



## LAND AND FUEL MANAGEMENT

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Bushfires occur naturally throughout many Victorian landscapes. The harm they cause to people and the environment has created the need for effective land management for prevention and mitigation of fire. One of the primary tools for fire management on public land is prescribed burning. The main purpose of prescribed burning is to make people and communities safer by reducing combustible fuel, and hence the risks associated with fire. A secondary purpose is protecting flora and fauna from the consequences of destructive bushfire by preferentially applying prescribed burning in the environment. The amount of prescribed burning occurring in Victoria has been insufficient to significantly reduce the risk of bushfires and the Commission is recommending that the State introduce a long-term, robust prescribed burning program.

The existence and maintenance of fuel breaks are important for giving firefighters access to forests for more effective bushfire suppression and prescribed burning purposes. Roads also act as fuel breaks and, importantly, allow access and egress during bushfires both for the authorities and for private individuals. It is therefore important to manage the vegetation along roadsides so that it does not impinge on these essential functions.

Roadsides may contain the only remnant native vegetation in some areas. Consequently, a balance must be struck between the competing objectives of maintaining biodiversity and reducing bushfire risk. The differing objectives of the regulatory framework with respect to road safety, biodiversity protection and bushfire prevention can be difficult to reconcile for road managers. The Commission's recommendations are aimed at making reducing bushfire risk a priority.

Properly carried out, prescribed burning reduces the spread and severity of bushfire. It makes a valuable contribution to reducing the risks to communities and firefighters by complementing effective suppression and is one of the essential protective strategies associated with making it safer for people to live and work in bushfire-prone areas in the state. Prescribed burning does not prevent bushfire: it is used in conjunction with building design, defensible space, community education and fire suppression to provide a comprehensive strategy for fire management to protect life and property.<sup>1</sup>

Prescribed burning can also contribute to other land management purposes, which may be reflected in the way it is implemented. It is, however, a high-risk activity to conduct, is resource intensive, is available only in limited time frames, and can have some adverse consequences for local communities.

The main focus of attention for prescribed burning is public land managed by the Department of Sustainability and Environment, comprising about 7.7 million hectares. These areas include national parks, state forests and reserves. A significant portion of public land is forested. It has a variety of uses or values, such as biodiversity conservation, recreation, water and carbon cycle maintenance, and timber production.<sup>2</sup> Australian forests are among the most fire dependent, fire adapted and fire prone forests in the world. The dry eucalypt forests in Victoria adjoin the majority of the economic assets at greatest risk from bushfire and in which the greatest reductions in risk to life and property might be obtained.<sup>3</sup>

The Commission is concerned that the State has maintained a minimalist approach to prescribed burning despite a number of recent official or independent reports and inquiries, all of which have recommended increasing the prescribed burning program. The State has allowed the forests to continue accumulating excessive fuel loads. Not dealing with this problem on a long-term and programmed basis means that fuel levels continue to increase, adding to the intensity of bushfires that inevitably eventuate and placing firefighters and communities at greater future risk.

The Commission did not review fire management on private lands in depth, although it recognises the importance of fuel management across the landscape. The level of hazard reduction on private land can influence fire behaviour and could either complement or detract from the effectiveness of the burning regimes on public land.

Since 2007 DSE and partner agencies have increased fuel break construction on public land, mainly around Melbourne Water catchments. Fuel breaks allow more rapid response and safer access for firefighters during bushfire suppression and for fire management during prescribed burning. Local councils and private landholders also construct and use fuel breaks as part of fire protection.

Roads and roadsides can be important fuel breaks, so fuels may need to be reduced during fire seasons by road managers. This occurs by mowing, slashing, pruning and, to a more limited extent, prescribed burning.<sup>4</sup> Roadsides offer wildlife corridors and shelter and contain remnant native vegetation.<sup>5</sup> Community consultations held by the Commission identified concerns that roadside vegetation had acted as a 'fuse' during the January–February 2009 bushfires and that dead vegetation and logs on roadsides had contributed to the fires. Fire experts investigated the effects of roadside vegetation during the January–February 2009 bushfires.<sup>6</sup>

Roads are also essential for members of the community seeking to escape fires and for emergency services attempting to access fires. Since the 2009 fires land and road managers and the Country Fire Authority have identified high-risk roads and are undertaking fuel-reduction works to reduce future bushfire risks.<sup>7</sup>

Local councils are responsible for bushfire prevention and mitigation activities and biodiversity management of roadsides, together with management of some local and arterial roads. VicRoads has similar responsibilities for rural freeways and arterial roads. There is legislative complexity around these competing objectives, and councils find compliance difficult and onerous.<sup>8</sup>

The Commission identified a number of important areas that require attention in relation to land and fuel management:

- The current prescribed burning regime in Victoria inadequately reduces the risks associated with bushfires.
- Accountability for achieving publicly recognised targets and effective implementation of prescribed burning is not evident or supported by transparent resourcing.
- There is a poor understanding of biodiversity and the effects of different fire regimes on biodiversity.
- There are unresolved tensions between bushfire risk mitigation and environmental conservation reflected in fuel management activities and roadside clearing.
- The legislative complexities associated with road safety, biodiversity and bushfire risk mitigation affect roadside management activities.

The Commission's recommendations in this chapter are designed to redress the land and fuel management areas of concern arising from prescribed burning, fuel breaks and roadside clearing. Protection of human life is considered the highest priority, although the Commission is also mindful of the importance of environmental protection. Prescribed burning must more effectively reduce the risk of bushfire, particularly in forested areas close to population centres. Wider use of fuel breaks will complement prescribed burning and assist fire-suppression activities. Attending to the level of regulatory complexity will reduce the burden on road managers of managing roadside clearing to reduce bushfire risk.

## 7.1 THE EXPERT PANEL

The Commission heard from experts who, as a panel, gave evidence about fire behaviour, forest fires and ecology. Before giving evidence, the experts participated in a joint conference at which they prepared a summary.<sup>9</sup> The conference provided a base for examining the complexities associated with prescribed burning. The members of the expert panel were as follows:

- Professor Mark Adams, fire and forest ecologist, Professor and Dean, Faculty of Agriculture, Food and Natural Resources, University of Sydney
- Professor Ross Bradstock, fire ecologist, Director of the Centre of Environmental Risk Management of Bushfires, University of Wollongong, and Visiting Fellow, Fenner School, Australian National University
- Mr Phil Cheney, fire behaviouralist, Honorary Research Fellow, CSIRO
- Dr Michael Clarke, ecologist, Associate Professor and Head of the Department of Zoology, La Trobe University
- Dr Malcolm Gill, fire ecologist, Visiting Fellow, Fenner School, Australian National University
- Dr Kevin Tolhurst, forest scientist and fire behaviouralist, Senior Lecturer, Department of Forest and Ecosystem Science, University of Melbourne
- Mr Jerry Williams, former director, Fire and Aviation Management, United States Forest Service

## 7.2 THE IMPACT OF PRESCRIBED BURNING ON BUSHFIRE

Bushfires obtain their energy from fuel and their speed and direction from the weather, topography and the fire itself. These factors affect fire behaviour, including the rate of spread, flame height and angle, persistence in the area, and the way firebrands travel.<sup>10</sup> The only element that can be controlled by humans is the management of fuel. Prescribed burning—‘the controlled application of fire under specified environmental conditions to a predetermined area and at the time, intensity and rate of spread required to attain planned resource management objectives’—is the most effective mechanism for managing fuel.<sup>11</sup>

The terms ‘controlled burning’, ‘planned burning’ and ‘prescribed burning’ tend to be used interchangeably. In their broadest sense, these phrases simply refer to all circumstances in which burning is done in a manner that is planned, deliberate and lawful. In this chapter the term ‘prescribed burning’ is used as it is used in the *Australian Emergency Management Manual*.<sup>12</sup>

Prescribed burning encompasses burning for fuel reduction to reduce bushfire risk, for regeneration following timber harvesting, and for maintenance of indigenous ecosystems. These are quite different objectives, and the characteristics of prescribed burning may reflect these differences.<sup>13</sup> In practice, prescribed burns may be conducted to meet multiple objectives simultaneously.

Land management objectives, and practicability, determine the purpose for undertaking prescribed burning in particular environments. The purpose of the prescribed burn should inform the characteristics of the implementation of the burns, such as:

- location in the landscape—in terms of the actual site and in the context of past fires and future prescribed burns
- size of the burn area—referring to the number of hectares to be treated. According to the expert panel, size *does* matter
- amount of area burnt within the burn area—typically expressed as a percentage. To effectively reduce bushfire risk a significant portion of the total area must be burnt
- intensity of the burn—the rate at which heat is released as the fire moves across the landscape. For hazard or fuel-reduction burns a ‘low’-intensity burn is typically preferred. The fire intensity determines whether burn objectives are met and whether the prescribed burn can be controlled
- frequency of the burning regime—should take into consideration fuel accumulation and the fire tolerance of the biota in the area under consideration.<sup>14</sup>

Dr Clarke observed that some plants and animals require fire to perpetuate their populations and that flora and fauna have evolved to cope with fire of particular frequency, intensity and scale. This ecological requirement for fire is tempered by the understanding that uniformity in fire history across the landscape should be avoided.<sup>15</sup> Dr Tolhurst identified the need to maintain fire in the landscape and pointed in particular to the strong link between seed germination and smoke for a significant proportion of Australian flora. He said, ‘The question for conservation land managers then is not whether to use fire but how’.<sup>16</sup>

### 7.2.1 EFFECTIVENESS OF PRESCRIBED BURNING

The effectiveness of prescribed burning for reducing the risks of bushfire is determined by the ability of past prescribed burns to stop or reduce the spread of bushfire, reduce fire intensity, and assist fire-suppression efforts. A range of approaches have been applied to determine the effectiveness of prescribed burning: empirical observations, applied research and case studies of prescribed fires and bushfires have all been used, as has simulated fire behaviour modelling.

