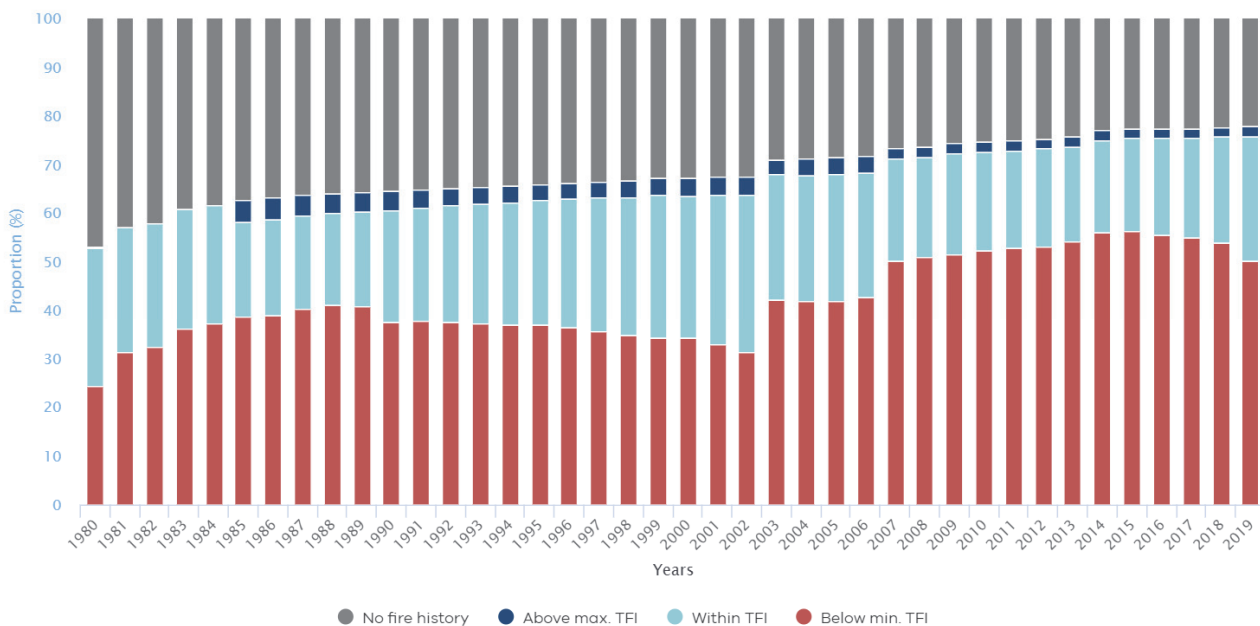
Source: DELWP's 2018–19 *Fuel Management Report.*

The results shown in Figures 3N and 3O reflect both bushfire activity and planned burning. Consequently, they do not reveal DELWP's impact on GSS and TFI.

As Figure 3P shows, DELWP does publicly report the number of hectares it burns that are below the minimum TFI before being burned. DELWP acknowledges that burning land below the minimum TFI is undesirable, but at times unavoidable when addressing bushfire risk. This is an example of reporting that provides good accountability to the public.

FIGURE 3P: **Hectares of public land below the minimum TFI burned from 1980 to 2019**
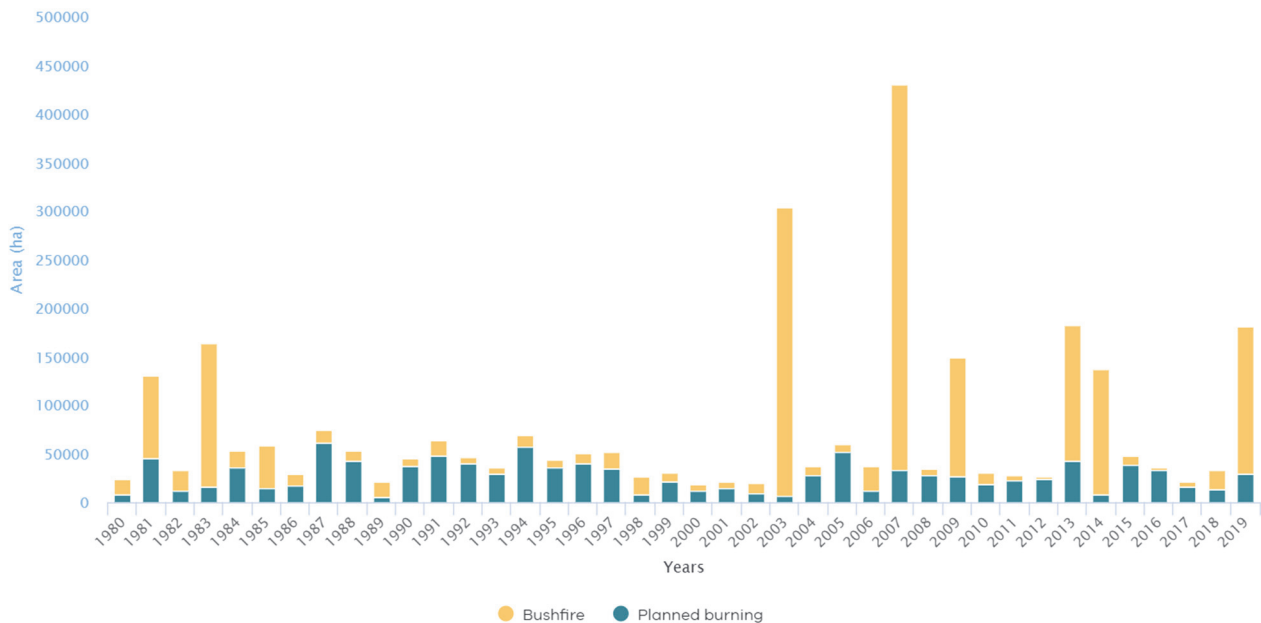
Source: DELWP's 2018–19 *Fuel Management Report.*

In 2015, DELWP commissioned La Trobe University to undertake the *Scientifically-based monitoring project—Final report: Guidelines for ecosystem resilience monitoring, evaluation and reporting within the Victorian Bushfire Monitoring Program*. This project developed a strategy, design and methods for addressing the ecosystem resilience evaluation questions in the MER Framework. The proposed approach is a two-stream model, consisting of a statewide stream and a regional stream. The statewide stream consists of a centrally coordinated systematic monitoring program that targets priority vegetation types. The regional stream assesses the more immediate effects of fuel management on animal and plant life in regions as well as how fuel management and bushfire affect species and ecological values of particular regional importance.

Statewide ecosystem resilience monitoring stream

DELWP's statewide stream involves surveys of vegetation, birds and ground-dwelling mammals at 200 sites within 11 priority vegetation types, with sites selected to encompass gradients of time since fire and intervals between fires. This network of sample sites (2 200 plots in total) will form the basis of ongoing long-term monitoring between 2018 and 2029. DELWP's project plan states its intention to monitor these plots at least every five years.

DELWP has allocated a budget to deliver the program through a consortium of research institutes (University of Melbourne, Deakin University, La Trobe University, University of Wollongong and DELWP's Arthur Rylah Institute) for three of the 11 priority vegetation types from the 2018–19. The 2015 La Trobe University report prioritised the list of the 11 vegetation types and the three ecosystems that DELWP selected are from this list. DELWP's project plan notes that the remainder of the program is subject to funding in future years. DELWP will need to secure funding for

the remaining priority vegetation types if it is to meet the long-term outcomes of the monitoring program.

If completed, this statewide ecosystem resilience monitoring program will enable DELWP to validate:

- the species response models that FAME uses to determine how species respond to and recover after fire (see Section 2.4)
- TFI thresholds for priority vegetation types.

Regional ecosystem resilience monitoring stream

As part of its fuel management reporting, DELWP reports the number but not the actual results of ecosystem resilience monitoring assessments completed by each region.

DELWP's chief fire officer's 2018–19 fuel management delivery directive states that regions are to undertake ecosystem resilience monitoring in accordance with their regional MER plans. However, this does not give regions a target or clear guidance on how many monitoring assessments they should conduct. As a result, regions conduct varying numbers of assessments and count assessments differently. For example, the Loddon Mallee region counts checking an individual animal trap in a single location as one assessment site. Other regions count an on-ground species survey that covers a wide area as one assessment site. This difference in approach is seen in the wide variance of assessment numbers across regions, which Figure 3Q shows.

Ecosystem resilience monitoring assessments measure how a fire affects an ecosystem's resilience. DELWP conducts these assessments on a site-specific scale and uses them to support its bushfire management strategy.

FIGURE 3Q: **Number of ecosystem resilience assessments completed by region in 2017–18 and 2018–19**
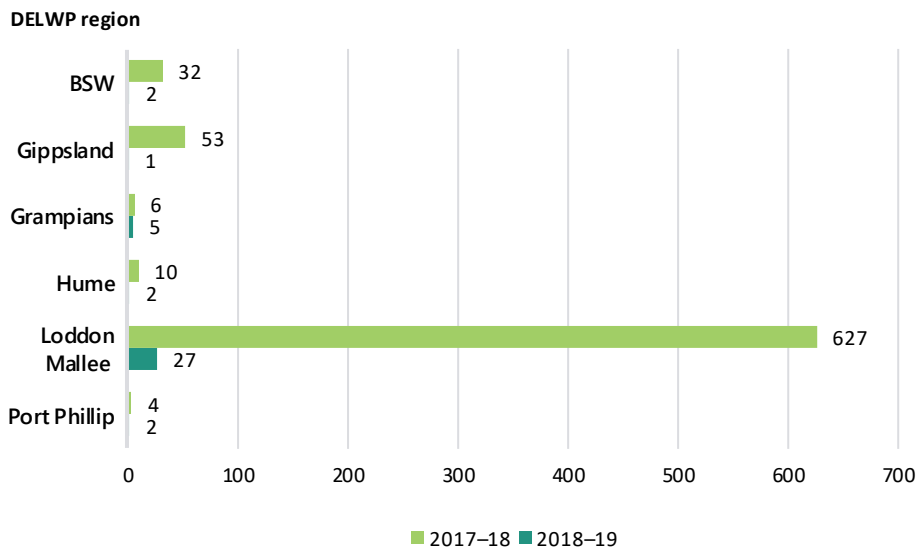
Note: BSW is Barwon South West.
Source: VAGO, using DELWP data.

DELWP acknowledges that comparing the number of assessments that each region conducts is an inaccurate indication of each region's ecosystem resilience monitoring

efforts. Despite this, DELWP publicly reports this data in a way that encourages such comparison.

Further, La Trobe University's 2015 ecosystem resilience monitoring report recommended monitoring within the regional stream using a 'before-after-control-impact' design to assess the impacts of fuel management on ecosystem resilience, as well as additional programs tailored to address species of regional significance. It also outlines guidelines for field methods and data analysis. However, only three of seven regional MER plans (Barwon Otway, Mallee and Murray Goulburn and South Western) reference use of control sites for one of the ecosystem resilience programs listed on their plans. There is no evidence that other regions or other ecosystem resilience monitoring programs are following this method.

Geometric mean abundance

DELWP does not currently report against GMA, despite stating its intention to do so in its *Measuring Ecosystem Resilience in Strategic Bushfire Management Planning* policy.

Reporting GMA is important because it is a good indicator of an ecosystem's resilience and the known species that inhabit it. Scientists use GMA to examine trends in biological diversity and assess if biodiversity targets are being met. DELWP acknowledges that this is a gap in its reporting. It advised us that FAME will enable it to forecast and report on GMA in its annual statewide reporting processes from the 2020–21 financial year onward.

4. Land-use planning

Victoria's bushfire history shows a strong link between property loss and loss of life. For this reason, planning and building controls play a key role in reducing bushfire risk by controlling where people can live and the construction standards they build to.

This chapter discusses:

- Limiting development in high-bushfire-risk areas
- Enforcing permit conditions within BPAs and the BMO
- Monitoring, evaluating and reporting the impact of planning on bushfire risk

4.1 Conclusion

Bushfire planning provisions, which were designed to protect human life by reducing development in high-bushfire-risk areas, do not always operate as intended. Audited councils consider bushfire risk when making planning decisions, such as approving permits for subdivisions or construction. However, they do not always ensure that applicants comply with the bushfire safety requirements in their planning permits. This undermines the core purpose of the planning provisions because properties may not provide adequate protection during a bushfire if they do not meet the planning requirements.

4.2 Limiting development in high-bushfire-risk areas

Strengthening the planning system

In 2017, the government changed the Victoria Planning Provisions to introduce strategies that help planners better identify, assess and manage bushfire hazards. These changes apply to all planning decisions for land in BPAs, the BMO and where land use and development may create a bushfire hazard.

Inter-agency engagement

DELWP effectively engaged with councils when it was developing and implementing BPA and BMO maps. In 2018–19, DELWP and CFA delivered 15 strategic land-use planning workshops across the state, where stakeholders were trained in how to interpret, consider and implement the state bushfire planning policy and strategies.

Existing developments

Following the Black Saturday bushfires, the government ran a voluntary buy-back scheme for landowners affected by the bushfires who had not rebuilt their properties. This placed more vegetation between properties in high-bushfire-risk areas. Property owners who chose to rebuild were able to submit a site plan with specific information, rather than apply for a planning permit, to streamline the approval process. To utilise the streamlined process impacted residents had until 30 September 2017 to submit a site plan.

As with all planning provision changes, the government's 2017 changes to Victoria's planning provisions were not retrospective. Consequently, properties that predate contemporary bushfire planning and building standards do not benefit from the updated controls designed to reduce bushfire risk. There are a number of possible options that DELWP, CFA and councils could explore to reduce risk to these properties. These include:

- providing grants to property owners so they can make small-scale modifications to their properties
- assessing properties for compliance with the new planning controls, which the New South Wales Rural Fire Service does
- councils introducing a restructure overlay into their planning scheme, as part of their strategic planning, such as the one used in the Dandenong Ranges after the 1969 fires, to reduce the number of houses in high-risk areas where land has been

A council may apply a **restructure overlay** to an area to identify old and inappropriate subdivisions that need to be restructured.

subdivided and sold but not built on yet. New developments built on land within the restructure overlay must meet the overlay's development guidelines.

Identifying high-bushfire-risk areas

Criteria for identifying potential bushfire hazards

DELWP maps BPAs and the BMO by identifying potential bushfire hazards. It does this by assessing proximity to continuous vegetation and the volume and type of that vegetation. An ember protection buffer is included in the mapped area to take into consideration the distance embers may travel from ignited vegetation to buildings. This varies depending on the type of vegetation and the size of the vegetated area. Vegetated areas were identified using aerial imagery and subsequently confirmed with council and CFA consultation.

Figure 4A shows the criteria that DELWP uses to map BPAs and the BMO.

FIGURE 4A: **Criteria for mapping BPAs and the BMO**

Vegetation type	Potential bushfire behaviour	Criteria for inclusion in BPA mapped area	Criteria for inclusion in BMO mapped area
Level 2			
• Forest • Woodlands • Scrub and shrublands • Mallee and rainforest	• Crown fire • Extreme radiant heat • Extreme ember attack	Vegetation area > 4 hectares + Ember buffer of 300 metres	Vegetation area > 4 hectares + Ember buffer of 150 metres
Level 1			
Scattered areas of: • Forest • Woodlands • Scrub and shrublands • Mallee and rainforest	• Crown fire • Ember attack	Vegetation area 2–4 hectares + Ember buffer of 150 metres	No BMO
Unmanaged grasslands	• Grassfire • Ember attack	Vegetation area > 2 hectares + Ember buffer of 60 metres	No BMO
Low			
• Managed grassland • Golf courses • Parks < 2 hectares	• Low bushfire risk	No BPA unless Level 2 or 1 ember buffer encroaches	No BMO

Source: VAGO, based on DELWP information.

DELWP developed its BPA and BMO hazard mapping criteria based on AS 3959:2009 vegetation types, stakeholder consultation and scientific reports. In addition,

recommendations of the Victorian Royal Commission that drew on studies of results from past fires, including Black Saturday informed the ember buffer. These criteria were also endorsed by CFA and the Metropolitan Fire Brigade.

DELWP advised that the selection of the hectare amount was based on Chen and McAneney's 2010 report, *Bushfire Penetration into Urban Areas in Australia: A Spatial Analysis.* The report observed that property losses for the historic bushfires it examined were associated with large continuous areas of bushland, with the smallest area being 1.6 hectares.

DELWP adds mapped BPA and BMO areas to VicPlan, which is the government's online mapping tool. VicPlan enables people to view the planning rules applicable to a property address or area in Victoria. Councils overlay these maps in their geographic information systems to confirm properties subject to BPAs or the BMO.

Bushfire prone areas

As shown by the green areas in Figure 4B, BPAs cover all of Victoria, except for metropolitan areas.

FIGURE 4B: **BPAs in Victoria**
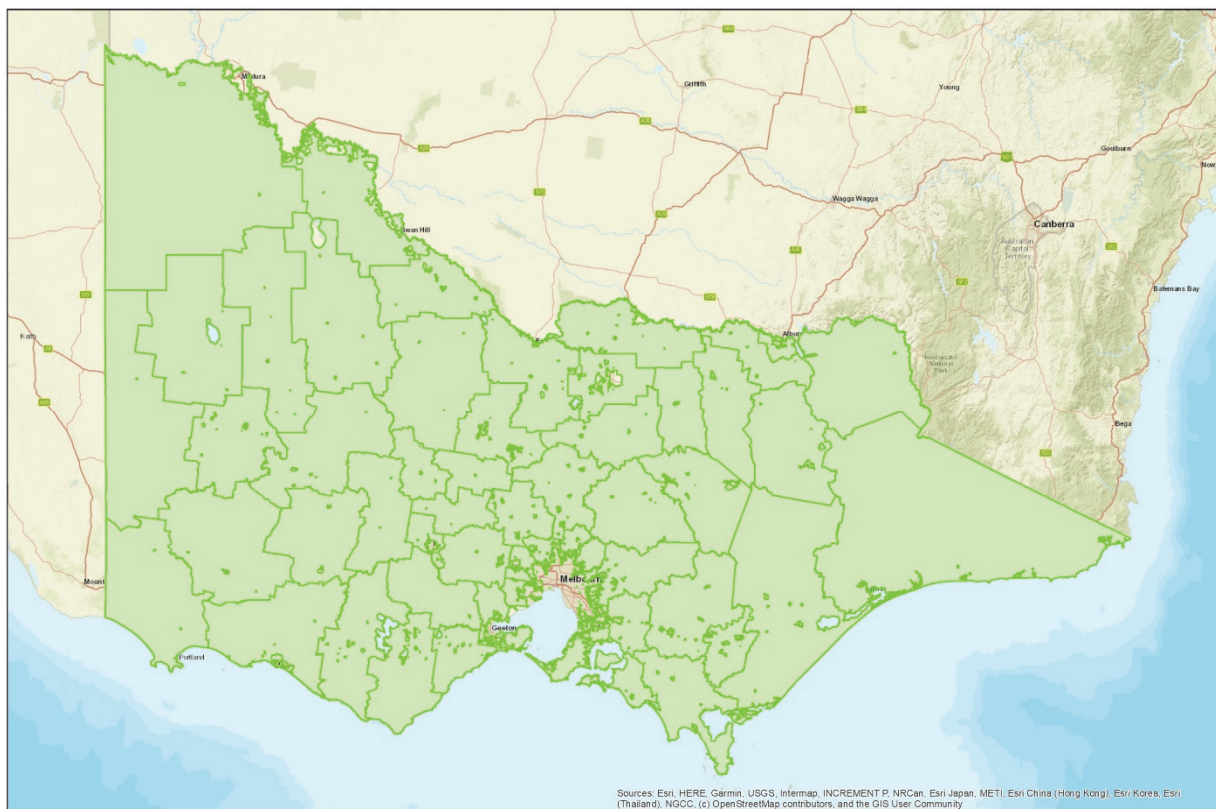
Source: DELWP.

DELWP reviews its BPA map twice each year based on its vegetation and ember protection buffer criteria. During this process, it consults with councils and CFA by seeking their comments on its draft maps. DELWP does not consider the assessments

that CFA and councils conduct on bushfire risk because the mapping control is based purely on the characteristics of the vegetation.

Bushfire management overlay

The BMO covers high-bushfire-risk areas where planning provisions apply. Figure 4C shows areas covered by the BMO in red.

FIGURE 4C: **BMO areas across Victoria**
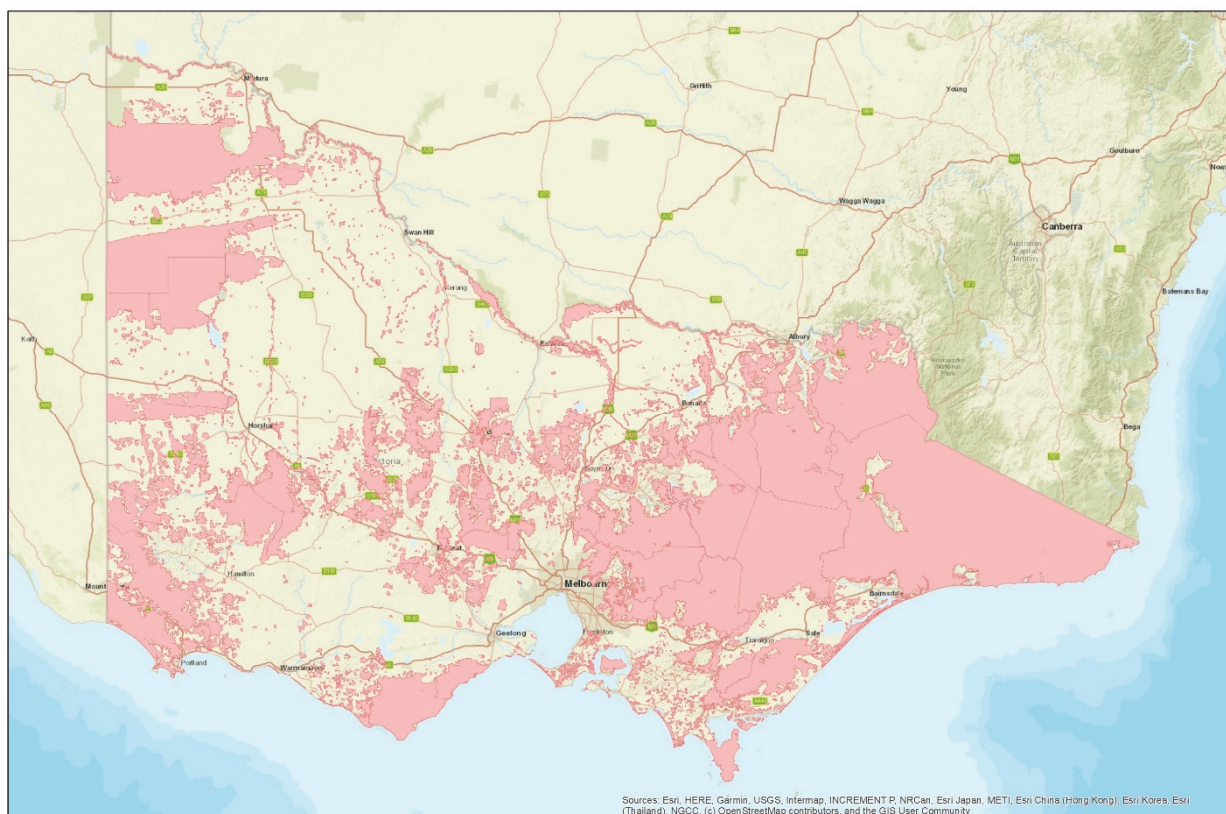
Source: DELWP.

DELWP reviews its BMO map every six months based on requests from landowners or councils. To do this, DELWP reassesses BMO review applications against the existing vegetation and ember protection buffer criteria.

Permit processes

As consistent statewide tools, DELWP's BMO and BPA maps have improved the consistency of councils' decision-making, as well as building and planning permit application processes across the state.

Planning permit process—bushfire management overlay

In addition to a building permit, all new buildings and extensions in the BMO need to apply for a planning permit. Landowners must include three components in their planning permit application—a bushfire site assessment, a bushfire hazard landscape

assessment and a bushfire management statement, as outlined in Figure 4D. To address the requirements of these three components, planning applications must also implement the clause 13.02-1 Bushfire, part of the Planning Policy Framework in the Victoria Planning Provisions and satisfy its requirements.

FIGURE 4D: **Planning application components in BMO areas.**

Bushfire site assessment	Bushfire hazard landscape assessment	Bushfire management statement
Assessment of the bushfire hazard within 150 metres of the development.	Assessment of the landscape bushfire hazard beyond 150 metres from the development.	How the development reponds to BMO provisions.

Source: VAGO.

A bushfire site assessment considers issues such as defendable space, access for fire trucks and water supply.

The regulatory framework does not require qualified or accredited consultants to perform these assessments. The CFA website refers landowners to the Fire Protection Association Australia's website for a list of accredited consultants. However, it advised us that there is a shortage of suitably qualified specialists in local and state government agencies who deal with bushfire risks to private land.

CFA also estimates that the cost of a qualified assessment ranges from $1 500 for a standard assessment to $5 000 for a more complex one. As qualified consultants are more expensive and hard to come by, councils and CFA report that they often receive poor-quality assessments completed by unqualified assessors.

Defendable space is an area of land that is maintained to provide a break between a building and bushfire fuel, such as vegetation, brush fencing and other flammable material. The amount of defendable space a building requires depends on its BAL.

4.3   Enforcing permit conditions within BPAs and the BMO

East Gippsland, Murrindindi and Whittlesea assess BMO and BPA regulations in their planning and building processes. While they enforce the revised building standards, they do not all enforce the BMO planning controls.

Audited councils do not routinely check that landowners comply with their planning permit conditions. Consequently, there is a risk that landowners:

• never meet the BMO conditions set by their permit

• do not maintain BMO standards for the life of their property

• may not be aware of BMO conditions when buying a property.

When a building is suitable for occupation, a building surveyor issues an occupancy permit or a certificate of their final inspection. However, the planning process does

not require a similar inspection to confirm that the property meets the permit conditions.

Murrindindi completes a compliance check on all house permits when their planning permits expire, which is two years after the planning permit has been issued. Planning officers write to property owners asking them to advise whether they have built the house and complied with all of the planning permit conditions, including BMO conditions. The property is then inspected by a planning officer to ensure that conditions have been complied with. This process only occurs once and there is no ongoing monitoring of BMO conditions.

While many permits require landowners to surround buildings on their property with defendable space, councils do not enforce it. If a property occupier does not maintain these areas on an ongoing basis, then they may not work effectively to reduce bushfire risk.

Under section 32C of the *Sale of Land Act 1962*, vendors must give prospective buyers a vendor statement that specifies if land is in a designated BPA or BMO. However, the legislation does not require vendor statements to outline a property's planning permit conditions. If buyers are not aware of permit conditions when they purchase property in a BMO, then they may not maintain its conditions.

In addition, property occupiers must maintain the conditions of the permit. Tenants of properties may not be aware of the conditions attached to the property they are renting.

Many buyers have no knowledge or understanding of what BPA or BMO designation indicates about the level of bushfire risk. For unbuilt properties, they often have no clear understanding of their risk from bushfire or the cost and complexity it may impose on building a dwelling in high-bushfire-risk areas.

Enforcing permit conditions on an ongoing basis imposes additional costs on councils. However, councils could enforce permit conditions on a risk-based or random basis to help enforce compliance. Figure 4E describes East Gippsland's approach to compliance inspections.

FIGURE 4E: **How East Gippsland enforces planning permit conditions**

East Gippsland reviews the status of a property development when its permit expires two years after approval. During this review, the council considers if the landowner needs a new permit or a permit extension.

During this process, the council could, but does not, assess the development's compliance with its permit conditions.

East Gippsland enforces planning permit conditions in response to concerns raised by the community or other parties. However, it stated that due to limited resources, it focuses on planning scheme breaches.

For example, due to a complaint raised in 2018, the council enforced planning permit conditions on Raymond Island, which is in the BMO. The council found that most properties on the island did not comply with their permit conditions. The council worked closely with CFA to help the community become compliant.

Source: VAGO.

4.4 Monitoring, evaluating and reporting

DELWP does not monitor, evaluate or report on how effective planning controls are at reducing bushfire risk. Additionally, it is yet to evaluate if the BPA and BMO requirements have resulted in a reduction in bushfire risk.

DELWP advised us that there have been no bushfires outside BPAs since 2013, which it believes supports the criteria and its application. Given that the BPA covers the majority of the state this is not surprising.

5.
Powerline Bushfire Safety Program

Powerline faults have started a number of major Victorian bushfires. In response to the Victorian Royal Commission's recommendations, the government is implementing the PBSP, which is a program of electrical safety upgrades, to reduce the risk of powerline faults starting future fires.

This chapter discusses how DELWP and ESV:

- Selected asset protection devices
- Identified risks and areas to treat
- Are implementing the program
- Are monitoring, evaluating and reporting on risk-reduction treatments

5.1 **Conclusion**

DELWP's PBSP, which has been informed by comprehensive research, is reducing the likelihood of powerline faults starting future bushfires. DELWP designed the program to achieve the greatest risk reduction in the highest risk areas with the available funds.

5.2 **How DELWP selected asset protection devices**

The PBSP was informed by:

- research completed by the Taskforce in 2011
- technology trials completed by external experts as part of the PBSP Research and Development Project (the R and D Project).

DELWP used research and trials to select which asset protection devices to install under the PBSP. These studies assessed REFCLs, which had not been previously tested for preventing bushfires.

Research and reviews

The Taskforce estimated that burying all of Victoria's high-voltage regional powerlines would reduce the risk of them starting a bushfire by 99 per cent. It estimated that insulating them would reduce the risk by 90 per cent. However, the Taskforce estimated that it would cost $40 billion to bury all of the powerlines in regional areas of the state or $20 billion to insulate them. The Taskforce decided that the cost of addressing all regional powerlines was too expensive. As a result, they recommended targeting treatment and burying or insulating powerlines in the highest risk areas.

The Taskforce also found that ACRs and REFCLs could be used to stop powerlines starting bushfires. In April 2013, the government commissioned an independent global review of current and emerging fire-prevention technologies to inform the PBSP. The report confirmed that ACRs and REFCLs were the best available option to reduce the risk of powerline faults starting bushfires.

The Research and Development project

The R and D Project also addressed three focus areas that the Taskforce had identified for further work:

- improving fire-loss-consequence modelling
- optimising how ACRs operate on high-fire-risk days
- investigating new protection technologies that reduce bushfire risk while minimising disruptions to electricity supply.

As part of the R and D Project, DELWP engaged CSIRO and experts to test the capacity of available REFCL models.

Rapid earth fault current limiter trials

DELWP invested $5.5 million from 2014 to 2015 in three REFCL technology trials. CSIRO's research indicated that once installed, these protection devices would reduce the risk of powerline faults starting bushfires by nearly 70 per cent on

31 000 kilometres of Victoria's 22kV high-voltage network. This represents a total risk reduction of around 38 per cent statewide.

CSIRO's research found that on average, installing a REFCL to a zone substation reduces the likelihood of a bushfire starting on the powerlines its supplies by between 51 to 56 per cent under all conditions. Later expert testing suggested that a 72 to 75 per cent reduction is likely under the highest fire danger conditions.

These expert trials also found that for REFCLs to prevent fires started by high-voltage powerline faults under Black Saturday weather conditions, they need to operate at a sensitivity of 0.5 amps. This is the optimal setting for reducing the risk of ignition while minimising customer supply disruptions. The government based the performance standard for REFCLs in the Regulations on this finding. Only one REFCL model that experts tested during these trials could achieve this result. This model was the one initially deployed under the PBSP. ESV advised us that another model has since been developed and is also being deployed.

Automatic circuit reclosers

In its June 2016 report to government, *PBSP Risk Reduction Model*, CSIRO stated that on bare-wire single-wire earth return powerlines, new-generation ACRs can reduce the likelihood of ignitions by 45.7 per cent under worst-case bushfire conditions.

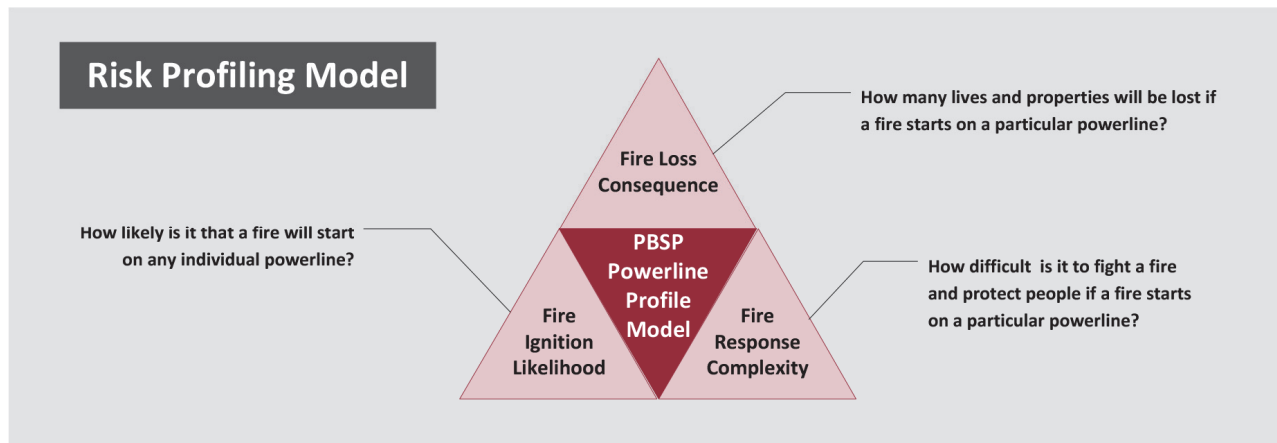## 5.3 Identifying risks and selecting treatment areas

DELWP's PBSP programs were informed by a comprehensive understanding of risk. DELWP targeted these programs to the highest risk areas to achieve the greatest benefit with the available funding.