The effectiveness of prescribed burning to mitigate the effects of bushfire has been the focus of applied research in Australia and internationally for some decades. It is difficult to quantify and measure the effectiveness of prescribed burning because of the variable characteristics of the prescribed burning applied, including the size and placement of the burnt area and the interactions between fuel amount and type, landscape features and weather.<sup>17</sup>



However, the research has established that fuel reduction through prescribed burning mitigates the intensity and effect of bushfires by reducing the extent and severity of fires and increasing the ability to suppress fires, hence reducing their potential size and impact.<sup>18</sup>

There are many case studies that draw on extensive data demonstrating the effectiveness of prescribed burning to mitigate the extent and severity of bushfires. The use of a case study approach allows systematic investigation of a single event collecting and analysing data for creating and testing hypotheses. Case studies can demonstrate the effect of past use of prescribed burning in a particular place at a particular time.<sup>19</sup>

This is illustrated by Tolhurst and McCarthy's case study following the Victorian alpine fires of 2003. They analysed a total burnt area of about 1.1 million hectares, within which there had been 152 fires greater than 100 hectares over the previous 33 years, most of which were prescribed burns. For each of the fire areas they selected a statistical 'pair' based on size, vegetation type and topography. These were burnt at the same time and under the same fire conditions. The results showed that the most significant factor determining fire severity was the weather, where fire severity was most strongly correlated with Forest Fire Danger Index. The second most important factor associated with fire severity was the time since the last fire, assumed to be associated with fuel levels. There was a significant trend showing increasing severity with time since the area was last burnt. There was a statistically significant difference between the fire severity in long-unburnt areas and the prescribed-burnt area for up to seven years before the 2003 bushfire. These findings are consistent with their earlier studies and with overseas studies.<sup>20</sup>

McCarthy and Tolhurst also assessed the effectiveness of fuel-reduction burning on public land across Victoria. They found that the fuel hazard level (time since last burn) and the fire danger index were critical to the probability of a previous burn slowing the rate of spread of a head fire. Prescribed burning was found to have a measurable effect in assisting suppression for up to 20 years after burning but the benefits started to reduce after about five years. On average, that benefit lasted about 11 years but benefits were conditional on other factors, in particular weather conditions, and the overall fine fuel hazard levels.<sup>21</sup>

Dr Tolhurst's work in Wombat State Forest indicates that one enduring effect of prescribed burning is to limit the production of embers (at least in stringybark trees), which are a significant cause of spot fires and therefore house loss in bushfires.<sup>22</sup> Mr Richard Sneeuwjagt, State Manager of the Fire Management Services Branch in the Department of Environment and Conservation Western Australia, noted that bark removal is important 'when it comes to minimising ember attack or spotting'.<sup>23</sup> Mr Cheney stated that firebrands, either embers or burning bark of trees, can be inhibited for as long as 20 years, in some forests.<sup>24</sup>

Studies conducted in south-west Western Australia since the mid 1980s have also examined the relationship between prescribed burning and the extent of bushfires.<sup>25</sup> Most recently, Mr Sneeuwjagt analysed the relationship between the area of prescribed burning in preceding years and bushfires in south-west Western Australian forests for the period 1961 to 2008. Using statistical analysis, Mr Sneeuwjagt found that the prescribed burning programs had reduced the area of bushfires for as long as eight years. The strongest correlation was evident when the average area of prescribed burning over five years was compared with the average area of bushfires over the following five years.<sup>26</sup> Dr Lachie McCaw, Principal Research Scientist in the Science Division of the Department of Environment and Conservation Western Australia, and others found that prescribed burning also reduced the incidence of bushfires by maintaining areas of sparse fuel that are less likely to remain alight following ignition.<sup>27</sup>

Project Vesta, a study conducted in the dry eucalypt forests of south-west Western Australia, examined the relationships between fuel age and fire behaviour by quantifying the age-related changes in fuel and fire behaviour in dry eucalypt forests. It aimed to establish the relationship between fire spread and fuel type and age. Over 100 experimental fires were lit under dry summer conditions of moderate to high fire danger at two sites with different vegetation understoreys and where it was between two and 22 years since fire had occurred.<sup>28</sup> The study concluded the following:

- The forward rate of spread of a fire is directly related to the characteristics of the surface fuel bed and understorey layers. The near-surface fuel layer has the strongest effect on rate of spread.

- Hazard reduction by prescribed burning reduces the rate of spread, flame height and intensity of a fire and the number and distance of spot fires by changing the structure of the fuel bed and reducing the total fuel load. The persistence of this effect is determined by the rate of change in fuel characteristics over time.
- It is difficult to control fires under average summer conditions of high to very high fire danger in open eucalypt forest where the fuels are older than about seven years.
- Further research is needed to understand fire–atmospheric interactions leading to ‘abnormal’ fire behaviour including conditions immediately after a cool, dry change.<sup>29</sup>

Recently Dr Matthias Boer, Bushfire CRC, and others used empirical data to quantify long-term regional-scale impacts of prescribed burning on the incidence and extent of bushfires in a eucalypt forest region of south-west Western Australia. They found the following:

- Prescribed burning had significantly reduced the incidence and extent of bushfires from 1953 to 2005.
- About four units of prescribed fire were required for each unit area reduction in bushfire.
- The probability of fire spread was low for three to four years after prescribed fire but after five years sufficient fuel had accumulated to support fire spread under a wide range of conditions. From six to seven years onwards fuel loads accumulate to levels that make high-intensity fire increasingly probable and suppression increasingly difficult.<sup>30</sup>

Effectiveness can also be measured by gauging the reduction in risk per unit of prescribed fire treatment. This can be applied to determine the proportion of the landscape that must be burned annually in order to reduce risk by a given proportion. Applying a 4:1 ratio, Professor Bradstock concluded that rates of treatment greater than 10 per cent of the landscape per annum are required to effect major risk reduction using prescribed burning. However, he also recognised that these levels of treatment may increase risks to biodiversity via habitat changes.<sup>31</sup>

Computer simulation benefits fire regime research because it has temporal depth, integrates complex, multi-scale spatial interactions and can be used to explore the effects of changing climates and vegetation types. Using computer simulation, Dr Tolhurst, Professor Bradstock, Dr Karen King, research fellow, Fenner School of Environment and Society, ANU and others have demonstrated the role of prescribed burning in reducing bushfire risk. Simulation is necessarily limited by present levels of data and its results depend on the assumptions embedded in the data models employed, but it is a valuable tool for fire management planners. The association of geographic information system technology with fire behaviour models makes predictions possible at landscape level.<sup>32</sup>

In addition, there have been few opportunities to research the effect of prescribed burning on landscape-scale fires occurring under catastrophic weather conditions (such as those of 7 February 2009) in Victoria. Understanding the interaction between fuel reduction and intense, landscape-scale fires, climactic conditions and terrain is therefore limited.<sup>33</sup> Research into the ‘megafires’ in the United States sheds some light on their impact on the landscape. This is discussed in Section 7.3.2.

### Effectiveness on 7 February 2009

The effect of previous burning (prescribed and bushfire) on the fires of 7 February was assessed by Professor Bradstock and Dr McCaw. The results of the studies are significant given the dearth of opportunities to observe the interaction between fuel and extreme fire weather and their effect on fire behaviour at the landscape scale. The studies adopted different methodologies but reached comparable conclusions.<sup>34</sup>

Professor Bradstock (with Dr Owen Price) analysed the effects of weather, terrain and time since fire and logging for the Kilmore East, Murrindindi, Bunyip and Churchill fires. Around 4,500 point samples were taken across the burnt areas, and at each point a range of environmental variables (including data on fire history) was calculated and fire severity estimated using DSE data. The information collected was used to conduct statistical modelling to relate fire severity to the other variables including time since fire (as a ‘surrogate’ for fuel age). The objective of the study was to quantitatively analyse the determinants of fire severity. The study sought to identify the roles played by factors such as weather and fuel age in determining fire severity, which was indicated by whether a crown fire would develop or whether the fire would remain in the forest understorey.<sup>35</sup>



Professor Bradstock and Dr Price concluded that on 7 February the probability of effective suppression was negligible under the extreme conditions, irrespective of fuel age or forest type. However, the probability of effective suppression was enhanced by reduced fuel age under more moderate conditions, measured from about an hour after the wind change, particularly for fuels that were one to five years old.<sup>36</sup> The principal conclusions of the analysis were as follows:

- Under the most dire weather conditions there is some change in fire intensity for relatively young fuel ages. That change is not strong enough to facilitate suppression but it may reduce spotting and the rate of spread. Reduced fuel age can reduce intensity from total or near-total crown consumption to partial crown consumption, thus potentially reducing ember propagation.<sup>37</sup>
- It is unclear that higher levels of prescribed burning would have increased opportunities for safe and effective suppression on the afternoon of 7 February. Professor Bradstock believed it was plausible that following the south-westerly wind change higher levels of prescribed burning may have increased the ability to undertake safe and effective suppression at very high rates of treatment (15–20 per cent of the landscape treated per annum). Dr McCaw was of the opinion that the conclusion was still to some degree untested because ‘there just weren’t the examples there to consider’.<sup>38</sup>
- Extreme weather is the predominant influence on the likelihood that a crown fire will develop, followed by forest type then fuel age. In contrast, for more moderate and low weather conditions fuel age has a significant effect on the fire being confined to the understorey. This means that there is a significantly greater chance of effective suppression.<sup>39</sup>
- Fuel age and weather interact, and both are important in influencing fire severity. The effectiveness of prescribed burns is strongly contingent on weather. At the same time the impact of weather conditions on fire intensity will vary with fuel age and the younger the fuels the greater their effect on fire intensity. Prescribed burning increases the potential for successful fire suppression, under mild and moderate weather conditions, providing most effect up to five years after treatment.<sup>40</sup>

Dr McCaw analysed the role of previous fuel reduction in the Beechworth, Bunyip, Kilmore East and Murrindindi fires by visually comparing fire progression and fire severity with information about all fires that had occurred during the period 2000 to 2008. Fire progression was evident from the position of the fires at different times during the day. Fire severity was captured by remote high-resolution aerial photography and measured against patterns of graded crown or canopy scorch. The analysis comprised a series of case studies within each fire, with the aim of identifying differences in fire severity associated with fuel age, excluding other factors such as terrain. Specific observations about individual fires are included in the relevant section of the fires chapters (see Volume I). Overall, Dr McCaw concluded:

- While previous burns did not mitigate the immediate impacts under the most severe conditions, some prescribed burns had significantly assisted in ultimate fire containment.
  - Under very severe or extreme conditions the fuels had to be quite young (three years or less) to reduce the intensity and spread of a fire, depending on the extent of fuel removal during the prescribed burn. In addition, the treated areas need to be large—of the order of 600 hectares or greater.<sup>41</sup>

Dr Tolhurst, who had separately made observations of the Beechworth fire and relevant fire history, was of the opinion that previous fires, prescribed burns and bushfires had had a significant impact on the final outcome of that fire, reducing its final area. He considered that the Beechworth fire would have travelled much further with different outcomes had it started near Yackandandah in long-unburnt areas.<sup>42</sup> In his opinion prescribed burning had significantly modified fire behaviour, but it was just beyond suppressible limits, with 10-metre flame heights and extreme weather conditions. Milder weather conditions with less wind or higher humidity would have resulted in a high chance of suppression success.<sup>43</sup>

## Summary

In summary, the effectiveness of prescribed burning is determined by the following characteristics and limitations:

- Fuel age and weather interact, and both are important in influencing fire severity. Extreme weather is the predominant influence on the likelihood that a crown fire will develop, followed by forest type and then fuel age. In contrast, in more moderate and low weather conditions fuel age has a significant effect on whether the fire is confined to the understorey, where it is more easily suppressed.<sup>44</sup>
- A well-conducted prescribed burn, if large enough, might stop a fire in the first one to two years after it is conducted. The expert panel considered that size *does* matter in relation to this question. Mr Cheney told the Commission that the placement of the prescribed burn block is also important: 'The key to a burning program for wide-scale protection is to have the blocks strategically located across the landscape in a pattern that, when repeated, large fires are going to sooner or later run into one of these *low* fuels and be checked ...'.<sup>45</sup>
- Prescribed burning reduces the number of bushfires because the take-up rate of fire in more recently fuel-reduced areas is low to zero, whether the ignition source is lightning or embers.<sup>46</sup>
- Prescribed burning reduces fuel load and consequently reduces fire intensity. The intensity of bushfires and the average intensity of all fires will decrease as a function of the prescribed burning treatment rate, although overall fire frequency will increase.<sup>47</sup>
- Reduction in the rate of spread of fire will persist as a consequence of prescribed burning for five to eight years. Reduction in flame height, firebrand prevention, and less spotting downwind of the fire are effects of prescribed burning that last longer than five to eight years. There is congruence among the studies of vegetation for eucalypt forests suggesting that 'the period of five years matters'.<sup>48</sup>
- The slowing down of fire, reduced spotting, and reduced intensity of fire improve firefighter safety because they provide a strategic advantage for firefighting. Mr Cheney stated he did not believe there could be effective fire suppression without adequate prescribed burning.<sup>49</sup>

## 7.3 LEARNING FROM OTHERS

The Commission heard about fire management from witnesses involved in land or fire management in other jurisdictions. The differences in geography, constraints of prescribed burning, and implementation of prescribed burning allow for comparison and are instructive.

### 7.3.1 WESTERN AUSTRALIA

Since the 1960s the Department of Environment and Conservation in Western Australia has had a bold program of landscape-scale prescribed burning—more than 5 per cent a year—in the south-west forests of the state.<sup>50</sup> There have been no high-intensity, landscape-scale bushfires in these forests since this program started. It has also been accompanied by the development of internal research capacity and skills. There are aspects of this approach that can be translated to Victoria, although it is a comparatively small section of the public land estate and has less severe topography than Victoria, enabling easier implementation of prescribed burning and easier suppression of bushfire. The more stable weather conditions also allow prescribed burning to be more readily achieved.

The Department of Environment and Conservation manages more than 27 million hectares of lands and waters in total, including national parks, marine parks, conservation parks, regional parks, state forests, timber reserves, nature reserves and marine nature reserves. It also has responsibilities for fire management for community protection and biodiversity conservation. As a land management agency, the department recognises that in fire-prone environments proactive fire management—in particular, prescribed burning—is integral to good conservation and land management. The department uses prescribed burning for fuel hazard reduction, bushfire mitigation and ecosystem management. Water catchment management, native forest regeneration and forest regeneration after timber harvesting are other land management objectives supported by the use of prescribed burning.<sup>51</sup>



Mr Sneeuwjagt described the 2.4 million hectares of forested lands that receive particular land management attention by application of prescribed burning above 5 per cent. This area is the most densely populated rural area of the state, with significant rural–urban interface. From the 1920s the south-west forests were regenerated, after earlier clearing, and had been left to grow without much intervention. Heavy fuel loads accumulated over time in most forest areas so that in the late 1930s bushfires had become large and uncontrollable. In response, in 1953 the Forests Department cautiously introduced broad-scale prescribed burning into the south-west forests. However, little effective burning actually occurred in the dense southern forests due to lack of access and concerns about fire behaviour. In 1960–61 there were massive and intense bushfires (the Dwellingup fires) in these long-unburnt forests, which resulted in a royal commission and an endorsement of the 1953 policy.<sup>52</sup>

Since 1961 the Department of Environment and Conservation has consistently undertaken broad-scale prescribed burning in the south-west forests and monitored its effectiveness by the occurrence and impacts of bushfires. This has informed its thinking, as follows:

- Prescribed burning of landscape is done annually at 7 to 8 per cent.
- The proportion of burnt or fuel-reduced area is at least 60 per cent.
- Prescribed burns should have minimum dimensions in area (1,500 hectares), depth (3 kilometres) and width (3 kilometres).
- Fuel-reduction zones are maintained at relatively low levels by regular burning around settlements and at the urban–rural interface.
- Prescribed burns data have been collected over time, including costs, and fire research programs have enabled analysis of the effectiveness of this approach.

Since implementation of broad-scale prescribed burning following the 1961 bushfires in Western Australia, no forest fire has exceeded 30,000 hectares and no lives have been lost in forest fires. In the past 20 years the average annual area burned by bushfire in the region is about 20,000 hectares, and 95 per cent of all bushfires have been less than 100 hectares and less than 1 per cent are greater than 2,000 hectares. This contrasts favourably with the impact of bushfire in the south-eastern Australian states, but Mr Sneeuwjagt noted that the topography of Western Australia makes prescribed burning and fire suppression easier.<sup>53</sup> The Department of Environment and Conservation reports the costs of fire suppression and loss of assets from bushfires. These have been kept at very low levels in comparison with other jurisdictions. Furthermore, the department considers this approach has better supported biodiversity values.

The department developed and currently applies the *Red Book* as a guide for burn controllers in relation to the fuel moisture content and fire behaviour for each forest fuel structural type. The *Red Book* is based on field studies and assists managers to decide when to light, when burning is likely to burn out, and the preferred spacing of burns to achieve land management objectives. Mr Sneeuwjagt commented that they find the *Red Book* more useful than the forest fire danger meter used elsewhere in Australia.<sup>54</sup>

Mr Cheney endorsed the Western Australian model conducted over 50 years of continued prescribed burning accompanied by a research program. He said that the Department of Environment and Conservation is the only organisation that can guarantee tenure and treatment of experiments over a sufficient period to enable any changes to be identified.<sup>55</sup>

### Victoria and south-west Western Australia: a comparison

There are important differences between the topography and climate of south-west Western Australia and Victoria. The topography is more undulating in Western Australia, so access to fire is easier and the chance of fire escaping is substantially reduced. The topography of Western Australia also makes it easier to burn up to 65–70 per cent treatment of the surface and near-surface fuels in any burn area, with sufficient intensity to affect the bark up to 3–4 metres, thus minimising spotting potential. Additionally, weather conditions are more stable in south-west Western Australia compared with Victoria, so that prescribed burning is conducted in spring as well as autumn, which gives staff the opportunity to extend the fuel-reduced areas and to build skills before the summer fire season. By contrast, in Victoria most prescribed burning occurs in the autumn.<sup>56</sup>

Mr Sneeuwjagt was of the view that, overall, there are ‘more similarities’ than differences between the forested regions of Victoria and the karri and jarrah forests of Western Australia. With the exception of the mountain ash species, the majority of all other eucalypt types in Victoria fall between the jarrah and the karri forest types of south-west Western Australia.<sup>57</sup>

Mr Sneeuwjagt described what he perceived to be the main differences between implementation of prescribed burning in Victoria and Western Australia. He identified differences between the scale, intensity and frequency of prescribed burns:

In Western Australia forests between six (6) to eight (8) per cent of the landscape is burned by DEC each year, compared with less than one or two per cent in other States. In addition to the larger scale and size of the prescribed burn program across the forested landscape, the WA practice of burning more than 60 per cent of each burn unit differs with south-eastern states burn cover achievements that are often limited to much less than 50 per cent.<sup>58</sup>

The applicability of the Western Australian prescribed burning regime to the south-east forests of Victoria was discussed by the panel members. It was recognised there are differences between the forests of south-west and south-east Australia that would affect the way prescribed burning could be undertaken in each.<sup>59</sup>

- The Western Australian forests are relatively small (2.5 million hectares) and have a history of intensive treatment, yet in the opinion of Professor Bradstock the Western Australian work robustly clarified the relationship between the treatment rate and the expected reduction in bushfire.<sup>60</sup>
- Mr Cheney stated that the differences between the structure of the eucalypt forest in Western Australia and Victoria were relatively minor. He thought the modification in fire behaviour from the prescribed-burning practices in Western Australia was transferable to Victoria. In view of the Western Australian experience, Mr Cheney identified a need for Victoria to develop burning guides, based on better information for the more difficult forest types, such as those on steep southerly and easterly slopes that raise particular difficulties for prescribed burning.<sup>61</sup>
- Dr Tolhurst was of the opinion that the Western Australian prescribed-burning regime needs to be considered in the context of what he contended were less severe fire weather conditions experienced in Western Australia compared with south-eastern Australia. In his view, Victoria should learn from Western Australia rather than simply duplicate the regime.<sup>62</sup>
- Professor Adams described the Western Australian regime as a success despite the worst 10-year reduction in rainfall anywhere in Australia.<sup>63</sup>
- Mr Williams made the valid distinction between what he described as an ‘operational response’ in terms of management in Victoria against a ‘programmatically oriented’ approach in Western Australia—in other words, staffing and funding for the long term compared with a more short-term operational approach.<sup>64</sup>

The Commission recognises that the long-term commitment to prescribed burning in Western Australia has reduced the risks of bushfires and supported development of internal research skills and materials for implementing burning. There are areas of Victoria to which the prescribed-burning experience of the south-west Western Australian forests may be translated, despite the more difficult conditions in Victoria. There is opportunity to learn from the processes and experience of Western Australia to develop increased knowledge applicable to prescribed burning.