Risk-assessment mapping

DELWP used three key inputs to develop its powerline risk profiling model, shown in Figure 5A:

• the consequences of a powerline-ignited bushfire, which it determined by modelling the number of houses that would be lost using Phoenix RapidFire (see Section 2.2 for further information about Phoenix RapidFire)

• the likelihood of ignition, which it based on CSIRO's analyses of the geographic location of electrical infrastructure, electrical asset fault history, and vegetation, terrain and weather conditions

• fire response complexity—the Emergency Management Commissioner used their knowledge and experience to identify high-bushfire-risk areas where it is difficult for firefighters to access and exit when responding to a fire.

FIGURE 5A: **The PBSP's powerline risk profile model**

Risk Profiling Model

How many lives and properties will be lost if a fire starts on a particular powerline?

Fire Loss Consequence

How likely is it that a fire will start on any individual powerline?

PBSP Powerline Profile Model

Fire Ignition Likelihood

Fire Response Complexity

How difficult is it to fight a fire and protect people if a fire starts on a particular powerline?

Source: DELWP.

In June 2013, the Fire Services Commissioner (now the Emergency Management Commissioner) determined the broad geographic area for deploying new asset protection devices under the PBSP.

To map the PBSP priority area, Phoenix RapidFire was used to predict the number of houses that would be destroyed if a powerline started a bushfire in Ash Wednesday weather conditions. As shown in Figure 5B, the PBSP priority area was mapped to include areas where modelled house loss numbers would exceed 2 000. The Fire Services Commissioner noted that finer geographic targeting within the PBSP priority area should occur on a project-by-project basis and consider vegetation, population, changes in technology and the progress of electricity asset deployment.

FIGURE 5B: **The PBSP priority area**

Fire Loss Consequence Map   **Local Government Area Map**

PBSP Priority Area
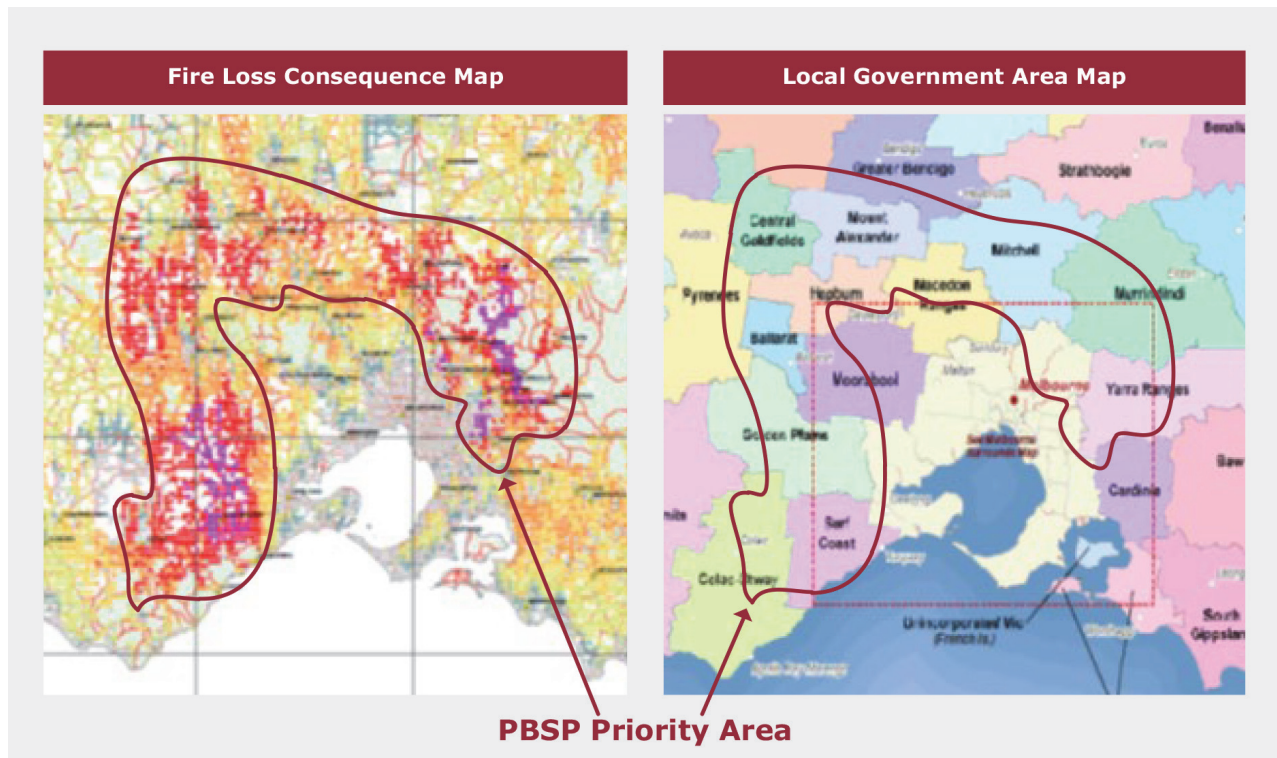
Note: The purple and red areas show where house losses would exceed 2 000 under Ash Wednesday conditions, as modelled by Phoenix RapidFire.
Source: DELWP.

Phoenix RapidFire modelling found that the greatest number of house losses were concentrated in a 130-kilometre radius of Melbourne's CBD, as shown in Figures 5B and 5C.

FIGURE 5C: **Victorian house-loss consequence 2014–2015**
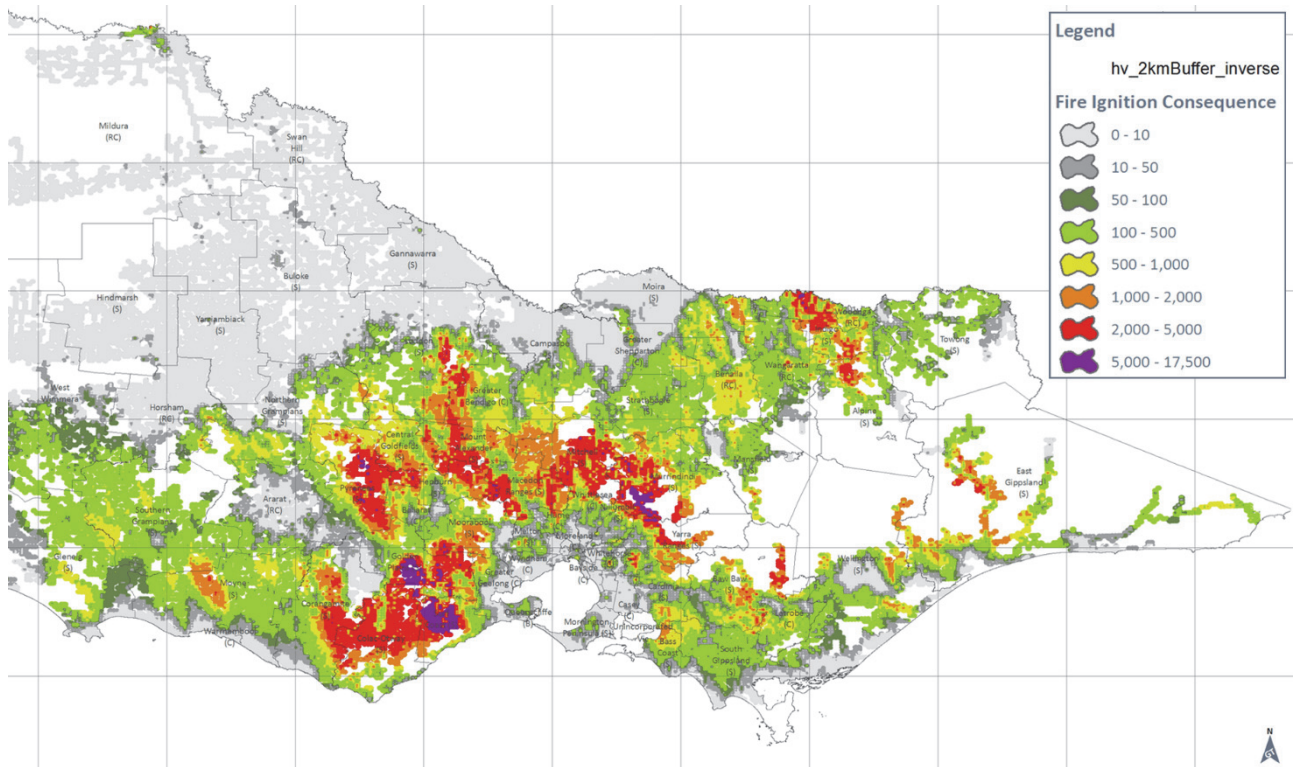
Note: The legend shows the number of houses that would be lost in a fire according to Phoenix RapidFire modelling
Source: DELWP.

Mapping the highest risk areas

DELWP also based its risk-assessment mapping on CFA's bushfire risk map. Under section 80 of the Electricity Act, CFA assigns high and low fire hazard ratings when identifying hazardous bushfire risk areas. DELWP added two new layers to the hazardous risk area of CFA's map—high risk and highest risk—to prioritise the focus of PBSP treatments. REFCLs are being installed in high-risk areas under the NAP. DELWP identified electric line construction areas (ELCA), which are the highest risk areas, for possible treatment under the PRF. ELCAs are regulated areas where future powerlines must be placed underground.

The PBSP project control board approved DELWP's final risk map in April 2015. Figure 5D shows the approved map.

FIGURE 5D: **PBSP risk treatment map**
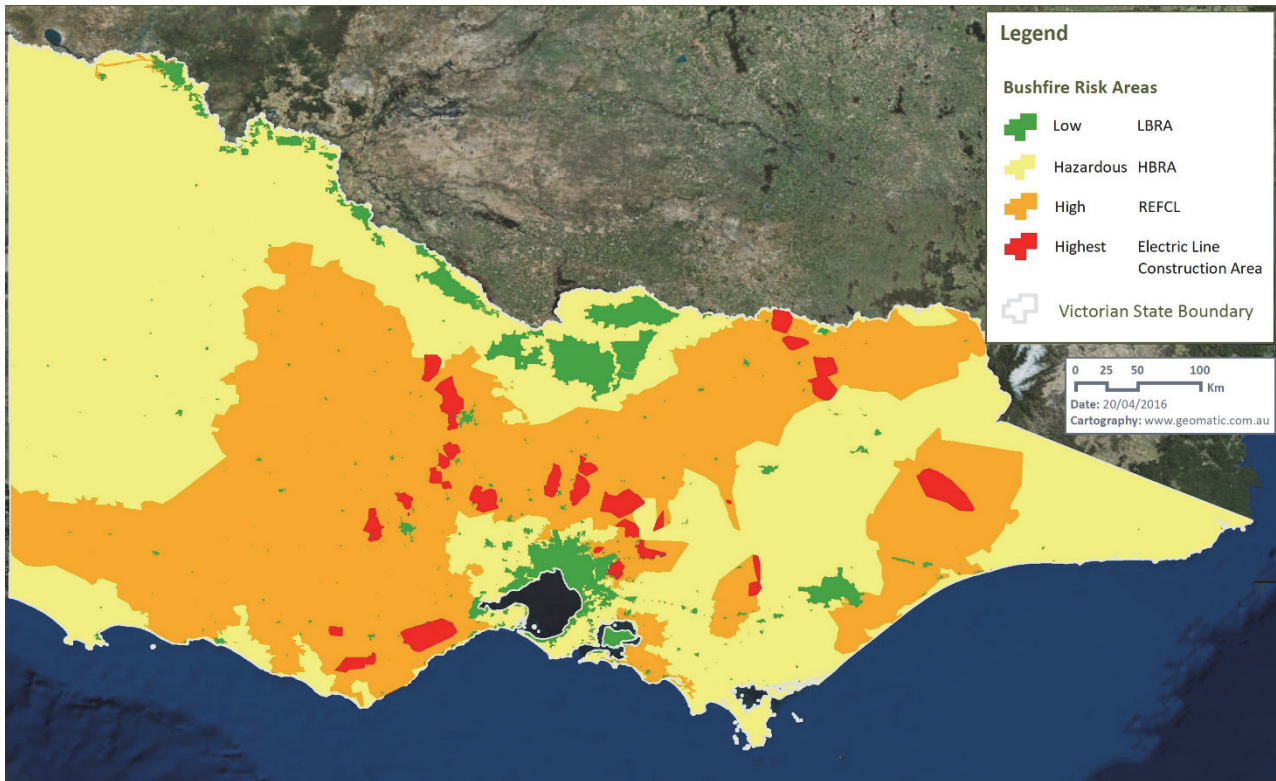
Source: DELWP.

Powerline Replacement Fund

DELWP used the PBSP risk profile model, shown in Figure 5A, to effectively identify ELCAs.

Due to the high cost of burying powerlines underground and the limited PRF funding of $200 million, DELWP could not afford to bury all high-voltage bare-wire powerlines in ELCAs. It costs around $325 000 per kilometre to bury or insulate bare-wire powerlines. These costs are only justifiable in areas where a powerline-started bushfire would have particularly high consequences, and where installing REFCLs or ACRs would not acceptably reduce the residual risk to human life.

DELWP's risk-based approach allowed it to deliver the best value-for-money outcome by prioritising powerline replacement in ELCAs where the greatest risk reduction could be achieved. It spent $169.7 million of the PRF funding to remove, insulate or bury high-voltage bare-wire powerlines.

DELWP allocated an additional $18.6 million to address the risk of low-voltage POELs. POEL owners within selected high-risk local government areas were able to apply for funding for the works.

High-voltage bare-wire powerlines

Identifying PRF treatment areas

In July 2013, three initial target areas were identified to commence phase one of the PRF which benefited from the first funding allocation of $26.5 million, over 2013–14 and 2014–15.

A selection team, chaired by the Fire Services Commissioner with representatives from DELWP's PBSP team and ESV, developed and applied the selection approach. They gave equal consideration to the following criteria when selecting the initial target areas:

• fire loss consequence—areas where the consequences would be the highest if a bushfire started. This was based on ignition points in Phoenix RapidFire where the estimated house loss from a bushfire would exceed 5 000 homes

• environmental conditions—areas where ignition points were most likely to lead to major bushfires due to vegetation, slope, aspect, drought and fire history

• exit and access points—which determine how easily and quickly people can be evacuated and effective emergency response delivered when a bushfire starts. The target areas were set to include areas with the least accessible access and exit points.

Three broad geographic areas—the Dandenong Ranges, the Otway Ranges and Warburton—were identified using the house loss criteria. Their boundaries were then reduced by excluding areas with good access and exit points and less hazardous environmental and fire conditions. These reduced areas were then modelled in Phoenix RapidFire with an overlay of powerline assets to establish possible ignition points. Based on this modelling, the selection team excluded populated areas that a fire would move away from and included populated areas a bushfire would move towards.

In May 2015, DELWP identified a further 30 ELCAs for potential PRF treatment based on the following criteria:

Criteria	Description

Fire carry and consequence	• areas where Phoenix RapidFire modelled:
	  • 2 000 houses would be lost under FDI 140, Ash Wednesday conditions
	  • 500 houses would be lost under FDI 70 conditions (total fire ban conditions).
	• areas where vegetation is capable of carrying fire over long distances, based on satellite images.

Exposure of people to bushfire risk	• communities that are not in close proximity to firefighting facilities and have the least accessible access and exit points • areas where powerline faults are the most likely to ignite a fire, based on historical fault information and CSIRO's modelling • communities with the highest risk levels according to Phoenix RapidFire's projected fire path, based on asset information contained in CFA's VFRR-B (see Section 2.5 for further information about VFRR-B).

Criteria	Description
Feasibility and value for money	• areas where bushfire risk can be addressed at a cost that is justified given the level of risk • areas with good network integration feasibility, which was determined by electricity distribution businesses in approved areas.

Prioritising ELCAs for PRF treatment

While DELWP identified 33 ELCAs, PRF funding was insufficient to replace all of the 3 477 kilometres of high-voltage bare-wire powerlines in these areas. The available funding would only replace 734 kilometres of powerlines. For scale, the total Victorian distribution network includes more than 144 000 kilometres of powerlines. DELWP therefore directed this funding to areas where treatment would achieve the greatest risk reduction.