### 7.3.2 THE US FOREST SERVICE

The Commission heard evidence from Mr Jerry Williams who explained how the USFS has reviewed its thinking about landscape-scale ‘wildfires’. The USFS found that there was a very small percentage of fires, based on the number of fires characterised by dramatic consequences for suppression costs and damage caused, that it has identified as megafires. These fires were occurring despite an ever-increasing focus on suppression. The USFS identified the need to shift to active land management across all landholdings, taking into consideration land condition and climate, to determine what actions are required for fire prevention and mitigation. It considers prescribed burning to be an important component of active land management.<sup>65</sup>



In the past 20 years asset loss and damage and natural resource damage have increased significantly despite substantial augmentation of fire protection resources. The increases have occurred in an era in which, as Mr Williams said, 'we have never enjoyed higher funding levels for fire suppression, greater technology in dealing with fires, better co-operation between government at state and local and federal levels in dealing with these fires'. In 2003, after a series of disastrous fire seasons, the USFS initiated a project with the aim of understanding the underlying causes of wildfire threat. At the start of the project it drew on the skills of a range of experts. Participants included the Forest Service, natural resource specialists, fire managers, predictive services personnel, researchers, academics and private citizens from local, state, tribal and federal agencies.<sup>66</sup>

They found that in the past there had been a focus on the 98 per cent of the fires that can be suppressed and do not cause most of the damage.<sup>67</sup> Traditionally the fires that escaped were seen as fire management failure. These few megafires accounted for only 1 per cent of all fires but burned 95 per cent of the total area burnt and consumed 85 per cent of total suppression costs. (This is also true of the bushfires in Australia, although our understanding about the nature of these fires is limited.) Professor Steven Pyne, Regents Professor in the School of Life Sciences at Arizona State University, described megafires as very large area fires, with related climate conditions favourable to large fires. He viewed the large, intense and often savage fires that occur in Southern California, which is subject to drought and explosive winds, as a separate phenomenon. Further, he regards the south-eastern corner of Australia as a 'fire flume', where very large fires will occur, and considered the Victorian mountains a special case that may be a separate phenomenon again, indicating differences in the nature of the megafires.<sup>68</sup>

The drivers of smaller scale fires are local fuel, weather and topographic conditions.<sup>69</sup> In contrast, the USFS project found that the drivers of the megafires are forest condition, landscape features and climate. Despite land management plans including active management strategies, constrained budgets, risks, public concerns or other factors have resulted in land being left undisturbed. Mr Williams noted that in the US 'we have tended to equate protecting a forest with preserving a forest. In other words, we have tended to equate saving a forest with not disturbing a forest'.<sup>70</sup>

The project found that high-hazard conditions were often the indirect consequence of land and resource management objectives that resulted in dense forests and undisturbed conditions in fire-dependent ecosystems. This means that ecosystems that historically burned the most frequently and at the lowest intensities have become some of the biggest fire threats because of the changes in the vegetation structure and composition and the fuel accumulation.<sup>71</sup> The prolonged absence of fire results in a 'melding' of broad landscapes, as forest age, structure and composition have become more homogeneous across the landscape. Drought is also a major driver, which may be tied to global warming, and as drought deepens there are fewer moisture differentials across the landscape.<sup>72</sup>

The Commission notes Mr Williams's observations:

We have always put human life and property very high, if not highest on that list. Endangered species habitat, watershed integrity, these are all extraordinarily high values. The irony here is that we are managing the land for these values, but the way we are doing it may be imperilling those values over time.<sup>73</sup>

In several areas studied there were high-value private lands immediately adjacent to undisturbed public lands. The greatest losses were sustained when fuel hazards reached across the landscape and crossed onto private property.<sup>74</sup>

Mr Williams said Florida was doing more prescribed burning than the entire US Forest Service nationwide and was the only state that had experienced a decline in wildfire acres burned per areas protected. He noted that the geographical differences between Florida and California are similar to south-west Western Australia and Victoria. Nonetheless, he concluded that the safest, most resilient fire-dependent ecosystems have prescribed burning as a major component of their overall management strategy. They also have supporting laws, policies and plans, and leadership continuity to sustain the strategy. He was of the opinion that fuel modification done at a sufficient scale can affect even very high-intensity fires.<sup>75</sup>

The USFS has identified the importance of using a programmatic approach that is landscape scale, has long-term objectives, sustains political support, and is funded, staffed and organised with the long-term objectives clearly in focus. Mr Williams echoed the observations of Mr Sneeuwjagt, who was referring to the Western Australian situation, in emphasising the importance of bipartisan political support for long-term policy decisions to appropriately manage land.<sup>76</sup> The Commission has considerable sympathy with the views expressed by Mr Williams with respect to a programmatic approach for land management.

### 7.3.3 NEW SOUTH WALES

The New South Wales Rural Fire Service has a role in bushfire prevention on private lands that is different to that of the CFA in Victoria. In NSW there has been some formal resolution of the different legislative objectives for vegetation and fire prevention on private landholdings, as described by the evidence of Mr Robin Rogers, Director Operational Services (Assistant Commissioner), of the RFS.

Mr Rogers said that before 2002 there had been 21 pieces of legislation administered by different Commonwealth and State agencies relevant to bushfire prevention activities involving removal of vegetation in NSW. This led to perceptions of conflict, and was seen to impede effective environmental assessment and hazard-reduction activity. Legislative changes were made that are reflected in the introduction of the Bush Fire Environmental Assessment Code, which provides an environmental assessment process so there is a single approval process to perform bushfire hazard-reduction activities. In NSW there has been a shift to consolidate fire management to the RFS, rather than local councils.<sup>77</sup>

## 7.4 PRESCRIBED BURNING IN VICTORIA

The Department of Sustainability and Environment has a Land and Fire Management Division that is responsible for prescribed burning on public land. The DSE Chief Fire Officer resides in this division. Section 16 of the *Emergency Management Act 1986* allows the Chief Fire Officer of DSE to appoint a Burn Controller in the event of a prescribed burn. The section provides that ‘... it shall be the duty of the Secretary [of DSE] to carry out proper and sufficient work for the prevention and suppression of fire in every state forest and national park and on all protected public land ...’. The obligation thus created is onerous.

The total public land estate in Victoria for which DSE has responsibility is 7.7 million hectares. Mr Liam Fogarty, Assistant Chief Officer, Land and Fire Division of DSE, identified that 5.5 million hectares of this land is treatable land for prescribed burning, and the expert panel referred to treatable land as ‘available’ land. Treatable public land excludes areas where prescribed burning is impractical, such as sand dunes, or harmful, as in the wet forests.<sup>78</sup>

The CFA has roles in the prevention and suppression of fires and the protection of life and property in country areas of Victoria. The CFA may be involved in prescribed burning by supporting DSE, conducting prescribed burning on roadsides on behalf of other authorities and providing to local councils and local residents guidance about fuel hazard-reduction activities.

Prescribed burning on public land has been part of Victoria's approach to land and fuel management for decades. The adequacy of the amount of prescribed burning for the purpose of risk reduction has been reviewed a number of times. DSE, as part of its public land management responsibilities, has developed a range of tools to underpin the complexities of land and fuel management, including prescribed burning.



Image 7.1



Source: Courtesy of the Department of Sustainability and Environment.

#### 7.4.1 THE PAST

Australian ecosystems provide evidence demonstrating that regular, deliberate burning has occurred since the arrival of Indigenous Australians at least 40,000 years ago.<sup>79</sup> Reasons for burning varied, from maintaining open areas of vegetation for ease of travel to promoting plant growth and flushing out animals for hunting.

More recently, prescribed burning has been used by land management agencies in Victoria since the 1920s, including for silvicultural purposes.<sup>80</sup> Mr Athol Hodgson, currently representing Forest Fire Victoria and former Chief Fire Officer of the Department of Conservation Forests and Lands, indicated that fuel-reduction burning was undertaken by foresters, bushmen and graziers using local knowledge and that this generally bolstered fuel-reduction burning programs until the 1950s. He noted that these activities were directed at managing vegetation, reducing the destructive capacity of bushfire and more easily controlling bushfire.<sup>81</sup> In the 1960s fuel-reduction burning was introduced into Victoria on a more scientific basis. The Forests Commission began using grid ignition patterns rather than strip ignition to obtain effective fuel reduction and to better control the intensity of burning. Aircraft were also used to ignite the fires, allowing prescribed burning over larger areas.<sup>82</sup>

Until the 1990s mapping and recording of fuel-reduction areas was not done consistently across the state. Very few assessments were conducted to determine whether the level of fuel reduction achieved was satisfactory: 'Areas recorded as having been fuel reduced may well have been ignited, but with very little spread of fire and intensities necessary to effectively reduce fuel loads in those sections that were burnt'.<sup>83</sup>

#### Lessons from the past

The use of prescribed burning for fuel-reduction purposes has been raised in a number of inquiries and investigations. The amount of prescribed burning, the characteristics of prescribed-burning practices, the costs associated with prescribed burning, and the associated public reporting were raised and given weight in the recommendations of past inquiries.

### The 1939 Royal Commission

The Royal Commission into the 1939 bushfires recognised that prescribed burning was an effective preventive and protective measure against bushfire. Justice Stretton commented in his report that the amount of prescribed burning done by the then Forests Commission was ‘ridiculously inadequate’ because of a shortage of staff and a tardy recognition of the importance of preventive measures.<sup>84</sup>

### The Inquiry into the 2002–2003 Victorian Bushfires

The report of the Inquiry into the 2002–2003 Victorian Bushfires made a number of important recommendations about prescribed burning. They covered the following:

- the setting of an annual optimum area for prescribed burning—noting that setting of targets was a difficult yet primary task for fire managers
- the routine and explicit reporting of the effectiveness of the burning program, including mapping of fire extent and fuel array data
- measuring the total area subject to prescribed burning treatment in each fire management zone each year, together with the average proportion of that area successfully burnt
- training more personnel to carry out prescribed burning
- DSE conducting a formal study of the level of prescribed burning in south-west Western Australia for its possible application in Victoria.<sup>85</sup>

Following this report DSE increased its annual target for prescribed burning from 100,000 hectares to 130,000 hectares.<sup>86</sup> This increase represents an annual prescribed burning area of about 1.7 per cent of the total area of public land.

### The Victorian Auditor-General’s 2003 report

In 2003 the Auditor-General undertook an audit focusing on the allocation of resources for planning, prevention and preparedness to prevent or reduce the severity of Victoria’s seasonal bushfires. The Auditor-General observed that the fire protection plan targets for fuel reduction were idealised, rather than practical, and aimed at maintaining ideal fuel loadings by implementing an environmentally acceptable burning regime for every identified hazard in each risk category.<sup>87</sup> The Secretary of DSE informed the Auditor-General in 2003 that ‘... Fuel reduction, at its most “idealistic” level, would occur in any one year on or around 3.3% of the public land estate’.<sup>88</sup>

Mr Greg Wilson, the current Secretary of DSE, characterised 3.3 per cent as a long-term aspiration.<sup>89</sup> If that is the case, seven years have passed since the aspiration was first announced. Mr Fogarty said he would favour a target of 4–5 per cent of treatable area as an effective percentage.<sup>90</sup>

The Auditor-General found that fuel-reduction burning was costly, that for DSE to meet targets it would require increased outlays, and that a risk and cost–benefit analysis would be needed to improve prescribed burning. The Auditor-General found that DSE’s understanding of the level of fuel–reduction burning and overall risk was limited and recommended that DSE cost fuel reduction burning within the budget process, allocate appropriate funding levels, and allocate the cost of staff employed from other business units.<sup>91</sup>

### The Environment and Natural Resources Committee’s 2008 report

The ENRC report of the Victorian Parliament’s Inquiry into the Impact of Public Land Management Practices on Bushfires in Victoria was explicit in relation to its recommendations concerning prescribed burning. The findings and recommendations included the following:

- The frequency and extent of prescribed burning have been insufficient for a number of decades for preservation of ecological processes and biodiversity across the public land estate.<sup>92</sup> The report quoted a report of the Victorian Fire Ecology Working Group (a partnership between DSE and Parks Victoria), which found biodiversity is threatened by the infrequency of current fire regimes in Victoria.

- An increase in the extent and frequency of prescribed burning should be a priority.
- 'A minimum average of 5 per cent of the public land estate', comprising 7.7 million hectares, should be adopted as the annual prescribed burning target by DSE.<sup>93</sup> This equates to increasing the prescribed burning target from 130,000 hectares to 385,000 hectares, to be treated as a rolling target.
- A comprehensive review of the effectiveness of the prescribed burning target in meeting ecological and bushfire suppression needs be conducted every three years.
- DSE should report its performance against the target in its annual report.
- DSE, the Department of Primary Industries, Parks Victoria and VicForests should separately cost and report annual expenditure on fuel-reduction burning, ecological burning and regeneration burning in their annual reports.

The committee report considered that a target was appropriate, understanding that achievement or underachievement of the target needed to be considered with care due to the constraints of weather and climate. Further, the actual risk reduction through fuel-reduction burning is not directly proportional to the area that has been fuel-reduced. Mr Wilson stated that at the time of the ENRC inquiry, government had 'articulated a preference to move away from simple hectare based targets which may lead to inappropriate prescribed burning programs as hectares targets do not necessarily reflect achievement of desired outcomes'.<sup>94</sup>

DSE further contended to the ENRC inquiry that a reason it could not quantify the increase in prescribed burning was because there was limited understanding about the ecological effects of fire, and research was ongoing. The Commission heard similar claims from a DSE witness.<sup>95</sup> The Commission agrees that more research is needed, but it does not see this as a rationale for inactivity. The Commission urges DSE to exercise leadership in relation to research on the effectiveness of prescribed burning.

The committee was unable to obtain data about the cost-effectiveness of fuel-reduction burning. In particular, it observed that the potential benefit of this information '... would be to demonstrate the reduced costs of fire suppression which flow from increased prescribed burning'.<sup>96</sup>

#### 7.4.2 THE PRESENT

There does not appear to be an understanding of the links between prescribed burning for bushfire prevention and the consequences of bushfires. The system of funding might have inbuilt bias in favour of suppression at the expense of prevention. From a government perspective, increased suppression costs can be funded by an increased contribution from insurance companies, and inflation in property values will automatically provide part of this funding over time. In contrast, prevention activities compete for funds as part of the budget process.

Prescribed burning is technically challenging, and the consequences of implementation, and particularly of any escapes, can be significant to DSE. Further, the amount of prescribed burning must also be large enough in scale to effect hazard reduction. Following large bushfires attention generally focuses on failures in response and suppression, rather than on the adequacy of prevention activities.<sup>97</sup> The Commission is of the firm view that the benefits of properly implementing prescribed burning outweigh the difficulties of implementation.

Several weeks before 7 February Mr Kenneth Williamson, captain of the Whittlesea fire brigade, noted the 'excessive' fuel loads and dryness in areas around Mt Disappointment and Strathewen. He attributed these conditions to a lack of fuel reduction and drought, which has been worsening over the years.<sup>98</sup> Mr Glen Woods, captain of the Flowerdale brigade, also noted the 'extreme' fuel loads around Flowerdale.<sup>99</sup> The combination of higher fuel loads and drought had led to an increased bushfire risk. Climate change has been directly correlated with drought periods that are more intense and is also projected to negatively affect water and biodiversity in the future, which will further contribute to an increase in fuel loads.<sup>100</sup>



## Implementation

Prescribed burning is a resource-intensive and costly activity accompanied by reputational, political and operational risks. The risks are increasing because more people are living at the forest interface, because of the changing demographics of the rural population with changing land use and development, and because the continuing drought increases fuel hazards.<sup>101</sup>

Intense bushfires pose a greater risk to the community than lower intensity prescribed burns, even though the consequences of prescribed burning, and problems with escapes, which comprise 2 per cent of total prescribed burns, have significant practical and reputational ramifications for the agencies engaged in the activity.<sup>102</sup> In contrast, when there are large bushfires, greater media attention is drawn to the failures of suppression rather than the failure of risk mitigation, so that there has been little incentive to change the approach to prescribed burning.<sup>103</sup>

DSE consults stakeholder groups, including industry representatives such as grape growers, before implementing prescribed burning programs. It is common for community members and those organising tourist events to seek to have prescribed burns deferred until after events are concluded.<sup>104</sup> Mr Fogarty said that many stakeholders take issue with some of the potential adverse impacts of prescribed burning, including its possible effect on biodiversity, and that 'stakeholder concerns and tensions are also especially acute at present because of the continued drought and already stressed ecosystems and industries in Victoria.'<sup>105</sup>

A range of physical factors must be considered before prescribed burning can occur. As with bushfire, the weather, topography and fuel loading affect the prescribed burn. As noted, most prescribed burning in Victoria occurs in autumn, when conditions are likely to be mild and stable. In terms of weather, the temperature, relative humidity, wind speeds, atmospheric stability and Forest Fire Danger Index are considered before burning, as is the time window for stability because burns can take days.<sup>106</sup> The report of the Inquiry into the 2002–2003 Victorian Bushfires found that the number of days that meet the weather prescriptions for prescribed burning are few, averaging around 10 a year.<sup>107</sup>

There are a number of operational matters that must be followed to prepare and conduct a burn, which is managed by means of a detailed approval process.<sup>108</sup> As Mr Shaun Lawlor, the DSE District Manager for Ovens, explained, a 'draft burn plan' must be prepared and must gain the necessary internal approvals. It outlines the method and pattern of ignition and planning and preparation of control lines. The public must be notified (including by the posting of notices of intention to burn), adjoining landholders and other stakeholders must be consulted, traffic management needs to be planned, resource needs for the duration of the burn must be determined, and escape routes, safety zones and potential hazards must be identified.<sup>109</sup> Weather and fine fuel moisture content are primary factors determining whether a burn proceeds.<sup>110</sup>

### 7.4.3 TARGETS

DSE has developed *Living with Fire—Victoria's Bushfire Strategy*, a corporate plan for 2008 to 2011 and a Fire Ecology Program. The Bushfire Strategy and the corporate plan document the need for increased prescribed burning, accompanied by increased numbers of personnel with the skills to carry out and support the activity. The corporate plan contains a prescribed burning target of 4 to 6 per cent of public land, in contrast with the current Treasury-funded measure of 130,000 hectares, which represents only 1.7 per cent of the total public land.<sup>111</sup>

In June 2008 the Government launched *Living with Fire*.<sup>112</sup> Former Secretary of DSE, Mr Peter Harris, stated:

The Strategy recognises that the combination of high fuel loads due to decades of effective fire suppression and changes to land use and management practice, drought, 'tree change' lifestyles and climate change has collectively and significantly raised the risk of bushfire threat. A key theme in the Strategy is to significantly increase the amount of planned burning across Victoria to reduce fuel loads, in a manner that recognises ecosystems.<sup>113</sup>

The strategy provides a framework for increasing prescribed burning of public and private land by informing communities involved in bushfire prevention and response, optimising firefighting resources and improving land-use planning and adaptive management. It recognises that more than 80 per cent of Victorian fires are contained as small

fires and that it is the remaining 20 per cent of fires that result in 90 per cent of the areas burnt annually. The Bushfire Strategy and the corporate plan recognise the need for significant investment in trained and experienced firefighters to increase prescribed burning.<sup>114</sup>