To determine which areas to treat, the PBSP team met with the Emergency Management Commissioner to seek advice on prioritising the list of 30 ELCAs for PRF treatment and to identify obvious omissions. The Emergency Management Commissioner added Warrandyte and parts of the Macedon Ranges based on their emergency management knowledge and fire history. They were added because there is one road in and out of these areas, which restricts fire services and community movement in the event of a bushfire.

The Emergency Management Commissioner reviewed the fire loss consequence data and maps of each area and determined all 30 areas to be high bushfire risk. However, the Commissioner believed that some areas should be given higher priority in relation to powerline treatment. They assigned a priority ranking of high, medium or low to each of the 30 ELCAs based on this information and their on-ground emergency management experience.

The PBSP director independently rated the 30 areas. The Emergency Management Commissioner and PBSP director then discussed their rankings and agreed on the final ratings shown in Figure 5E.

Using these rankings, CSIRO incorporated new Powercor fault data and modelled the risk reduction that could be achieved by treating bare-wire powerlines in each group of priority areas. CSIRO's modelling of the 30 additional ELCAs found that by focusing on high-priority areas, DELWP could replace fewer kilometres of high-voltage bare-wire powerlines to achieve a 1 per cent reduction in state-wide bushfire risk. Figure 5E shows the risk reduction that CSIRO expected DELWP could achieve by replacing powerlines in all 30 ELCAs across the three priority areas. Figure 5F shows the same 30 ELCAs colour-coded by priority.

FIGURE 5E: **Estimated risk reduction by priority area**

Priority rating	Number of areas	Powerline length (single wire earth return and 22kV)			Estimated risk reduction potential	Number of kms needing replacement to reduce risk by 1%
		Gross total	Total length (unburnable)	Net total (gross - unburnable)		
High-priority areas	8	765.7	43.3	722.5	–4.3%	168.0
Medium-priority areas	11	1 051.6	64.6	987.0	–5.1%	193.5
Low-priority areas	11	995.2	38.6	956.6	–1.4%	683.3

Source: DELWP, and the PBSP's internal *Determination of PRF Further Target Areas* report.

FIGURE 5F: **ELCAs by priority rating**
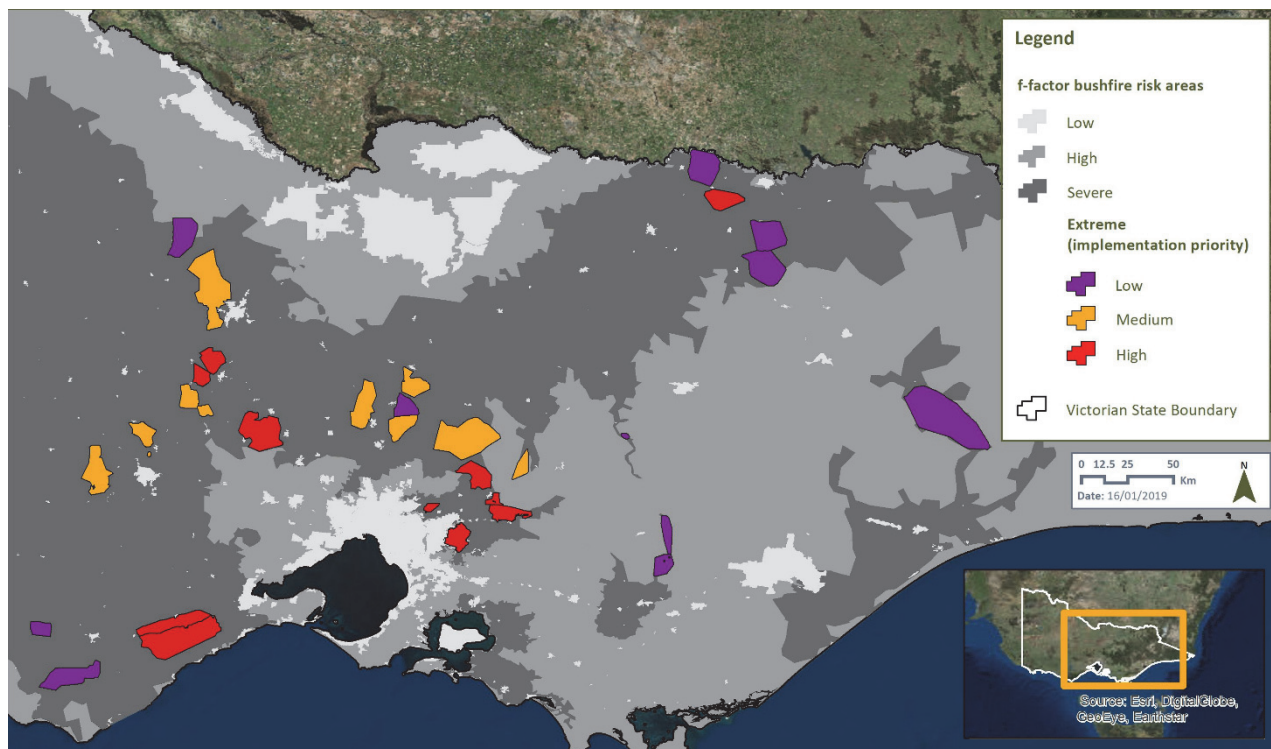
Source: DELWP.

DELWP only selected 11 ELCAs to treat under the PRF—the three initial target areas and the further eight high-priority areas. These areas are shown in Figure 5G. The further eight high-priority areas were:

• Maldon

• Muckleford Nature Conservation Reserve

- Chiltern
- Kyneton
- Warrandyte
- Kinglake
- Healesville
- Otway Ranges extension.

FIGURE 5G: **Areas selected for the PRF**

Source: DELWP.

Low-voltage private overhead electric lines

A number of significant Ash Wednesday fires were attributed to POEL faults. As a result, regulations were changed to require electrical distribution businesses to inspect POELs. When significant defects are found, owners are required to bury their POEL underground.

None of the significant fires on Black Saturday were caused by POELs.

The Taskforce took the effectiveness of this legislative initiative into account when making it recommendations. It did not make a recommendation about existing POELs, which are found almost exclusively in regional areas. However, in 2013, the government offered POEL owners funding to bury their POELs.

To be eligible for the funding, POELs had to be located in either:

- a local government area where, according to CSIRO's modelling, a POEL-ignited bushfire could destroy more than 1 000 houses
- a CFA-designated high-bushfire-risk area. While this applies to most of regional Victoria, properties within a township could be in a designated low-risk area.

CSIRO's modelling identified 33 local government areas as high risk (these areas are not the same as the 33 ELCAs). DELWP effectively prioritised areas based on their fire risk. Figure 5H shows how DELWP modelled and prioritised these areas based their house-loss consequences.

FIGURE 5H: **POEL replacement areas and their house-loss consequences**
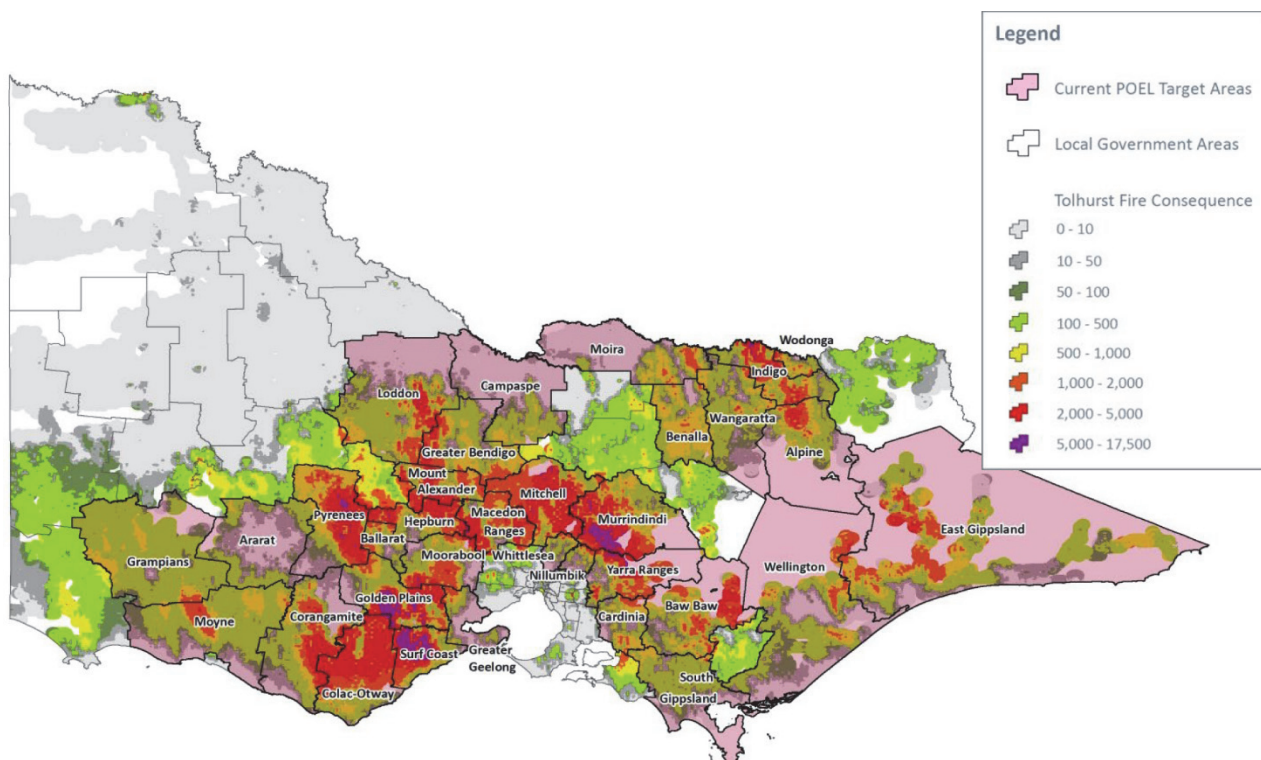
Source: DELWP.

Network Assets Project

REFCLs

The Taskforce package selected by the government recommended installing REFCLs at all 108 zone substations that supply electricity to regional Victoria. The Taskforce's recommendation assumed:

- the average cost of installing each REFCL was $4 million
- all zone substations were equally in need of REFCL protection
- it was cost-effective to deploy REFCLs at each zone substation.

Further research completed by the PBSP found:

- installation costs were much higher than estimated (approximately $10 million per REFCL)
- the powerlines associated with some zone substations were in low-risk areas (based on Phoenix RapidFire house-loss consequence modelling) and were therefore a lower priority
- some zone substations had less than 20 kilometres of powerline to protect, which was too small to justify REFCL investment. Alternative risk treatments were considered more appropriate for these zone substations.

DELWP determined that implementing REFCLs at all 108 zone substations would not be possible due to:

- budget constraints—the expected cost to implement REFCLs and ACRs was set at $500 million to limit the cost to electricity customers
- the need for electricity distribution businesses to complete REFCL installations within the program's 10-year period.

DELWP's PBSP team completed a risk assessment of each zone substation and the powerlines associated with them to determine which parts of the electricity distribution network most needed REFCL protection.

Zone substations cover 22kV networks, with powerline lengths ranging from 10 to 1 456 kilometres. The PBSP team combined Phoenix RapidFire fire loss consequence modelling with powerline information supplied by electricity distribution businesses. They used this information to determine the length of powerlines within each zone substation's network that were associated with different levels of estimated house losses.

DELWP's PBSP team did not consider ignition likelihood or fire response capability in their ranking process because zone substations cover large areas and their fire risk factors are sensitive to local conditions.

They ranked zone substations based on which ones had the highest number of kilometres of powerlines that were associated with estimated house losses of more than 1 000. They then compared outcomes achievable under three scenarios:

- installing REFCLs at the 20 highest ranked zone substations
- installing REFCLs at the 33 highest ranked zone substations
- installing REFCLs at the 45 highest ranked zone substations.

DELWP's PBSP teams' analysis was informed by ESV, modelling experts, emergency management advice and information provided by electricity distribution businesses.

In March 2015, the Emergency Management Commissioner approved the prioritisation approach, analysis, and a list of the 45 highest ranked zone substations subject to data updates. They stated their preference for installing as many REFCLs as possible. DELWP's PBSP project control board endorsed the 45 zone substations in July 2015.

Figure 5I shows Phoenix RapidFire's house-loss consequences map overlayed with the areas covered by the 45 selected zone substations.

FIGURE 5I: **House-loss consequences of the selected 45 zone substations**
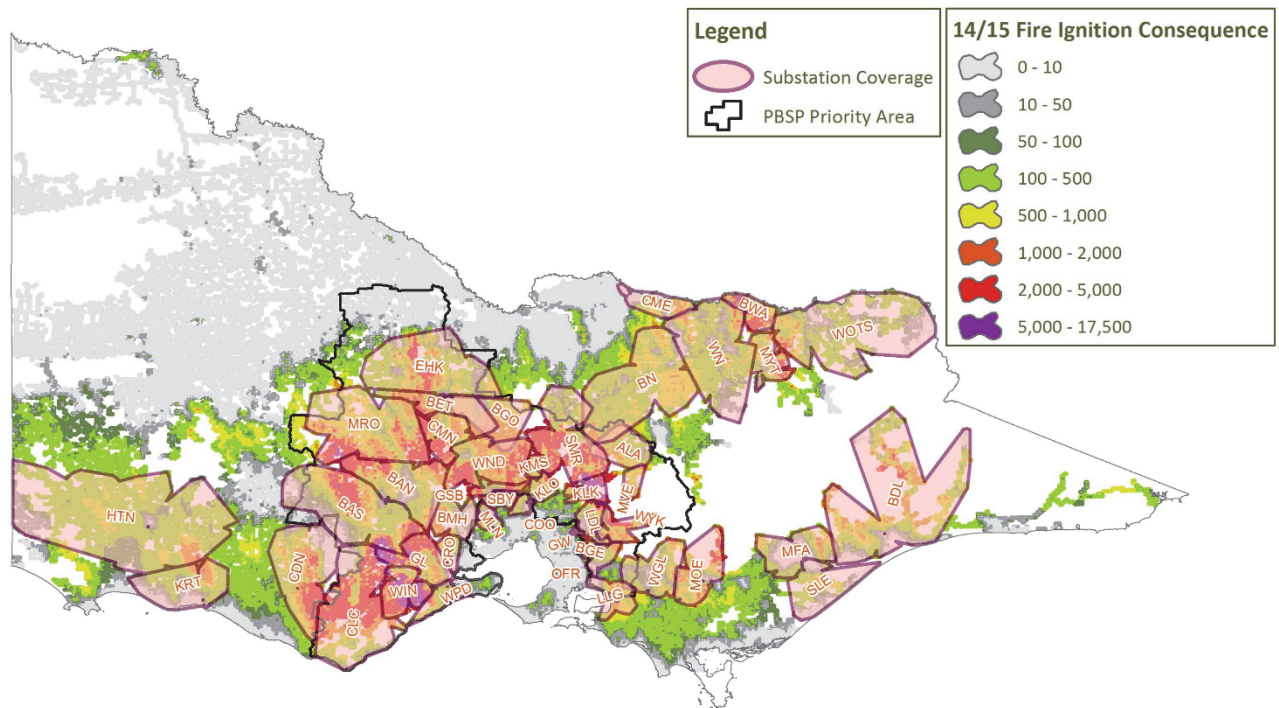
Note: The legend shows the estimated number of houses that would be lost in a bushfire, as modelled in Phoenix RapidFire.

Source: DELWP and modelling by Geomatic Technologies using Phoenix RapidFire data.

DELWP further ranked its selection of zone substations based on cost analyses for each site to achieve the best risk-reduction outcome.

DELWP found that installing REFCLs to the selected 45 zone substations would protect:

- 99.5 per cent of powerlines that had a modelled house-loss consequence greater than 2 000 houses
- 98.7 per cent of powerlines that had a modelled house-loss consequence greater than 1 000
- 48.8 per cent of Victoria's total 22kV network.

REFCLs are expected to contribute to 72 per cent of the total risk reduction delivered by the PBSP.

ACRs

Under the NAP, DELWP requires electricity distribution businesses to install new-generation ACRs to all of the regional single-wire earth return powerlines in their networks by 1 January 2021.

5.4   What has been delivered?

Powerline Bushfire Safety Program

As shown in Figure 5J, DELWP has delivered three of the four government-funded PBSP programs on time and within budget—the R and D Project, the PRF and the Local Infrastructure Assistance Fund. The NAP, which is funded by electricity customers, is expected to exceed its projected cost by nearly $250 million.

FIGURE 5J: **The PBSP's estimated costs and timelines at May 2020**

Project	Budget (millions)	Costs to date (millions)	Performance against budget	Project status	Performance against timeline
R and D Project	$10	$10	On budget	Completed	On time
PRF	$200	$188	Under budget	Completed	Ahead
NAP	$500[a]	$747	Over budget	Ongoing (due April 2023)	On track
Local Infrastructure Assistance Fund	$40	$38[b]	Under budget	Completed	Ahead
PBSP total	**$750**	**$983**			

[a] Based on DELWP's estimated cost in 2015.
[b] Includes $10 million redirected from the Local Infrastructure Assistance Fund to the High Voltage Customer Assistance Program.
Source: DELWP.

Powerline Replacement Fund

Progress and costs

DELWP used the $200 million PRF to get electricity distribution businesses to insulate or bury high-voltage bare-wire powerlines in 11 of the 33 ELCAs. Electricity distribution businesses put forward projects within ELCAs. The projects were reviewed by a technical advisory panel and recommended through the PBSP director to the PBSP project control board for approval. DELWP also directed funding to private property owners in selected local government areas to bury their POELs underground.

DELWP completed the PRF in March 2020 ahead of schedule and under budget. In total, the project cost $188.3 million. This consisted of the following costs:

• $169.7 million for 65 projects to treat high-voltage bare-wire powerlines
• $18.6 million for 798 projects to treat POELs.

Risk-reduction outcomes

Electricity distribution businesses have retired a total of 734 kilometres of high and low-voltage bare-wire powerlines under the PRF. They have the reduced risk on treated powerlines in ELCAs by 98 to 99 per cent. On completion of the NAP on

30 April 2023, all high-voltage powerlines in the 33 ELCAs will be protected by REFCLs.

A 70 per cent risk reduction, compared with the modelled risk in 2015, is expected to be achieved for the 11 ELCAs treated under the PRF on completion of the REFCL installations. As of January 2020, the risk reduction achieved was 63 per cent.

When the REFCL implementation is complete ahead of the 2023–24 bushfire season, the relative risk across all 33 ELCAs will be reduced by 58.6 per cent. This reflects a 48 per cent risk reduction across the state.

High-voltage bare-wire powerlines

Electricity distribution businesses have retired 540.8 kilometres of high-voltage bare-wire powerlines in 11 ELCAs, which is 0.5 per cent of Victoria's total high-voltage bare-wire powerline network. This includes 4.4 kilometres of single-wire earth return powerlines, which were removed and replaced with standalone power systems at three remote properties in the densely forested Otway ranges.

Standalone power systems, such as wind and solar systems, are independent from Victoria's energy network.

Private overhead electric lines

Using registered electrical contractors, property owners have replaced 193 kilometres of POELs in 33 local government areas.

Addressing untreated ELCAs

Prior to the PRF, there were 3 542 kilometres of high-voltage bare-wire powerlines across the 33 ELCAs. The PRF allowed DELWP to treat 15 per cent, or 540.8 kilometres, of them. This has left 85 per cent untreated.

In 2016, the government amended the Regulations to complement the PRF. This amendment requires electricity distribution businesses to bury or insulate new bare-wire powerlines in ELCAs and upgrade existing powerlines when they need to replace spans of four or more.

Electricity distribution businesses annually report to ESV on the progress of their bushfire-mitigation initiatives, as required by Section 120P of the Electricity Act. They report annually in August on work performed between 1 May to 30 April and work planned over the next reporting period. In August 2019, AusNet Services' *2019 Compliance Report* stated that it expects to decrease the amount of high-voltage bare-wire powerlines in its ELCAs to 81 per cent by 30 April 2020. Final figures are not yet available. Powercor did not report the projected percentage of remaining high-voltage bare-wire powerlines in its ELCAs. Figure 5K shows the number of kilometres of high-voltage bare-wire powerlines remaining in AusNet Services and Powercor's ELCAs since 1 May 2018.

FIGURE 5K: **Kilometres of high-voltage bare-wire powerlines remaining in AusNet Services and Powercor's ELCAs**

Kilometres
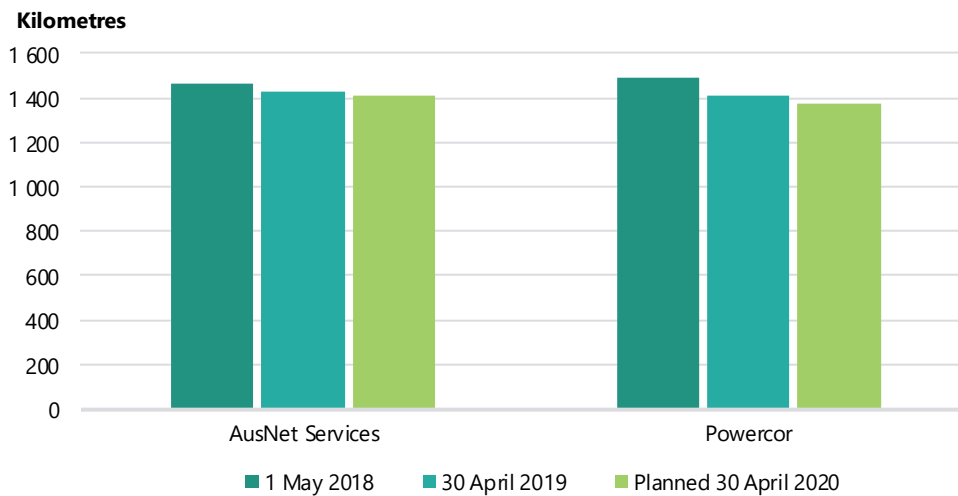
Source: ESV.

While the PRF accelerated these upgrades, DELWP and ESV estimate that at AusNet Services and Powercor's current replacement rates, it will take 30 to 50 years to insulate or bury all high-voltage bare-wire powerlines in the 33 ELCAs.

Ausnet Services and Powercor have recently applied to the Australian Energy Regulator for funding to accelerate their replacement works. In particular, AusNet Services has requested $35.5 million to bury or insulate 17 per cent of the remaining single-wire earth return powerlines in its ELCAs in 2021. The Australian Energy Regulator has not made a decision on these requests yet.

Network Assets Project

When the NAP is completed in 2023, REFCLs will protect 31 000 kilometres of high-voltage powerlines and ACRs will protect 30 000 kilometres of single-wire earth return powerlines in ELCAs.

Progress and costs

While electricity distribution businesses have had some challenges installing REFCL technology, they are making good progress. DELWP and ESV have been working closely with electricity distribution businesses to manage issues.

Electricity distribution businesses are passing the cost of the NAP onto electricity customers through increased rates on their bills. While the program was expected to cost $500 million, it is now forecast to cost customers $747 million, which is almost $250 million more. This estimate does not include the costs incurred by private and government organisations to prepare for the implementation of REFCLs. These additional costs are due to challenges that distribution businesses experienced while installing REFCLs. The Australian Energy Regulator, which decides what costs distribution businesses can pass onto customers, has reviewed and approved this.

The costs incurred to date include:

- $65 million for the installation of 1 754 new-generation ACRs
- $682 million for the installation of REFCLs at 45 zone substations.

Delivery of automatic circuit reclosers

Electricity distribution businesses completed the installation of all
1 754 new-generation ACRs across their high-voltage single-wire earth return
networks in April 2020, ahead of their 1 January 2021 deadline.

AusNet Services has installed all 524 planned ACRs and Powercor has installed all
1 230 planned ACRs.

Delivery of rapid earth fault current limiters

Electricity distribution businesses are installing REFCLs at 45 designated zone
substations. The government has spread the installation work across three tranches,
with the project due to be completed by 30 April 2023. AusNet Services and Powercor
each have 22 zone substations to treat across the three tranches. Jemena has one,
which is due in tranche three. AusNet Services and Powercor have completed tranche
one and are making good progress with tranche two.

Figure 5L summarises the project's implementation timelines and progress.

FIGURE 5L: **REFCL tranches and progress**

	Tranche 1 1 May 2019 Status: Completed Two approved extensions	Tranche 2 1 May 2021 Status: On track High-voltage customer delays expected	Tranche 3 1 May 2023 Status: Scheduled High-voltage customer delays expected	Zone substations Total: 45
Powercor Australia	1. Camperdown 2. Castlemaine 3. Eaglehawk 4. Gisborne 5. Maryborough 6. Winchelsea 7. Woodend	1. Ararat 2. Bendigo 3. Bendigo Terminal 4. Ballarat North 5. Ballarat South 6. Colac 7. Charlton 8. Terang	1. Corio 2. Geelong 3. Hamilton 4. Koroit 5. Merbein 6. Stawell 7. Waurn Ponds	22
AusNet Services	1. Barnawartha 2. Kilmore South 3. Kinglake 4. Myrtleford 5. Rubicon 6. Seymour 7. Wangaratta 8. Woori Yallock	1. Bairnsdale 2. Belgrave 3. Eltham 4. Lilydale 5. Mansfield 6. Moe 7. Ringwood North 8. Wodonga 9. Wonthaggi	1. Benalla 2. Ferntree Gully 3. Kalkallo North 4. Lang Lang 5. Sale	22
Jemena			1. Coolaroo	1

■ Completed—in service   ■ In service—not yet compliant   ■ Planned

Source: VAGO, based on information from DELWP as of 14 July 2020.

Tranche one

ESV gave AusNet Services extensions for two of its tranche one zone substations to meet the required performance standards—Woori Yallock, which is now due by 1 November 2020, and Kinglake, which is now due by 1 May 2021.

AusNet Services and Powercor have met the deadline for the rest of their tranche one works. To date, ESV has approved that 17 zone substations, 13 from tranche one and four from tranche two, meet their capacity requirements.

Tranches two and three

ESV expects that tranches two and three may be delayed if some high-voltage customers do not prepare their infrastructure for the new technology in time. Electricity distribution businesses have recently revised the deployment program for tranches two and three to accommodate high-voltage customer delays.

Issues and options for high-voltage customers

To optimise risk reduction on extreme fire days, REFCLs need to operate at their maximum sensitivity of 0.5 amps. However, REFCL operations can cause outages and potentially damage high-voltage customers' equipment. To prevent this, high-voltage customers need to alter or upgrade their electrical systems to be REFCL ready.

While electricity distribution businesses expect to install REFCLs on time, they may not be able to operate them if high-voltage customers are not REFCL ready by the required dates. Alternatively, electricity distribution businesses would need to disconnect these customers on total fire ban days.

High-voltage customers have the following three options to prepare their electrical systems for REFCLs:

• convert their supply to low voltage
• harden their high-voltage equipment
• isolate their equipment from REFCL operations.

Through the PBSP, the government established the $10 million High Voltage Customer Assistance Program to help private high-voltage customers meet the costs of these upgrades, which are about $250 000 per connection point. Under this program, high-voltage customers can receive direct financial assistance to upgrade their equipment depending on the solution they choose and the type, age and condition of their electrical assets. Financial assistance is capped at $250 000 per high-voltage customer and may cover up to 50 per cent of their upgrade costs.

In August 2019, AusNet Services reported that high-voltage customer Metro Trains' tranche two sites will not be REFCL ready by the required dates. As a result, AusNet Services will need to request extensions for up to four of their tranche two zone substations—Belgrave, Eltham, Ferntree Gully and Lilydale. AusNet Services has also stated that the Australian Defence Force may not be REFCL ready in time, which will put completion of work at the Wodonga zone substation at risk. Powercor reported delays for their Charlton and Ballarat North zone substations due to the readiness of high-voltage customers.

High-voltage customers are electricity users who are directly connected to Victoria's high-voltage distribution network. These users are typically commercial or government users who require large amounts of electricity to operate. There are 95 high-voltage customer sites across Victoria that will be impacted by REFCLs.

Performance standards

Under the Regulations, REFCLs must meet certain performance standards by the legislated compliance deadline for each tranche. These standards include being able to operate at a sensitivity of 0.5 amps. However, the Regulations do not specify when electricity distribution businesses must operate REFCLs at this setting. To minimise disruption to electricity supply, electricity distribution businesses only operate them at this setting from 10.00 am on a total fire ban day, code red days or when the FDI exceeds 30 (whichever is earlier). The settings do not revert back to normal until the FDI falls below 30.

Risk-reduction outcomes

When the project is completed in April 2023, REFCL technology is expected to reduce the risk of powerlines starting bushfires by 33.7 per cent across the state compared to the modelled risk in 2015.

Implementation challenges

Electricity distribution businesses are dealing with a range of issues as they implement REFCLs across their networks. The PBS Committee, ESV and DELWP are working closely with these businesses to address installation challenges. Distribution businesses are also sharing their learnings. Figure 5M describes the REFCL implementation challenges.

FIGURE 5M: **Implementation challenges**

	Implementation challenge	Cause	Result
New technology	Lack of REFCL expertise Implementation is not business as usual Significant change management requirements	REFCL technology is new to the Australian distribution system Electricity distribution businesses must meet ambitious implementation timelines or face civil penalties	The initial lack of expertise made the implementation timeframes challenging
Single source of supply	Lack of REFCL expertise Logistical challenges, such as working through technical and operational issues	Initially only one Swedish-based supplier made REFCLs that meet the required performance standards. There is now one other product which appears to meet the performance requirements and may be used for tranche three implementations	Deployment has taken longer than it might have otherwise taken
Technical issues	Some zone substations require more than one REFCL	Some zone substations have larger distribution networks and more customers	Some installations are more complex and costly
	REFCL operations result in a higher than normal voltage and this may damage existing assets	The elevated voltage that is associated with testing and operating REFCLs	Performance issues and installation delays
	Access issues	Challenging site topography	Increased installation time and costs

	Implementation challenge	Cause	Result
Supply reliability	Delays locating and fixing faults	The legislated REFCL performance standard is challenging to achieve	More customers experience supply disruptions for longer periods of time
		When operating at a sensitivity of 0.5 amps, REFCLs are more likely to be tripped and disrupt supply	Distribution businesses may not receive incentives for reliability
		When a REFCL is activated, the drop in voltage makes it harder to find the fault	

Note: DELWP recently funded a research and development project to investigate options to improve fault identification.
Source: VAGO.

5.5   Monitoring, evaluating and reporting

DELWP and ESV are effectively governing and monitoring the PBSP. They have also developed an effective framework to evaluate it. While DELWP has comprehensive internal reporting, it could improve its public reporting on the program.

Monitoring

The PBSP has been subject to various reviews that have made positive findings about its governance. These previous reviews include:

- the Bushfires Royal Commission Implementation Monitor's *Final Report 2012* and *2013–2014 Annual Report*
- DELWP's annual internal reports
- the Department of Treasury and Finance's 2012, 2014, 2016 and 2019 gateway reviews.

DELWP has continued to effectively govern, monitor and report internally on the PBSP.

We observed the PBS Committee's August 2019 meeting, reviewed its meeting papers and met with its chair and distribution businesses. The PBS Committee plays an effective role in monitoring the PBSP's implementation. We also found that it is engaging with the distribution businesses well.

DELWP uses a number of methods to identify and respond to learnings about governance and implementation challenges, including workshops, internal reports and benefits-realisation analyses. ESV's PBS Committee also helps electricity distribution businesses share their learnings.

Measuring performance

PBSP performance indicators

When the PBSP commenced, DELWP identified a range of output measures to track each project's performance. These are reported to every project control board meeting. DELWP has also set annual risk-reduction targets up to 2023 for its PBSP initiatives.

Commencing in the 2018–19 financial year, DELWP added two PBSP performance measures to its BP3 service delivery measures. Figure 5N outlines these measures, the targets and program's actual performance.

FIGURE 5N: **PBSP performance measures**

New service delivery performance measure		*2018–19*		
Program	**Measure**	**Target**	**Actual**	**Variance**
PRF	Cumulative length of powerlines retired in high-bushfire-risk areas to reduce the risk of bushfires from electrical assets.	770 km	693 km	–77 km
PBSP	Relative reduction in statewide powerline-related bushfire risk.	36.1%	32.5%	–3.6%

Source: DELWP's *Annual Report 2019* and the Victorian State Budget 2018–19.

Both the PRF and PBSP missed their 2018–19 risk-reduction targets due to time delays. DELWP expected to deliver the PRF a year early in November 2019, but actually finished it in March 2020. Similarly, due to some ESV-approved delays to REFCL installations, the PBSP missed its risk-reduction target by 3.6 per cent.

Evaluation

Evaluation plan

DELWP developed a comprehensive evaluation plan and a benefits-realisation framework for the PBSP early on. DELWP intended the PBSP to:

- reduce the potential for harm to people and property posed by powerline-started bushfires
- maintain the reliability of power supply
- reduce the impact of power disruptions on vulnerable Victorians
- add to the pool of knowledge that Victoria can use to improve power distribution and manage bushfires.

DELWP plans to evaluate the risk-reduction benefits and outcomes for individual PBSP projects by the end of 2020. DELWP has commenced this evaluation by commissioning external consultants to review the effectiveness and benefits of REFCLs, ACRs and the overall PBSP.