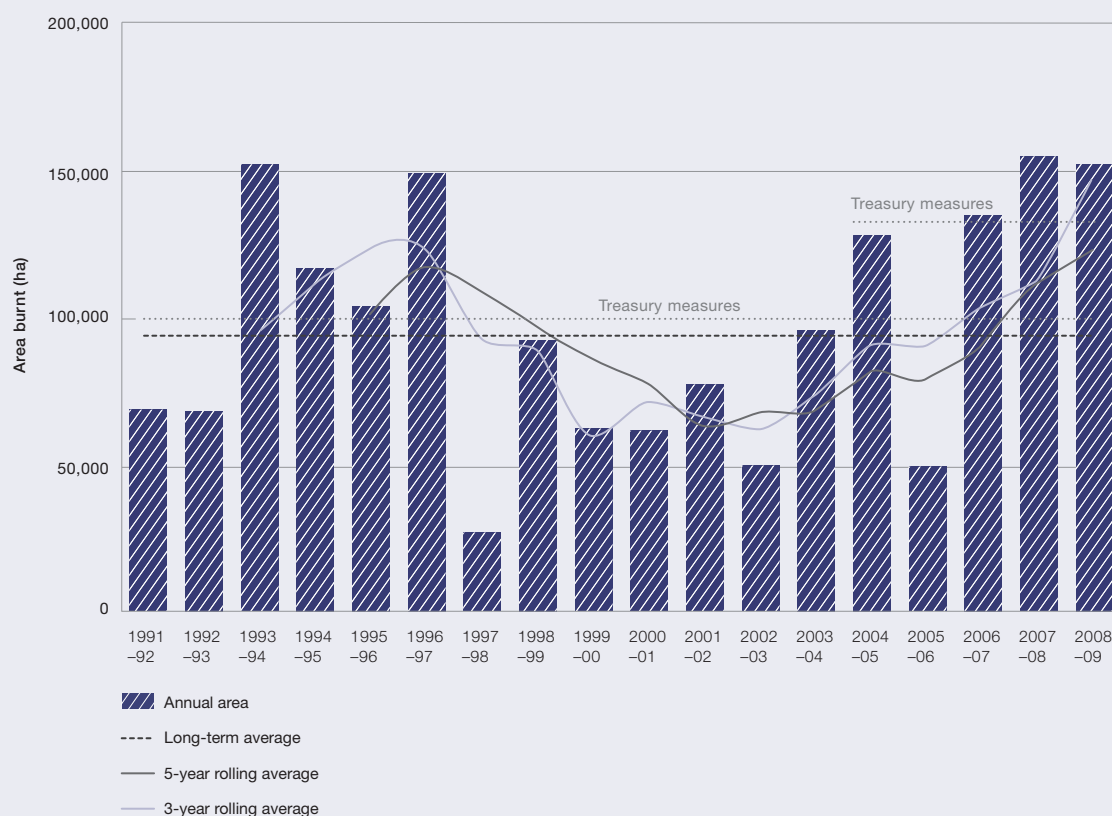
The corporate plan identified four strategic priorities for DSE, for the period 2008 to 2011, of which one was responding to fire threat. An important component of this priority was 'increasing and improving planned burning programs'.<sup>115</sup> The plan stated, '... fuel reduction burning will need to increase to between 4 and 6 per cent of public land each year', which underscored the importance of fuel-reduction burning in the overall strategy.<sup>116</sup>

In his evidence Mr Wilson retreated from the target and the need for the increased prescribed burning identified in the corporate plan. He stated that DSE 'ought to have strategies that build the capability to head towards that type of scale' and that 'a lot more of the work' was necessary.<sup>117</sup> Mr Wilson was unable to comment on the basis behind the target of 4–6 per cent on public land. He indicated the advice he received was to the effect 'that 3, 4, 5 per cent' was what 'may ultimately' be achieved but that DSE does not have the confidence to convert that to a target because 'we need to get more feedback from the science, we need to bring the community along ...'.<sup>118</sup>

Mr Wilson was not even sure if the document remained the corporate plan. He advised there was '... some doubt about that'.<sup>119</sup> This answer from the person responsible for ensuring sufficient work for the prevention and suppression of fire on the public land estate highlights the lack of direction in Victoria on this vital matter.

At the end of 2001–02 the three-year rolling average for area burnt was 66,390 hectares; at the end of 2008–09 it had risen to 146,141 hectares. The reason provided for this increase was that '... risk factors (such as, climate change, land use and development in rural areas and increased fuel hazards) had been escalating relatively unchecked for approximately 20 years in the State'.<sup>120</sup> The 146,141 hectares equates to 1.9 per cent of the total public land estate.<sup>121</sup>

Figure 7.1 Annual and rolling trends in prescribed burning, 1991–92 to 2008–09



Source: Exhibit 716 – Supplementary Statement of Fogarty, Annexure LGF 1.<sup>122</sup>

In practice, the DSE target remains 130,000 hectares of prescribed burning a year. In his statement Mr Wilson said DSE was aiming to 'gradually increase' the scale of its prescribed burning program. He was unable to explain any strategy or science behind the current regime. His view was that the target of 130,000 hectares was set because that was a figure '... commensurate with resources that were given'.<sup>123</sup> His inability to justify or properly explain the basis of the current target of 130,000 hectares contrasts with the legislative duty imposed on him pursuant to s. 62(2) of the State's *Forest Act 1958*. Mr Fogarty could not point to any scientific justification for the figure either, stating 'There is no solid basis for those figures'.<sup>124</sup>

Mr Fogarty stated that DSE is committed to incrementally increasing prescribed burning.<sup>125</sup> In response to the counsel assisting submission about land and fuel management, the State indicated it would explore resource allocation for an incrementally higher target based on treatable public land.<sup>126</sup>

### **Targets: the expert panel**

Members of the expert panel considered that the past prescribed burning regime of about 100,000 to 130,000 hectares a year is equivalent to a low level of risk reduction. They thought the strategic distribution and implementation of a prescribed burning regime of at least 5 per cent of the available land would reduce risk. To increase prescribed burning above 10 per cent carries greater risk of adverse ecological outcomes.<sup>127</sup>

Dr Clarke clarified that there is some evidence to support the notion that prescribed burning at 5 per cent a year in the dry eucalypt foothill forests would be unlikely to result in undesirable environmental impacts. The available evidence suggests that prescribed burning of that magnitude is justifiable if the primary goal is appreciable reduction of risk to life and property on days of severe fire weather. Scientific knowledge is also most advanced in relation to the dry eucalypt forests.<sup>128</sup>

Dr Tolhurst and Professor Adams both made the point that a target of 5 per cent across treatable public land was a starting point and the benefits would not be evident for 10 years at least.<sup>129</sup> Mr Cheney said an 8 per cent target for fuel reduction would be more effective.<sup>130</sup>

Professor Bradstock emphasised the importance of what he termed 'the other side of the ledger': there could be ecological benefits from 5 per cent prescribed burning and he pointed to the example of protecting water yield.<sup>131</sup>

Panel members agreed in their summary that a statewide target is useful because it provides a guide to the overall scale of prescribed burning that should be done. The target must, however, take into consideration the fact that each hectare burnt is not of equal 'value' and the location of prescribed burns affects the effectiveness of risk reduction.<sup>132</sup> Notwithstanding the usefulness of a statewide target, panel members were of the view that conducting prescribed burning strategically would involve placing prescribed burns to maximise risk reduction, assessing the most appropriate prescribed-burning regime for each region or habitat type, and considering the appropriate level of burning in particular regions.<sup>133</sup>

### **Targets: other views**

The Victorian Association of Forest Industries and the National Association of Forest Industries considers that prescribed burning is most effective when applied at a landscape scale to continuous tracts of forest.<sup>134</sup> Ms Lisa Marty, Deputy CEO of VAFI, said VAFI 'consider that standing timber in a forest is a commercial asset and should be protected' and prescribed burning is a means of protection.<sup>135</sup> VAFI and NAFI both acknowledged that the skills and resources of the forestry industry could be better used for more effective forest management in terms of bushfire prevention and suppression. They mentioned reducing fire hazards by prescribed burning, by using forestry equipment to remove forest fuel close to housing and other developed assets, and by developing cost-effective techniques for thinning native forests.<sup>136</sup>

Forest Fire Victoria, a group describing itself as comprising 'like-minded and concerned practitioners and scientists', are also strong supporters of a target for prescribed burning in Victoria.<sup>137</sup> The group stated that 'an annual target of prescribed burning 460,000 hectares of public land is necessary to ensure the long-term wellbeing and safety of forest ecosystems and their surrounding rural and urban communities'.<sup>138</sup> The group also



called for the government to fund DSE to enable it to increase its workforce and skill levels to enable it to carry out higher levels of prescribed burning.<sup>139</sup>

Similarly, the Australian Workers Union supports increased prescribed burning. Mr Cesar Melhem, the State Secretary, described it as an important tool for reducing fuel loads and minimising the incidence and intensity of bushfires. The union strongly supports an annual 385,000-hectare rolling target.<sup>140</sup>

DSE has continued with a 130,000-hectare target for prescribed burning, despite the recognition by it and others that a substantial increase in such burning is necessary for community protection. DSE has not been held accountable for this. The State has failed to respond to numerous recommendations and provide the necessary resourcing for increased prescribed burning. This reflects a general lack of will to do the level of burning necessary for community and environmental protection by reducing the risk of large and intense bushfires.

The Commission considers that a target of 5 to 8 per cent prescribed burning of public land is necessary for community safety and would not pose unacceptable environmental risks, particularly if priority is given to the dry eucalypt forests referred to by the expert panel.

#### RECOMMENDATION 56

The State fund and commit to implementing a long-term program of prescribed burning based on an annual rolling target of 5 per cent minimum of public land.

#### RECOMMENDATION 57

The Department of Sustainability and Environment report annually on prescribed burning outcomes in a manner that meets public accountability objectives, including publishing details of targets, area burnt, funds expended on the program, and impacts on biodiversity.

#### 7.4.4 COSTS

If the community is to understand and appreciate the benefits that accrue from prescribed burning, it must have an understanding of the costs and be able to compare those against the costs associated with fire suppression. The expert panel referred to the importance of this information being available.<sup>141</sup> Professor Bradstock noted that the rudimentary nature of current information ‘imposes a major impediment to informed decision-making about prescribed fire’.<sup>142</sup>

Mr Wilson said he had been in his current job, as Secretary of DSE, for six months and is committed to being able to provide information on the cost of prescribed burning, but he was currently unable to provide a figure to the Commission. He stated that he had been advised that it was a ‘vexed issue’.<sup>143</sup> Yet, the Code of Practice requires that the department record its expenditure on prescribed burning.<sup>144</sup>

The Commission finds it inexplicable that, despite recommendations since 2003 to report the costs associated with prescribed burning, DSE (or its former entity) is unable to provide this vital information. If the current cost is not recorded and reported, it is difficult to understand how future funding, resources and increases in prescribed burning can be properly assessed and allocated. There is also the important question of public accountability—not just of the efforts and resources applied, but also of the goal set by government and reflected in its annual budgetary allocations.

#### 7.4.5 FIRE ECOLOGY

The biological impact (killing power) of a single fire event and the rate of recovery (of bushland and/or of human communities) is proportional to the intensity and size of the fire. Very large and intense wildfires cause high levels of mortality and damage to native plants and animals, and irreversible loss of topsoil. Post-fire recovery may take many decades, or even centuries where old growth forests have been killed. On the other hand, low intensity, patchy fires have little long term impact on the biota, which recovers relatively quickly from such events.<sup>145</sup>

—Mr Richard Sneeuwjagt

The intensity and frequency of fire, the season of occurrence, and the size and patchiness all influence the relative abundance of plant and animal species in a community and the viability or vulnerability of their continued existence in the landscape. Fires that occur outside an organism's range of tolerance can cause local extinctions. As Dr Clarke explained, fire planners need to know what biological assets they are attempting to conserve and where they are located.<sup>146</sup>

DSE's Fire Ecology Program aims to develop the science and community engagement to support appropriate fire regimes for biodiversity management and asset protection. The current statement of strategic directions for fire ecology describes the need to understand the relationship between fire events, fire regimes and biodiversity outcomes in an environment in which unpredictable bushfires are a major challenge.<sup>147</sup> It recognises the key drivers of fire management, some of which are also statutory obligations. Relevantly, they include:

- the requirement to achieve ecologically appropriate fire regimes to maintain biodiversity
- the requirement to reduce the occurrence, spread and severity of bushfires
- the need to improve knowledge about the requirements of fauna and to develop sound faunal vital attributes for use in fire planning decisions
- the need to develop sound and adaptive monitoring programs that also include fauna
- the need to increase understanding through research.<sup>148</sup>

DSE explicitly recognises the importance of understanding the ecology and spatial distribution of flora and fauna populations and communities, the necessity of conducting scientifically robust monitoring and assessment of the effects of fires, the need for fire managers to have timely and accessible fire ecology data and the requirement for adaptive management.<sup>149</sup> Mr Wilson agreed that appropriate management of prescribed burning programs is heavily reliant on the quality and availability of information about ecological values.<sup>150</sup>

The ability to apply prescribed fire events in locations that minimise adverse effects to biodiversity requires, at a minimum, accurate fire history mapping (including timing, location and severity) and a sound understanding of flora and fauna responses to fire. According to Professor Bradstock, currently available geographic information systems can be used to record and spatially map all fires and could commence routinely measuring fire severity and adding that to the record.<sup>151</sup> Mr David Tainsh, DSE Area Manager Land and Fire Services for East Gippsland, noted that 'Fireweb and its associated mapping links provide a database to allow planners to superimpose a detailed fire history across public land, as well as providing a systematic record of past and future programs'.<sup>152</sup> The Commission considers that DSE should enhance its recording and spatial mapping of all significant fires, prescribed and bushfire, in Victoria and progressively consolidate fire maps into fire histories.

Dr Clarke's evidence was that ignorance of the current distributions and needs of flora, and particularly fauna, in relation to prescribed burns and bushfire means that there is a very real risk of causing local extinctions through the application of inappropriate fire regimes. If habitat needs are known, prescribed burns can be implemented to take into account the needs of the least tolerant and therefore most vulnerable organisms in the region. This approach ensures prescribed burning does not jeopardise biodiversity.<sup>153</sup>

Dr Clarke considered that agencies should act as custodians of the long-term data sets of surveys of flora and fauna and that spatially explicit databases on the distribution of key species and their habitats are years out of date. In Victoria the largest surveys of flora and fauna were done in the 1970s.<sup>154</sup> Further, the State has recently identified

in the *Land and Biodiversity* White Paper that the health of Victoria's ecosystems is declining; increasing variability in weather patterns is likely to increase stresses on many ecosystems and threaten ecological function; and the capacity for adaptation to change has been reduced because our landscapes are highly fragmented.<sup>155</sup> In this context, developing our understanding of flora and fauna is becoming even more important.

Responses of biodiversity to fire regimes and prescribed burning are inherently complex, as is the task of managing fire and land for multiple values.<sup>156</sup> The Commission considers, however, that that is no justification for inaction. As Mr Philip Ingamells of the Victorian National Parks Association submitted, '... given our predicament with biodiversity in Victoria and our predicament as the most fire prone state by far ... we have to become clearly the experts. We have to lead the game here. We don't have to wait for somebody to show us the way'.<sup>157</sup>

The Commission notes that the decline in the health of Victoria's ecosystems—which has not been helped by the decline in the quality and maintenance of biodiversity information—is having a deleterious impact on planning for community safety. The Commission agrees with the expert panel that the recommended increase in prescribed burning must be accompanied by a corresponding long-term commitment to monitor, map and model its ecological consequences.<sup>158</sup> A sustained and substantial commitment to long-term, ongoing research is also required, including studying the impact of large, high-intensity bushfires across landscapes.

#### RECOMMENDATION 58

The Department of Sustainability and Environment significantly upgrade its program of long-term data collection to monitor and model the effects of its prescribed burning programs and of bushfires on biodiversity in Victoria.

#### The Flora and Fauna Guarantee Act

DSE has separate statutory responsibilities for biodiversity conservation and for fire management on public land. Managing environmental values and bushfire risk mitigation are quite different objectives. Inappropriate fire regimes, either bushfire or prescribed burning, have been identified as processes that threaten biodiversity. Information about threatened biota is therefore essential to minimise the consequences of prescribed burning at the landscape scale. Yet DSE has limited understanding of the biology, ecology and distribution of flora and fauna.

The Secretary of DSE administers the *Flora and Fauna Guarantee Act 1988* to promote flora and fauna conservation and management objectives. The Act is the primary Victorian legislation providing for the conservation of threatened species and ecological communities. A potentially threatening process is one that threatens the survival, abundance or evolutionary development of any taxonomic group or community of flora or fauna. Such processes may be listed under the Act.<sup>159</sup> Inappropriate fire regimes were gazetted as potentially threatening processes in 2004.<sup>160</sup>

The Secretary of DSE must prepare an action statement for any listed potentially threatening process as soon as possible after that process is listed and must prepare a flora and fauna guarantee strategy setting out how the objectives of the Act are to be achieved, including the proper management of the potentially threatening process. Action statements are the primary tools for the conservation of threatened flora and fauna and 'set out what has been done to conserve and manage ... that process and what is intended to be done'.<sup>161</sup>

In a review of the administration of the Act published in April 2009 the Victorian Auditor-General found that the effort being directed to listing threatened species and threatening processes had not been matched by effort to develop action statements, to monitor the implementation of actions or to assess their effectiveness, and that the gap between listed items and items the subject of action statements continues to widen. The Auditor-General found that at the current rate, assuming no additional listings beyond 2008, it would take 22 years to develop action statements for the remaining listed items. DSE broadly agreed with the main conclusions and findings of the review.<sup>162</sup>



The Auditor-General's recommendations included a review by DSE of the efficacy and efficiency of the tools and processes in the Act, and an assessment of the resources that DSE applies to developing, monitoring and reviewing action statements.<sup>163</sup> DSE agreed to undertake those reviews, which are still occurring. In 2009 the State indicated its intention to repeal the Act.<sup>164</sup> Dr Clarke said there is minimal understanding of the biology, distribution and ecology of many of the species listed under the Act. The assumption that, in the absence of information, inactivity is preferred may involve making a decision against the organism's interest.<sup>165</sup>

The Commission's hearings were not directed to a review of the implementation or the administration of the Act. The underlying issues detected by the Auditor-General's review—namely, a lack of resources or a failure to apply appropriate resources—is germane to the subject of fire management for biodiversity. In its response to the Auditor-General's recommendation that DSE continue to build its knowledge base in relation to threatened species, DSE said further development of its major biodiversity information systems was proceeding and 'will continue to be supported, subject to resource availability and competing priorities'.<sup>166</sup> When asked in the Commission's hearings whether DSE had the resources to meet its present statutory functions Mr Wilson said:

I'm not sure I could conclude or have been advised that we don't have the resources to meet statutory requirements ... I ought to be examining that issue and where we are at with action statement and biodiversity issues more generally. But my sense is that, yes, we could use more resources and we can use better science and so on. But I couldn't necessarily conclude that there is absolutely not enough to meet minimum statutory requirements.<sup>167</sup>

Nevertheless, Mr Wilson agreed that the situation was 'less than optimal'.<sup>168</sup>

The Commission notes the importance of current biodiversity data to enable objective decision making when implementing prescribed burning strategies. In the absence of such information, judgments are subjective and it is difficult to determine the consequences of actions taken. The Commission also recognises, however, that action—both increasing prescribed burning and increasing biodiversity knowledge—is essential for the protection of people and the environment.

### **The Environment Protection and Biodiversity Conservation Act**

The Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* is administered by the Department of the Environment, Water, Heritage and the Arts. The Act provides a mechanism for protecting Australia's native species and ecological communities and for listing the species and ecological communities that are threatened.<sup>169</sup> DSE has primary responsibility for the management of fire and biodiversity on public land and is thus in the best position to determine whether increased prescribed burning will affect species and communities protected under the Environment Protection and Biodiversity Conservation Act and the appropriate course of action should that be the case.