Measuring risk reduction

DELWP uses Phoenix RapidFire and CSIRO modelling tools to calculate how PBSP initiatives will reduce Victoria's statewide residual risk level. To do this, it compares the risk of the electricity network starting a bushfire before PBSP treatments to after they have been implemented.

DELWP calculates the risk-reduction outcomes of treatments in each distribution businesses' network at the level of individual poles and powerline spans. However, it

does not calculate the risk reduction achieved by replacing POELs because it did not include these networks in its initial risk modelling.

Figure 5O shows the residual risk reduction that DELWP expects the PBSP to achieve over its lifespan.

FIGURE 5O: **The PBSP's relative reduction from financial year 2011–12 to 2072–73**
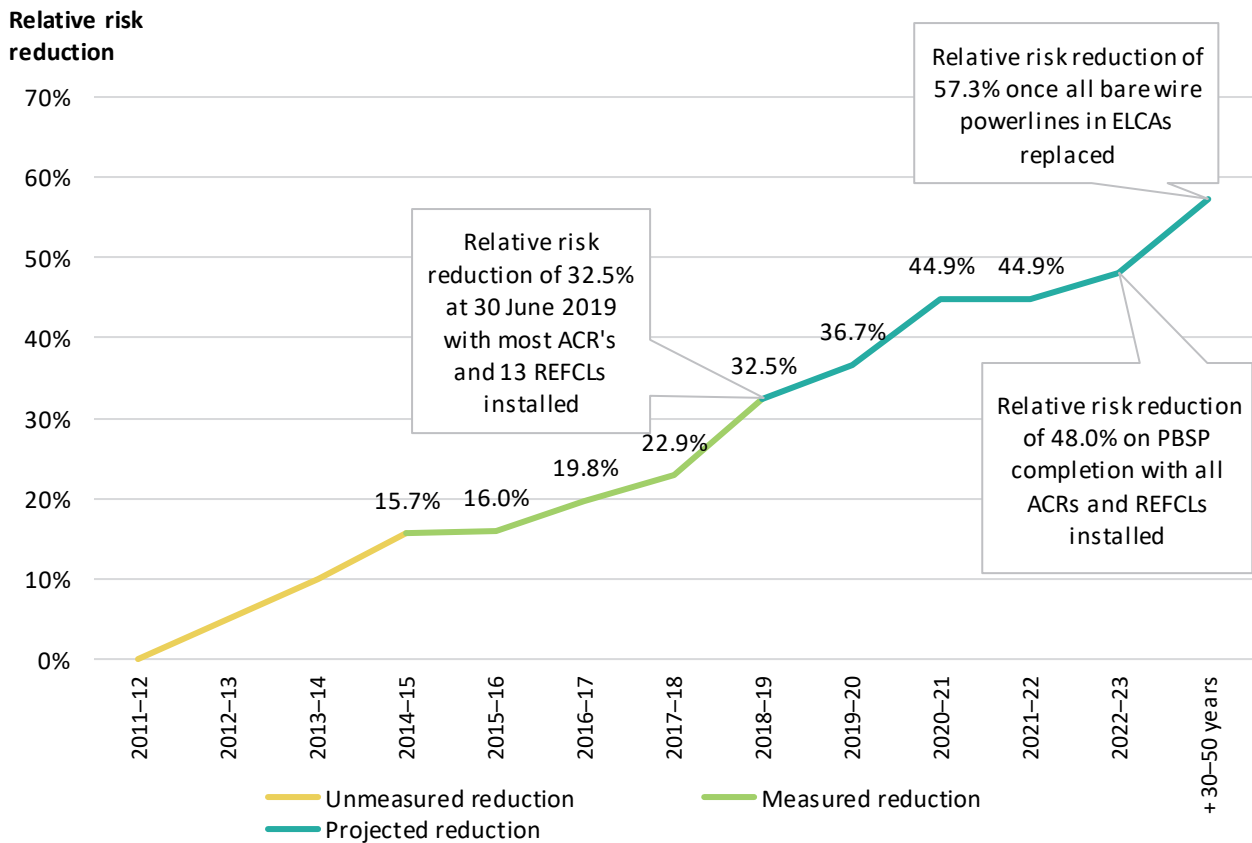

Source: VAGO, based on DELWP information.

DELWP has projected that the PBSP will achieve the sharpest falls in risk in financial years 2018–19, 2020–21 and 2022–23, which coincide with each REFCL tranche. This reflects how important REFCLs are to reducing bushfire risk. When tranche three is completed on 30 April 2023, Victoria's statewide risk level will have been reduced by 48 per cent.

DELWP estimates that once it completes the PBSP in 2023 and electricity distribution businesses finish replacing all bare-wire powerlines in ELCAs in 30 to 50 years, Victoria's statewide powerline-related bushfire risk will have been reduced by 57.3 per cent. Figure 5P shows the expected risk reduction by region in 30 to 50 years.

FIGURE 5P: **Expected risk reduction by region in 30 to 50 years**
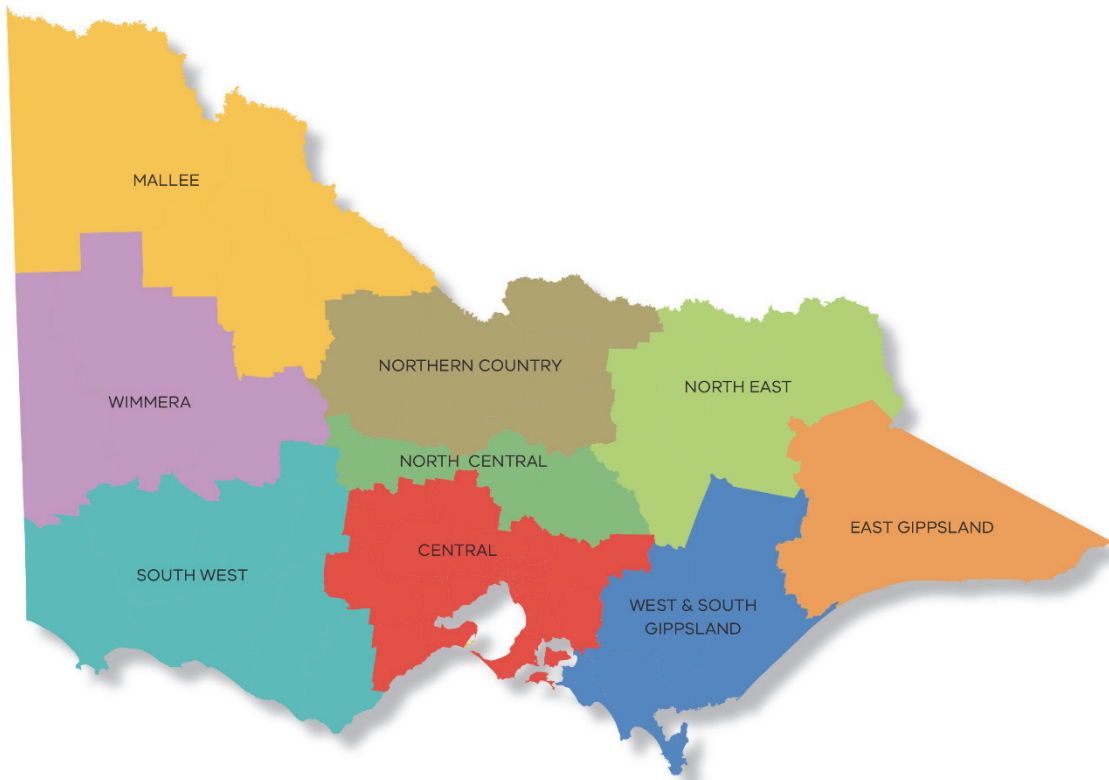
	Malee	Wimmera	South West	Northern Country	North Central
Total HV line length (kms):	9,885	8,404	13,951	13,320	4,716
HV line length (kms) to be protected by: • Underground/insulating lines • REFCLs • ACRs	0 985 9,885	0 812 8,404	297 6,808 13,951	383 3,274 13,320	868 3,142 4,716
Reduction in HV powerline risk	-44%	-39%	-52%	-52%	-67%
Other protection measures introduced: • POELs placed underground • Vulnerable people protected from outages	0 612	0 595	224 1,387	210 2,448	28 287

	Central	North East	West & South Gippsland	East Gippsland	State-Wide
Total HV line length (kms):	21,843	7,241	8,980	2,777	91,117
HV line length (kms) to be protected by: • Underground/insulating lines • REFCLs • ACRs	1,184 8,456 21,843	440 4,915 7,241	99 1,801 8,980	181 1,415 2,777	3,452 31,608 91,117
Reduction in HV powerline risk	-61%	-60%	-35%	-55%	-57%
Other protection measures introduced: • POELs placed underground • Vulnerable people protected from outages	205 7,305	93 1,028	35 1,781	3 494	798 15,937

Note: HV stands for high voltage.

Source: DELWP.

Assessing REFCL performance

2019–20 bushfire season

REFCLs were operating at 19 zone substations on 17 total fire ban days during the 2019–20 bushfire season. Across these days, REFCLs were activated by electrical faults 49 times. 24 of these faults would have likely started a bushfire. Despite these faults, no fires started on REFCL-protected networks. The REFCLs potentially prevented ignitions at a time when Victoria was enduring catastrophic bushfire activity.

For all other days during the 2019–20 bushfire season, there were 15 fires reported to ESV that occurred on REFCL-protected networks. However, it is unknown how many faults occurred that did not result in a fire on these days.

Incentives for electricity distribution businesses

Electricity distribution businesses report fire starts to the Australian Energy Regulator and ESV as part of the f-factor Incentive Scheme.

The government introduced this scheme in 2012 in response to the Black Saturday bushfires. The scheme assesses each fire ignition by location and time and imposes higher penalties or incentives for fires started or prevented on high-fire-risk days.

The **f-factor Incentive Scheme** is a regulatory scheme under the *National Electricity (Victoria) Act 2005.* It incentivises electricity distribution businesses to lower the number of fire starts on their networks. If the number of fire starts falls, they receive a financial incentive. If it rises, they receive a penalty.

Reporting

Public reporting

ESV has released comprehensive public reports on its bushfire risk-mitigation activities and the progress of the NAP and PRF.

Distribution businesses report to ESV on their bushfire risk-mitigation activities through their bushfire mitigation plans, the PBS Committee and their annual compliance reports.

During the bushfire season, ESV prepares weekly reports detailing:

- cumulative and rolling fire incidents on Victoria's electricity networks
- electricity distribution businesses' progress in undertaking fire-mitigation activities.

The PBS Committee is transparent about its activity and publishes its meeting minutes, agendas and status updates about electricity distribution businesses to the ESV website.

DELWP's public reporting on the PBSP has been limited. However, during the audit in August 2020, DELWP released its first public report, *Powerline Bushfire Safety Progress Report*, covering 2012 to 2019. The report provides the public with a comprehensive overview of the program, its elements and outcomes.

Internal reporting

DELWP produces comprehensive internal reports on the PBSP's progress. These include progress reports to program control board meetings for all PBSP projects and its PBSP annual performance reports, which monitor how the program is reducing Victoria's risk of powerline-related bushfires. DELWP advised us that it does not publicly communicate its PBSP annual performance reports because they are technically complex and contain some highly sensitive information.

APPENDIX A
Submissions and comments

We have consulted with CFA, DELWP, East Gippsland, EMV, ESV, PV, Murrindindi and Whittlesea, and we considered their views when reaching our audit conclusions. As required by the *Audit Act 1994*, we gave a draft copy of this report, or relevant extracts, to those agencies and asked for their submissions and comments.

Responsibility for the accuracy, fairness and balance of those comments rests solely with the agency head.

Response provided by the Chairperson, CFA

Patron: Her Excellency the Honourable Linda Dessau AC, Governor of Victoria

Chair, CFA Board
Headquarters
8 Lakeside Drive, Burwood East Vic 3151
Phone: 9262 8605

Our Ref: 2020.10.05GW:js

5 October 2020

Mr Andrew Greaves
Auditor General
Victorian Auditor General's Office
Level 31, 35 Collins St
MELBOURNE VIC 3000

Dear Mr Greaves

REDUCING BUSHFIRE RISKS

Thank you for your letter of 4 September 2020, and the opportunity to review and provide comment on the proposed performance audit report for Reducing Bushfire Risks.

On behalf of the Country Fire Authority, I accept the findings in the report and the recommendations appropriate to CFA, and provide the enclosed action plan which describes work we will undertake to implement the recommendations.

A number of the recommendations apply across multiple agencies, either directly or in consultation. CFA commits to collaborating with the Department of Environment, Land, Water and Planning (DELWP), and other agencies such as Fire Rescue Victoria (FRV) and municipal councils as appropriate to support the most effective action for these recommendations.

I would like to express my thanks to the members of the audit team for the professional and constructive approach they have taken to this audit. The audit team members have been effective in their work, easy to work with, and responsive to our input.

Audits such as this provide us with an opportunity to improve our service to the community and we appreciate the process and efforts of your team in conducting the audit.

If you would like more information or would like to discuss this matter further, please contact Mr Alen Slijepcevic, Executive Director Bushfire Management, by email at the following address: a.slijepcevic@cfa.vic.gov.au

Protecting lives and property

cfa.vic.gov.au

I look forward to the implementation of the recommendations to reduce the impact of bushfires on our people, property, our environment & cultural heritage, and our economy.

Yours sincerely

Greg Wilson
Chairperson

Enc: Action Plan CFA – Reducing Bushfire Risk

cc: Ms Catherine Greaves, Acting CFA Chief Executive Officer
        Mr Garry Cook, Acting CFA Chief Officer

2 of 2

Country Fire Authority action plan to address recommendations from Reducing Bushfire Risks

No	VAGO recommendation	Action	Completion date
1	DELWP in partnership with **CFA** and FRV develops, implements and publicly reports on a holistic suite of performance metrics to demonstrate: • the impact that planned burning has on public and private land on bushfire risk • the impact that planned burning has on public and private land on ecosystem resilience • the impact that non-burn fuel management activities have on public and private land on bushfire risk • the impact that its activities at local and regional levels have on bushfire risk • the cost-effectiveness of its fuel management	CFA subject matter experts (Research and Development staff, Predictive Services staff and Vegetation Mgt staff) will work with DELWP to develop these performance metrics. CFA will determine data required to contribute to these metrics and establish systems with regionally based vegetation management staff for data input. CFA will work collaboratively with DELWP in the development of public facing data reporting tools. The level of ongoing support will be determined by continued funding of current Safer Together funded resources.	Dec 2021
2	DELWP enhances Phoenix RapidFire by: • exploring multiple bushfire modelling tools to lower the uncertainty and limitations associated with using a single modelling tool • applying more detailed fire-severity data • validating and updating fuel accumulation curves • establishing and regularly updating an archive of well-documented fire events and using this to systematically test it against a broad range of burning and fuel conditions • establishing and implementing processes to routinely review and update its underlying datasets (see Section 2.2).	CFA subject matter experts will assist DELWP with this action, consistent with current support to joint-agency projects improving modelling developments and the application of modelling tools in planning and response. CFA will contribute its expertise to the design and implementation of a database to store necessary data.	
3	DELWP develops more holistic bushfire-management planning that focuses on the best mix of risk treatments rather than planned burning alone (see Section 2.3).	CFA notes that more holistic planning should be blind to land tenure and will involve CFA, Local Government, the community, other responsible agencies and stakeholders.	
4	DELWP determines which elements of different regional planning approaches are the most effective and implements these across the state (see Section 2.4).	CFA notes that regional planning approaches need to plan across public and private land. This will necessarily involve CFA, Local Government, the community and other stakeholders.	
5	DELWP – regarding Values Checks		
6	DELWP – regarding Traditional Owners		
7	CFA improves planning on private land to ensure risk assessments and plans are conducted consistently across public and private land to address statewide bushfire risk based on where and how they can most effectively reduce risk (see Section 2.5).	CFA notes the relationship of this recommendation to the single entity recommended by the IGEM inquiry into the 19-20 Bushfire Season (rec 4). CFA will collaborate with and support the operation of these arrangements.	Dec 2023

CFA will seek funding for continuing existing Safer Together funded resources and additional regional planning capability. These critical resources will allow CFA to more effectively contribute to the development, and consistent utilisation on private land of joint agency systems. CFA notes that planning for bushfire risk mitigation on private land will need to occur in partnership with DELWP, Local Government, the community and other stakeholders.

CFA will develop a project to further previous work on the current application of VFRR (and integration with other modelling tools such as Phoenix) and enhance its utility as an asset register to better inform planning (and response) to reduce risk to important private, public and community assets.

CFA will review existing programs and where necessary initiate new programs (in partnership with other agencies and stakeholders) to further develop approaches for place-based planning and engaging with communities to ensure that risk and appropriate mitigation actions and shared responsibility are better understood by community and individuals.

CFA will seek new resources to improve our understanding and datasets of private land vegetation and factors affecting potential fire behaviour and appropriate management decisions. This will improve the management of private lands for reducing risks to people, financial assets, cultural heritage and the environment.

8	CFA		Dec 2021
	improves its values checks by providing ongoing statewide support to regional vegetation management officers and leveraging any relevant systems or capabilities from DELWP to conduct values checks through guidance, training and ongoing funding (see Section 2.4).	CFA will seek funding for ongoing employee costs for the two advisors currently funded by Safer Together and an additional cultural heritage advisor. CFA will run periodic specialist training and professional development for field based vegetation management staff, that will improve utilisation of CFA specific systems and those managed by other agencies.	
9	DELWP and CFA		Dec 2022
	systemically documents and publicly reports reasons why it does not complete planned burns (see Section 3.2).	CFA (in partnership with DELWP) will determine data input requirements and utilise joint systems to record planning and operational decisions for planned burns. This information will be presented in an annual fuel management report.	

10	DELWP and CFA develops financial reporting to monitor fuel management costs and estimate future costs (see sections 2.4, 3.2 and 3.3).	CFA (in consultation with DELWP) will further develop its financial monitoring tools and determine how to integrate finance reporting and works management systems in a manner which supports efficient and timely analysis of performance and effectiveness.	Dec 2022
11	DELWP Regarding targets for the number of fuel hazard assessments conducted		
12	DELWP regarding more effective ecosystem resilience monitoring		
13	DELWP in partnership with Parks Victoria, CFA, FRV and councils as appropriate, collect empirical evidence after bushfire events to assess the effectiveness of different fuel management treatments, including planned burning, mulching, slashing and mineral earth breaks, and build an evidence base to the effectiveness of these treatments (see sections 3.2, 3.3 and 3.5).	CFA will collaborate with DELWP to establish a routine post bushfire event assessment process with a lead agency representative(s) and other resources (subject to funding) to collect and store required data for efficient and effective analysis. CFA will seek funding for ongoing employee costs for the two Fire Behaviour Analysts (FBANs) to routinely undertake that work as well as reconstruct other bushfires as a part of ongoing learning. This work will contribute to a continuous improvement process which will inform future prevention and response strategies and improve bushfire modelling.	Dec 2021
14	DELWP & CFA in partnership with councils, provide advice to government in line with the *Safer Together: A New Approach to Reducing the Risk of Bushfire in Victoria* policy on options to better resource the assessment of risk on private land, its treatment and activities to enforce compliance of land owners with risk-reduction treatments. (see Section 3.3).	CFA (in partnership with DELWP) will develop advice and funding requirements to continue the Safer Together implementation particularly with respect to resources and funding for bushfire risk mitigation on private land. This will include community engagement programs, planning and delivery of fuel management, and knowledge development & application.	Dec 2021
		CFA (with DELWP and other stakeholders) will develop a Bushfire Management Strategy that will guide the sector in preparing and responding to bushfires in the future. With particular attention to a changing climate and population in bushfire prone areas, the strategy will support a model of shared responsibility, together with strengthened community engagement approaches and further development and utilisation of social and biophysical sciences to underpin actions.	Dec 2021
		CFA will work with DELWP and Councils to develop an options paper regarding planning, conducting and enforcing risk-reduction treatments on private land and	Dec 2022

		potential legislative change. This work will be undertaken noting the recommendation 2 of the IGEM inquiry into the 19-20 Bushfire Season.
15	Discussed with VAGO. Recommendation removed.	
16	DELWP provides advice to government, in consultation with CFA and councils, on options to improve owner and occupier awareness of and accountability for Bushfire Management Overlay planning controls (See Section 4.3).	CFA land use planning section will work with DELWP Planning Section through established working relationships to contribute to advice to be provided by DELWP. CFA will assist in communicating and raising awareness of bushfire management planning controls and outcomes of this work by publishing guidance and advice in various media and inclusion as appropriate in community engagement programs.

Department of Environment, Land, Water and Planning

PO Box 500, East Melbourne,
Victoria 8002 Australia
delwp.vic.gov.au

Ref: SEC014805

Mr Andrew Greaves
Auditor-General
Victorian Auditor-General's Office
Level 31, 35 Collins Street
MELBOURNE VIC 3000

Dear Mr Greaves

PROPOSED FINAL REPORT – REDUCING BUSFHIRE RISKS

Thank you for your letter of 4 September 2020, enclosing the proposed report for the Victorian Auditor-General's Office (VAGO) 'Reducing Bushfires Risks' performance audit and inviting a submission from the Department of Environment, Land Water and Planning (DELWP) for inclusion in the final report.

DELWP appreciates the work of your office in conducting this audit and I am pleased to confirm acceptance of all recommendations directed to the Department. An action plan detailing how we will address these recommendations is enclosed.

I note that VAGO has identified significant strengths in DELWP's approach to the planning, monitoring and delivery of public land fuel management. The recommendations of the audit reflect a confidence that DELWP has the capacity, capability and coordination ability to make a positive difference in areas identified as requiring improvement, including by driving integration in fuel management across public and private land.

The importance of strong, evidence-based policy and practice in respect of bushfire risk management on both public and private land will become even more important as the impacts of climate change are increasingly felt in the form of more frequent and severe bushfires. This report's recommendations to DELWP and other agencies set out key measures required to build on and continuously improve capability in this space.

Consistent with the direction set out in Safer Together, DELWP agrees that end-to-end bushfire risk management across all public and private land is needed to minimise the impacts of bushfire on human life and property, and to maintain the resilience of Victoria's natural ecosystems. In close consultation with sector partners, councils and the community, DELWP will lead the expansion of Safer Together, and build on past successes to further strengthen land and fire management in Victoria.

The actions set out in the attached management action plan will complement – and in many cases link closely to – those arising from the Government's response to the Inspector-General for Emergency Management's recently released Phase 1 report of its Inquiry into the 2019-20 Victorian Fire Season.

DELWP is well-placed to respond to your recommendations, including developing clear performance metrics for fuel management on public and private land in consultation with sector partners, increasing collaboration with Traditional Owners to support cultural burning practices, driving consistency in ecosystem resilience monitoring, and continuing to invest in and enhance bushfire management systems and tools.

The Department is also pleased that the important need to continue to address powerline bushfire safety has been acknowledged in the report.

VICTORIA State Government

Should you require any further information in relation to the Department's response, please contact Christine Ferguson, DELWP Deputy Secretary Forest Fire and Regions at Christine.Ferguson@delwp.vic.gov.au or on 0419 540 308.

Yours sincerely

John Bradley
Secretary

02 / 10 / 2020

Encl.

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DELWP Management Action Plan – *Reducing Bushfire Risks*

VAGO Recommendation	№	DELWP Agreed Action	Agreed Completion Date	Accountable Officer
Recommendation #1 DELWP in partnership with CFA and FRV develops, implements and publicly reports on a holistic suite of performance metrics to demonstrate: • the impact that planned burning has on public and private land on bushfire risk • the impact that planned burning has on public and private land on ecosystem resilience • the impact that non-burn fuel management activities have on public and private land on bushfire risk • the impact that its activities at local and regional levels have on bushfire risk • the cost-effectiveness of its fuel management activities on public and private land (see Section 2.2).	1.1	**DELWP supports this recommendation** DELWP will commission a comprehensive review of fuel management targets in response to Recommendation 9 of the Inspector-General for Emergency Management's (IGEM) Inquiry into the 2019-20 Victorian Fire Season. This will occur in consultation with partner agencies and communities, including CFA and FRV. This work will be closely aligned with work to expand DELWP's Monitoring, Evaluation and Reporting Framework to incorporate all public and private land, in response to Recommendation 8 of IGEM's report. This will include: – Development of a holistic suite of performance metrics and targets for fuel management on public and private land, – Establishment of measures of fire size and intensity, – Enhanced measurement of the effectiveness of mechanical fuel treatments, – Measures of ecosystem resilience, and the effect of bushfire and fuel management on these, and – Publishing regional risk targets and exploring the application of smaller scale risk targets. This work will provide information about bushfire risk at the appropriate regional and local level to support community-based risk understanding.	December 2021	Executive Director, Policy and Planning Division
	1.2	DELWP will report on the contribution of fuel management to bushfire risk reduction in its 2019-20 Fuel Management Report.	October 2020	Executive Director, Policy and Planning Division
	1.3	DELWP will expand its Monitoring, Evaluation and Reporting Framework and Fuel Management Report to incorporate all public and private land, commencing with available activity data included in the 2021-22 Fuel Management Report.	December 2022	Executive Director, Policy and Planning Division
	1.4	DELWP will pilot metrics for evaluating the cost-effectiveness of fuel management commencing in 2021. This pilot will inform a longer-term plan for improvement of cost monitoring linking with the actions set out in response to Recommendation 10.	December 2021	Executive Director, Policy and Planning Division
Recommendation #2 DELWP enhances bushfire risk modelling by: • exploring multiple bushfire modelling tools to lower the uncertainty and limitations associated with using a single modelling tool • applying more detailed fire-severity data • validating and updating fuel accumulation curves • establishing and regularly updating an archive of well-documented fire events and using this to systematically test it against a broad range of burning and fuel conditions • establishing and implementing processes to routinely review and update its underlying datasets (see Section 2.2).	2.1	**DELWP supports the recommendation** DELWP will enhance Phoenix RapidFire by updating fuel accumulation curves and establishing a review process to update datasets as part of its Risk 2.0 project, linking with implementation of recommendations from IGEM's Inquiry into the 2019-20 Victorian Fire Season. This work will be done in partnership with the other agencies in the sector, including CFA, as well as academic and research bodies.	June 2021	Executive Director, Policy and Planning Division
	2.2	DELWP will increase the use of remote sensing data to improve fire severity information for application in bushfire risk modelling.	December 2021	Chief Fire Officer
	2.3	DELWP supports the importance of exploring multiple bushfire modelling tools and will continue working with research partners and other State and Territory Governments to enhance its bushfire risk modelling capability, and lower uncertainties and limitations.	Ongoing	Executive Director, Policy and Planning Division
	2.4	DELWP will develop a procedure for Phoenix validation that will establish an archive of well-documented fire events by June 2021, piloting methods for data collection during the 2020-21 fire season.	June 2021	Executive Director, Policy and Planning Division
Recommendation #3 DELWP develops more holistic bushfire-management planning that focuses on the best mix of risk treatments rather than	3.1	**DELWP supports the recommendation** DELWP will incorporate additional bushfire risk treatments into strategic planning frameworks for bushfire management, working with the emergency management sector. This will link with actions in the Victorian Government's response to Recommendation 3 of IGEM's Inquiry into the 2019-20 Victorian Fire Season to review risk-based strategic and operational planning frameworks to better incorporate roadsides and private land.	December 2022	Executive Director, Policy and Planning Division

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DELWP Management Action Plan – *Reducing Bushfire Risks*

VAGO Recommendation	Id	DELWP Agreed Action	Agreed Completion Date	Accountable Officer
planned burning alone (see Section 2.3).	3.2	DELWP will develop metrics and models for measuring the effectiveness of mechanical fuel treatment on reducing bushfire risk.	December 2020	Executive Director, Policy and Planning Division
	3.3	DELWP will prepare a bushfire science, fire ecology and knowledge and predictive services strategic plan, to identify priority investment areas.	April 2021	Executive Director, Policy and Planning Division
	3.4	DELWP will develop metrics and models to measure the effectiveness of bushfire suppression and ignition prevention actions.	December 2022	Executive Director, Policy and Planning Division
Recommendation #4 DELWP determines which elements of different regional planning approaches are the most effective and implements these across the state (see Section 2.4).	4.1	**DELWP supports the recommendation** DELWP will evaluate the tools and processes used by each region to undertake strategic and operational bushfire management planning to identify approaches which should be implemented state-wide.	June 2021	Executive Director, Policy and Planning Division
	4.2	DELWP will integrate the most effective elements of different regional planning approaches into standard planning processes for the next generation of regional Bushfire Management Strategies, to enable the expansion in the breadth of risk treatments within the scope of strategies outlined in response to Recommendation 3.	December 2022	Executive Director, Policy and Planning Division
Recommendation #5 DELWP improves effectiveness, consistency and transparency of its environmental and cultural values checks by • finalising its review of operational values checking processes and committing to an implementation plan • clarifying and formalising principles and procedures, making them publicly available where possible • improving capability and capacity among staff responsible for carrying out values checks, for example through training • developing a long term program of work and investment to improve the quality, consistency and comprehensiveness of underlying datasets • increasing alignment in regards to values checks between agencies carrying out fuel management.	5.1	**DELWP supports the recommendation** DELWP will develop an implementation plan for its review of operational values checking processes. This will include the matters specified in VAGO's recommendation.	December 2020	Executive Director, Policy and Planning Division
	5.2	DELWP will develop detailed guidance, including standard operating procedures, to improve the effectiveness, consistency and transparency of environmental and heritage values checks and enhance assurance around compliance with environmental legislation. This guidance will be made available to all agencies with legislated responsibilities for fuel management on public and private land.	December 2021	Executive Director, Policy and Planning Division
	5.3	DELWP will review and update standard mitigations to respond to identified values across high risk fire management actions.	June 2022	Executive Director, Policy and Planning Division
	5.4	DELWP will develop a values checking training module, incorporating new legislative guidance and mitigations.	December 2022	Executive Director, Policy and Planning Division
Recommendation #6 DELWP increases its collaboration with Victorian Traditional Owner groups to facilitate the re-introduction of cultural burning and ensure effective support for these practices across all of its regions (see Section 2.6).		**DELWP supports the recommendation** DELWP acknowledges the rights of Victoria's Traditional Owners to lead the return of cultural fire practices and determine the manner and timing in which this occurs. Any timelines and actions included in this response reflect actions that DELWP can directly undertake to enable Traditional Owner led cultural fire, or are under the direction of Traditional Owners. All actions will respect the principles of self-determination.	N/A	N/A
	6.1	DELWP will support each Traditional Owner Corporation to develop a country level implementation plan for the *Victorian Traditional Owner Cultural Fire Strategy*.	Timelines to be developed in consultation with Traditional Owner Corporations	Executive Director, Policy and Planning Division

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DELWP Management Action Plan – *Reducing Bushfire Risks*

VAGO Recommendation	№	DELWP Agreed Action	Agreed Completion Date	Accountable Officer
	6.2	DELWP will undertake work to embed Aboriginal cultural burn practices by updating strategic, operational and tactical burn planning processes to improve alignment with Traditional Owner cultural fire objectives as described in Country Plans, Cultural Fire Implementation Plans and/or Self-Determination Action Plans.	December 2021	Chief Fire Officer
	6.3	DELWP will advise the Minister for Energy, Environment and Climate Change on options to better align the *Code of Practice for Bushfire Management on Public Land* with Traditional Owner objectives and the *Victorian Traditional Owner Cultural Fire Strategy*. This will inform the development of a new Code when the existing Code is due to expire in 2022.	30 June 2022	Executive Director, Policy and Planning Division
	6.4	DELWP will develop options for sustainable funding for cultural burning.	June 2021	Deputy Secretary Forest, Fire and Regions
	6.5	DELWP will review and report on procedural, policy, and legislative barriers to cultural fire practice.	December 2021	Chief Fire Officer
	6.6	DELWP will establish a Traditional Owner led land management monitoring and research focus within DELWP's core research program to support the Traditional Owner Reading Country initiatives.	December 2022	Executive Director, Policy and Planning Division
	6.7	DELWP will establish Traditional Owner led statewide leadership and governance arrangements to lead implementation of cultural fire practices.	December 2021	Chief Fire Officer
Recommendation #9 DELWP and CFA systemically documents and publicly reports reasons why it does not complete planned burns (see Section 3.2).	**9.1**	**DELWP supports the recommendation** DELWP will incorporate additional information on factors influencing delivery of burns into the 2020-21 Fuel Management Report.	December 2021	Chief Fire Officer
	9.2	DELWP will assess requirements and either introduce a new system or enhance an existing system to enable the systematic capture and evaluation of reasons why planned burns are not completed for transparent reporting in the annual Fuel Management Report commencing from 2021-22.	December 2022	Chief Fire Officer
Recommendation #10 DELWP and CFA develops financial reporting to monitor fuel management costs and estimate future costs (see sections 2.4, 3.2 and 3.3).	**10.1**	**DELWP supports the recommendation** DELWP will develop financial reporting tools and processes to monitor fuel management costs and estimate future costs, supporting more effective and efficient risk-based bushfire management. This will support analytics to drive business intelligence and resource optimisation over time.	July 2025	Executive Director Infrastructure and Resources Division
Recommendation #11 DELWP reviews its target for the number of fuel hazard assessments conducted and ensures that this measure is evidence based, accurately reflects regional performance, and that the department monitors and reports on each regions' performance against it (see Section 3.5).	**11.1**	**DELWP supports the recommendation** DELWP will review its fuel hazard assessment target by June 2021.	June 2021	Executive Director, Policy and Planning Division
	11.2	DELWP will monitor and report on regional performance in the annual Fuel Management Report from 2021-22 onwards.	December 2021	Executive Director, Policy and Planning Division
Recommendation #12 DELWP conducts more effective ecosystem resilience monitoring by: • setting a target for regions on the quantity of ecosystem resilience monitoring assessments that they should complete annually. • setting an outcomes-level target that defines desirable values for key ecosystem resilience metrics • report publicly against all of the metrics in its Measuring Ecosystem Resilience in Strategic Bushfire Management Planning policy in its fuel management reports (see Section	**12.1**	**DELWP supports the recommendation** DELWP will expand its Monitoring, Evaluation and Reporting Framework to better address ecosystem resilience. This work will form part of the expansion of DELWP's Monitoring, Evaluation and Reporting framework commited to in response to Recommendation 8 of IGEM's Inquiry into the 2019-20 Victorian Fire Season.	November 2021	Executive Director, Policy and Planning Division
	12.2	DELWP will develop an outcomes-level target or targets for ecosystem resilience as part of the review of fuel management targets, as committed to in response to Recommendation 9 of the IGEM's Inquiry into the 2019-20 Victorian Fire Season.	December 2021	Executive Director, Policy and Planning Division

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DELWP Management Action Plan – *Reducing Bushfire Risks*

VAGO Recommendation	№	DELWP Agreed Action	Agreed Completion Date	Accountable Officer
3.5).				
Recommendation #13 DELWP in partnership with Parks Victoria, CFA, FRV and councils as appropriate, collect empirical evidence after bushfire events to assess the effectiveness of different fuel management treatments, including planned burning, mulching, slashing and mineral earth breaks, and build an evidence base to the effectiveness of these treatments (see sections 3.2, 3.3 and 3.5).	13.1	**DELWP supports the recommendation** DELWP will work with Parks Victoria, CFA, FRV and councils to develop a structured and systematic process to collect the evidence necessary to assess the effectiveness of different fuel management treatments in supporting bushfire response operations and outcomes.	December 2021	Executive Director, Policy and Planning Division
Recommendation #14 DELWP and CFA in partnership with councils, provide advice to government in line with the 'Safer Together: A New Approach to Reducing the Risk of Bushfire in Victoria' policy on options to better resource the assessment of risk on private land, its treatment and activities to enforce compliance of land owners with risk-reduction treatments. (see Section 3.3).	14.1	**DELWP supports the recommendation** DELWP, working with CFA, councils and the emergency management sector, will lead the development of a whole of sector strategy to guide land and fire management in the context of a changing climate, growing population and changing demographics. The whole of sector strategy will consider how to effectively support public and private land managers, including road managers and local governments to mitigate bushfire risks. DELWP will provide advice to Government on the matters specified in this recommendation as part of the implementation of the Government response to IGEM's Inquiry into the 2019-20 Victorian Fire Season.	November 2021	Executive Director, Policy and Planning Division
	14.2	**DELWP supports the recommendation** DELWP, working with CFA, councils and the emergency management sector, will provide advice to Government on the matters specified in this recommendation as part of the legislative review in response to Recommendation 2 of the IGEM Phase 1 Inquiry into the 2019-20 Victorian Fire Season. This will include advice on whether there is any need to enhance DELWP's legislative tools to support operation on the highest risk private land, such as the 'marginal mile' applying within 1.5 kilometres of lands subject to fire management provisions of the *Forests Act 1958*.	December 2022	Executive Director, Policy and Planning Division
Recommendation #15 DELWP provides advice to government, in consultation with CFA and councils, on options to improve owner and occupier awareness of and accountability for Bushfire Management Overlay planning controls (See Section 4.3).	15.1	**DELWP supports the recommendation** DELWP will work with the CFA in consultation with councils and Consumer Affairs to establish options.	November 2021	Deputy Secretary Planning, Executive Director Planning and Heritage
Recommendation #16 DELWP investigates incentives and advises government on options to accelerate burying and insulating the remaining high-voltage bare-wire powerlines in the 33 highest risk areas (see Section 5.4).	16.1	**DELWP supports the recommendation** DELWP will examine the current policy of replacing powerline assets at end-of-life or when replacing more than four spans with a view to advise Government on accelerated options for the 33 highest risk areas.	June 2022	Director, Energy Programs
Recommendation #17 DELWP improves the Powerline Bushfire Safety Program's transparency by publicly reporting on activities, costs and risk-reduction outcomes (see Section 5.5).	17.1	**DELWP supports the recommendation** The first Powerline Bushfire Safety Program Progress Report (2012-2019) has now been released and communications will continue throughout the life of program.	Powerline Bushfire Safety Program completion	Director, Energy Programs

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Response provided by the Chief Executive Officer, East Gippsland

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Email: feedback@egipps.vic.gov.au

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2 October 2020

Mr Andrew Greaves
Auditor General
Victorian Auditor-General's Office

By email: jenny.koong@audit.vic.gov.au

Dear Mr Greaves

Proposed report Reducing Bushfire Risk

Thank you for the opportunity to provide submissions and comments on the proposed report Reducing Bushfire Risk.

This audit is particularly timely in light of the 2019-20 summer bushfires and Council welcomes the outcomes of this audit. Together with the recently tabled report by the Inspector General for Emergency Management in relation to Phase 1 of the inquiry into the 2019-20 summer bushfires, the audit can inform action at all levels to strengthen work to reduce bushfire risk.

We valued the opportunity to participate in the audit and appreciate the professional nature of the work carried out, despite the challenges of the pandemic.

Council notes the audit findings and recommendations and that there are no recommendations specific to East Gippsland Shire Council. Council does not have further submissions to make.

If you would like more information or have any queries, please don't hesitate to contact Stuart McConnell on 51539500.

Yours faithfully

ANTHONY BASFORD
Chief Executive Officer

Website: www.eastgippsland.vic.gov.au   Twitter: @egsc   Email: feedback@egipps.vic.gov.au

Response provided by the Secretary, Department of Justice and Community Safety (EMV)

Department of Justice and Community Safety

Secretary

Level 29
121 Exhibition Street
Melbourne Victoria 3000
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Our ref: 20097635

Mr Andrew Greaves
Auditor-General
Victorian Auditor-General's Office
Level 31, 35 Collins Street
MELBOURNE   VIC   3000

Dear Mr Greaves

Thank you for your letter of 4 September 2020 enclosing the proposed *Performance Audit Report Reducing Bushfire Risks* report, and the invitation to provide a response.

I note that there are no recommendations that are the direct responsibility of the Department of Justice and Community Safety, but I welcome the opportunity to continue to work with our partner agencies as the government responds to the recommendations identified in this report.

I also note that several matters that are the subject of the *Performance Audit Report Reducing Bushfire Risks* may also overlap with several concurrent inquiries that Victoria is participating in, including:

- The Royal Commission into National Natural Disaster Arrangements;
- The Victorian Inspector-General for Emergency Management's Inquiry into the 2019-20 Victorian Fire Season;
- The CSIRO review of climate and disaster resilience; and
- The Federal Senate Inquiry into Lessons to be Learned in the Preparation and Planning for, Response to and Recovery from the 2019-20 Bushfires.

Collectively, these inquiries and reviews provide a significant opportunity to draw lessons and identify areas for improvement in how jurisdictions meet the challenges of future natural disasters.

Thank you again for providing me with a copy of this report.

Yours sincerely

Rebecca Falkingham
Secretary

Response provided by the Director of Energy Safety, ESV

energy**safe**
VICTORIA

Creating a
safer state with
electricity and gas

Our Ref: CM-9283

18 September 2020

Mr Andrew Greaves
Auditor General
Victorian Auditor-General's Office
Level 24, 35 Collins Street
MELBOURNE VIC 3000

Dear Mr Greaves

AUDIT REPORT – REDUCING BUSHFIRE RISKS

Thank you for providing Energy Safe Victoria (ESV) with the opportunity to comment on the proposed audit report on *Reducing Bushfire Risks*.

As one of the most bushfire-prone areas in the world it is essential that government and community do all they can to mitigate this risk to people, property and the environment. It is wholly appropriate to review both our response to, and our preparedness for such events, as we all know they cannot be eliminated.

ESV welcomes the audit report and supports the recommendations put forward by your office. There are no matters ESV wishes to raise for further consideration and we will not be making any further submissions.

While there are no specific recommendations for ESV, we are committed to working collaboratively with other government departments to deliver against all recommendations in the report.

Yours sincerely

Marnie Williams

Marnie Williams
DIRECTOR OF ENERGY SAFETY

Murrindindi
Shire Council

Date: 2 October 2020
Reference: 20/66107

Mr Andrew Greaves
Auditor General
Level 31, 355 Collins Street
MELBOURNE VIC 300

Proposed Performance Audit Report Reducing bushfire risks

Dear Auditor General

Thank you for your letter of 4 September 2020 providing Murrindindi Shire Council with an opportunity to comment on the proposed performance audit report – Reducing bushfire risks.

Murrindindi Shire Council appreciates the work of your office in conducting this audit and providing the Council with an opportunity to respond to the proposed actions identified by this audit report. It is noted that Murrindindi Shire Council has no actions as a result of the audit and given there are no recommendations that directly impact the Shire, Council will not include an action plan with recommendations.

Council however do welcome the findings of the audit report and will use the outcomes as a means to work collaborative with all agencies to enhance the protection of the health and wellbeing of our Community in relationship to bushfire management.

If you would like more information about this matter please contact Vito Albicini, Director Assets and Development, Murrindindi Shire Council on (03) 5772 0333 or email valbicini@murrindindi.vic.gov.au.

Yours Sincerely

Cr Leigh Dunscombe
Mayor

Page 1 of 1

MURRINDINDI SHIRE COUNCIL
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Response provided by the Chief Executive Officer, PV

Parks Victoria
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Telephone 13 1963
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2 October 2020

Ref: File 34161 20

Mr Andrew Greaves
Auditor General
Victorian Auditor General's Office
Level 31/35 Collins Street
MELBOURNE VIC 3000

Dear Mr Greaves

PROPOSED PERFORMANCE AUDIT REPORT REDUCING BUSHFIRE RISKS

Thank you for the opportunity to comment on the Reducing Bushfire Risks Proposed Report. Parks Victoria commends VAGO on the preparation of this report.

Parks Victoria supports all the recommendations included in the report, with our interest on the elements relating to Parks Victoria's land management responsibilities in reducing Victoria's bushfire risk. Following are some areas that Parks Victoria views as important for further consideration:

- **Parks Victoria's Conservation Action Plans -** to provide an effective pathway for their use in strategic planning and the Joint Fire Management Plan (JFMP);

- **Using planned burning to actively manage fire dependent natural landscapes -** ecological burning as a land management tool as outlined in Parks Victoria's Conservation Action Plans; and

- **Protection of Victoria's key fire sensitive biodiversity assets from severe bushfire impacts -** an addition to the risk-based approach that is used for life and property.

Parks Victoria and the Department of Environment Land and Planning (DELWP) are currently working to re- establish a group to provide strategic oversight of the Fire Ecology Program. This group will play an important role in providing guidance in environmental measures and data management.

Parks Victoria will work with DELWP, the Country Fire Authority (CFA) and Fire Rescue Victoria (FRV) to develop a better evidence base to understand the effectiveness of fuel treatments following bushfires.

I look forward to working with the other agencies to respond to the recommendations in your report.

Yours sincerely

Matthew Jackson
Chief Executive Officer

Response provided by the Acting Chief Executive Officer, Whittlesea

Enquiries: Tel: 9217 2170

2 October 2020

Mr Andrew Greaves
Auditor-General
Victorian Auditor-General's Office
Level 31, 35 Collins Street
MELBOURNE VIC 3000

Dear Mr Greaves,

Proposed Audit Report - Reducing Bushfire Risks

Thank you for your letter providing the City of Whittlesea (CoW) an opportunity to comment on the proposed report on Reducing Bushfire Risks.

The CoW has valued being part of the process since its inception and we would like to acknowledge the professional manner in which it was conducted during a period of significant challenges including major fires and pandemic. The final report is fair, balanced and reflective of the information provided throughout the process.

We note the findings and recommendations of the report, as well as that there are no specific recommendations for Council to make representations or submit on.

Whilst there were no specific recommendations for Council, CoW will use learnings and principles from the report where relevant to continue to investigate ways to improve systems and processes to ensure that the impacts of bush or grass fires to the municipality are mitigated as far as practicable.

If you have any questions, please don't hesitate to contact Julian Edwards, Director Partnerships, Planning and Engagement on 9217 2262.

Yours sincerely

Joe Carbone
Acting Chief Executive Officer

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APPENDIX B
Acronyms, abbreviations and glossary

Acronyms

ACR	automatic circuit recloser
BAL	bushfire attack level
BMO	bushfire management overlay
BoM	Bureau of Meteorology
BP3	Budget Paper 3
BPA	bushfire prone area
CFA	Country Fire Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DELWP	Department of Environment, Land, Water and Planning
ELCA	electric line construction area
EMV	Emergency Management Victoria
ESV	Energy Safe Victoria
FAME	Fire Analysis Module for Ecological Values
FDI	McArthur Forest Fire Danger Index
FRV	Fire Rescue Victoria
GMA	geometric mean abundance
GSS	growth stage structure
IGEM	Inspector-General for Emergency Management
MFPO	municipal fire prevention officer
NAP	Network Assets Project
PBSP	Powerline Bushfire Safety Program
POEL	private overhead electric line

Acronyms

PRF	Powerline Replacement Fund
PV	Parks Victoria
REFCL	rapid earth fault current limiter
TFI	tolerable fire interval
VAGO	Victorian Auditor-General's Office
VFRR-B	Victorian Fire Risk Register—Bushfire

Abbreviations

22kV	22 kilovolt
AS 3959:2009	Australian Standard 3959:2009 *Construction of Buildings in Bushfire Prone Areas*
AS 3959:2018	Australian Standard 3959:2018 *Construction of Buildings in Bushfire Prone Areas*
the Code	2012 *Code of Practice for Bushfire Management on Public Land*
East Gippsland	East Gippsland Shire Council
Electricity Act	*Electricity Safety Act 1998*
km	kilometre
MER Framework	*Monitoring, Evaluation and Reporting Framework for Bushfire Management on Public Land*
MER plan	monitoring, evaluation and reporting plan
Murrindindi	Murrindindi Shire Council
the PBS Committee	Powerline Bushfire Safety Committee
R and D Project	PBSP Research and Development Project
the Regulations	*Electricity Safety (Bushfire Mitigation) Amendment Regulations 2016*
Safer Together	*Safer Together: A new approach to reducing the risk of bushfire in Victoria*
the Strategy	*The Victorian Traditional Owner Cultural Fire Strategy*
the Taskforce	Powerline Bushfire Safety Taskforce
Victorian Royal Commission	2009 Victorian Bushfires Royal Commission
Whittlesea	City of Whittlesea

APPENDIX C
Scope of this audit

Who we audited	What we assessed	What the audit cost
Department of Environment, Land, Water and Planning	We assessed whether responsible agencies are effectively working together to reduce Victoria's bushfire risk.	The cost of this audit was $1.25 million.
Parks Victoria		
Country Fire Authority		
Emergency Management Victoria		
Energy Safe Victoria		
City of Whittlesea		
East Gippsland Shire Council		
Murrindindi Shire Council.		

Our methods

As part of the audit we:

- consulted with subject-matter experts
- interviewed audited agencies' staff and other relevant stakeholders
- conducted site visits to DELWP and CFA regions and audited councils, attended a cultural burn at Woolshed Swamp near Boort and observed a PBS Committee meeting.

Our methods included interviewing audited agencies' staff, reviewing documents, including key agency documentation about risk modelling, planning, delivery, monitoring and reporting and analysis of data that informs risk modelling, target setting, planning, monitoring and reporting.

We conducted our audit in accordance with the *Audit Act 1994* and ASAE 3500 Performance Engagements. We complied with the independence and other relevant ethical requirements related to assurance engagements.

We also provided a copy of the report to the Department of Premier and Cabinet.

Auditor-General's reports tabled during 2020–21

Report title	
Rehabilitating Mines (2020–21: 1)	August 2020
Management of the Student Resource Package (2020–21: 2)	August 2020
Victoria's Homelessness Response (2020–21: 3)	September 2020
Reducing Bushfire Risks (2020–21: 4)	October 2020
Follow up of Managing the Level Crossing Removal Program (2020–21: 5)	October 2020

All reports are available for download in PDF and HTML format on our website www.audit.vic.gov.au

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