#### **7.4.6 THE CODE OF PRACTICE**

DSE's Code of Practice for Fire Management on Public Land sets out the principles, standards and guidelines that apply to fire management on all public land in Victoria. It supports DSE in fulfilling its legislative obligations to protect human life and property by fire prevention and suppression, protect biodiversity, manage public lands, protect cultural values, and protect the health and safety of people affected by DSE work activities.<sup>170</sup>

#### **Objectives and priorities**

The Code of Practice refers to three main objectives for prescribed burning—'to reduce fuel levels for fire protection, to stimulate regeneration of tree species following timber harvesting and to maintain and enhance indigenous ecosystems'.<sup>171</sup> It aims to achieve multiple land management objectives while recognising that trade-offs might be required. The current expression of objectives encapsulated in the code is '... to promote the efficient, effective, integrated and consistent management of fire and fire related activities on public land for the purpose of protecting human life, assets, and other values from the deleterious effect of wildfire or inappropriate fire regimes ...'.<sup>172</sup>

The expert panel members considered these to be broad goals and called for the governing code to provide an outcome-oriented approach, rather than consisting of statements of 'vague principles' or merely being a means of 'measuring activity'.<sup>173</sup>

The expert panel's summary advocated explicitly identifying objectives and assigning priority to them and called for a model for transparently resolving competing objectives in the Code of Practice. It recognised that trade-offs are inevitable in some situations where the priority is protecting human life.<sup>174</sup>

- Dr Clarke proposed a model that explicitly rates (or 'prioritises') values promoted by a prescribed burning regime. The model should set out the values sought to be maintained, possible actions and consequences, and the associated risks and costs. Decisions could be made based on transparently weighing up the costs and benefits of different choices, realising that there is uncertainty in estimates of risks and consequences.<sup>175</sup> Other panel members supported such a model.<sup>176</sup>
- Mr Sneeuwjagt described the Wildfire Threat Analysis tool used in Western Australia as a risk analysis tool that is used to locate and schedule prescribed burns through the development of a rolling three-year indicative prescribed burning program. This risk analysis process enables fuel-reduction zones around settlements and the rural-urban interface to be identified and maintained in a state of relatively low fuel.<sup>177</sup> Mr Cheney and Dr Tolhurst considered this an effective process for community engagement. Dr Tolhurst commented that it was a 'more open, transparent way of discussing the issues and what's at risk'.<sup>178</sup>
- Mr Williams advocated using what he called an 'optimisation model', which involves the whole community in determining a means by which one can use long-term trade-offs to optimise the outcomes for competing values.<sup>179</sup>

The Commission sees the value of a transparent process involving the community to identify the differing values, objectives and risks from which the desired outcomes, consequences and costs of different options could be considered. Ultimately, though, the need to keep communities safe should not be subordinated to other considerations.

DSE ought make sufficient information publicly available when planning its prescribed burning operations to enable community involvement in weighing up the risks, consequences and costs of benefits of future prescribed burning. It should engage in community consultation in order to gauge reaction to help in the information-sharing process and to help build public understanding and confidence in the purposes of the program.

### Fire management zones

The Code of Practice allows for four fire management zones, which are determined on the basis of the importance of fire protection to the area, fuel management alternatives, land values, land management objectives, suppression alternatives and environmental management principles.<sup>180</sup> The zones are as follows:

- *The Asset Protection Zone.* This provides the highest level of protection to human life and other valued assets. High-intensity fuel management will take precedence over other values in this zone.<sup>181</sup>
- *The Strategic Wildfire Moderation Zone.* This consists of areas of sufficient width and continuity to provide a substantial barrier to the spread of bushfire. The aim in this zone is to reduce the speed and intensity of fires and the potential for spot fire development. This also assists in making fire suppression safer and more effective. The fuel management characteristics are generally broader than those set for an Asset Protection Zone. According to the Code of Practice, the treatments in this zone aim to maximise ecological outcomes by seeking to manage for ecologically desirable fire regimes, provided fire protection objectives can still be met.<sup>182</sup>
- *The Ecological Management Zone.* This aims to achieve ecologically appropriate fire regimes for native species and ecological communities that have specific fire regime requirements and manage particular areas and values, including forest regeneration and protection of water catchments at a landscape scale.<sup>183</sup>
- *The Prescribed Burning Exclusion Zone.* This is where prescribed burning is excluded for at least the duration of the relevant fire management plan. Such areas are identified as having high potential for economic, ecological or cultural loss if subjected to prescribed burning.<sup>184</sup>

With the exception of the exclusion zone, there is no guidance in the Code of Practice on the expected characteristics—the size of the prescribed-burn area, the percentage of the burn area to be burnt, fire intensity, frequency of a fire regime, or expected residual overall fuel hazard—of the prescribed burning applied to each zone.

DSE introduced a ‘landscape mosaic burning component’ to its prescribed burning program after publication of the Environment and Natural Resources Committee’s report in 2008. Mr Fogarty suggested that landscape mosaic burning is ‘a very different approach’. He described it as a process for the broad-scale burning of large areas of public land in which burn coverage could vary from 30 to 70 per cent. It is usually conducted over three years to achieve a range of land and fire management objectives and is ‘supplementary and supporting’ to ‘strategic burning’. He said the idea was to use fire more broadly over the landscape and to burn larger areas—maybe 2,000 to 5,000 hectares—over a longer period.<sup>185</sup>

It is not clear how the introduction of ‘landscape mosaic burns’ fits within the zone system established by the Code of Practice. The use of landscape mosaic burning appears to operate outside, and in addition to, the zone regime. It is also not clear what portion of the total 150,999 hectares of prescribed burning conducted in 2008–09 was achieved through what Mr Fogarty calls ‘traditional prescribed burns’ compared with ‘landscape mosaic burns’.<sup>186</sup>

Dr Clarke noted that virtually nothing is known about the scale at which mosaics should be implemented in Victoria or about how they should be composed in terms of age classes. This lack of understanding limits the ability of DSE to determine whether ‘landscape mosaic burns’ achieve good ecological outcomes.<sup>187</sup>

### Fire management zones and February 2009

The State tendered maps of the areas surrounding Marysville, Kinglake, Flowerdale, Mudgegonga and Callignee.<sup>188</sup> These maps depicted past prescribed burns and planned prescribed burns as at February 2009. They did not show which zones the treated areas fell into; nor did they provide information about the size of treated areas or the intensity of the treatment. The Commission considers that this additional information is essential to any assessment of the age and accumulation of fuels and whether the prescribed burns have achieved what they set out to do. The maps—or at least the way in which they were explained in evidence—did not reveal the existence of systematic designation of Asset Protection Zones close to towns or of Strategic Wildfire Moderation Zones in areas designed to provide a further ‘buffer’ to towns.

Mr Fogarty also accepted that the maps in relation to Kinglake indicated there had been no fuel-reduction burning within 5 to 7 kilometres of Kinglake township since 1991.<sup>189</sup> This suggests that fuels in areas around the town were reasonably ‘old’ and not subjected to the sorts of intensive treatment the Code of Practice suggests for Asset Protection Zones.

Mr Fogarty explained (by reference to the map that depicted past prescribed burns around Marysville as at February 2009) that the aim had been to ‘build some sort of moderation zone north of Marysville’ and then build up ‘asset protection burns just to the west of the township’. He was not able to say how large the treated sites were or were intended to be. He acknowledged, however, that the analysis of the 2009 fires indicated that ‘those [prescribed] burns were largely overwhelmed by the force of the fire’.<sup>190</sup> He also indicated that part of the thinking behind the location of some burns near Marysville had been to try to pick places where ‘if a fire starts, you have a chance of that fire running into a burnt area’. He also acknowledged that the areas ‘do need to be larger’ and that the ‘thinking in the area was [to] get this broader landscape treated and get it treated more comprehensively in a strategic context’.<sup>191</sup> For example, he explained in evidence that the narrow fuel break that encircles the town of Marysville ought not be confused with an Asset Protection Zone or any sort of buffer aimed at protecting the residents. Rather, he said, the purpose of that fuel break was simply to provide opportunities for prescribed burning and, in some circumstances, back-burning or burning out.<sup>192</sup>

The Commission concluded from this evidence that there has clearly been insufficient prescribed burning in areas of high bushfire risk. It is also difficult to ascertain how an area has been determined to be an Asset Protection Zone or Strategic Wildfire Moderation Zone or how the zones’ placement interlinks in the protection of people. There are also deficiencies in the data available about the scale and age of completed prescribed burning.

### Fire management zones: the expert panel's views

Although the expert panel members felt there were strengths in the concept of the zone system, there was also recognition that it could be improved and that there were shortcomings in its application.

Dr Tolhurst described the present system as imperfect but as providing a 'good basis for discussion because the objective of what the zone is trying to achieve is clearly stated, and it then means that you are able to provide prescriptions and management objectives, operational objectives, that would help achieve that'.<sup>193</sup> Some panel members expressed the view that the zone system does not provide adequate guidance on how each zone should be treated to bring about effective reduction in risk, including the width or size of zones.<sup>194</sup> Professor Adams said a zone system was an 'explicit way of acknowledging the sorts of trade-offs' that may be required.<sup>195</sup>

Panel members highlighted concerns about the way in which the zone system has been applied. Dr Tolhurst said he was aware of locations where Wildfire Modification Zones had been selected on the basis that the level of treatment could be 'easily maintained', rather than as a result of a systematic analysis of the landscape in order to ascertain the best location of the zone for risk reduction.<sup>196</sup> Dr Clarke agreed that sometimes the applications of zones do not obviously reflect clear land management objectives.<sup>197</sup> Professor Bradstock stated that there are 'few quantitative insights that critically test whether typical zone configurations and associated rates of treatment provide an optimum reduction in risk'.<sup>198</sup>

The expert panel also had clear views about the expected characteristics of prescribed burning for the purpose of risk reduction. These views included the following:

- Mr Cheney explained what needs to be considered when selecting the location of a prescribed-burning block, and said:

The key to a burning program for wide scale protection is to have the blocks strategically located across the landscape in a pattern that, when repeated, large fires are going to sooner or later run into one of these low fuels and be checked and in the lighter fuels suppression of the fire in subsequent hours or days after the extreme weather will be made much easier and can be done more efficiently.<sup>199</sup>

- The panel was unanimous in its view that burning areas smaller than 500 or 1,000 hectares is 'usually of minimal value in reducing the scale of unplanned fires'.<sup>200</sup> Dr Tolhurst indicated that the reference in the panel's summary to burning areas 1,000 hectares in size was not 'just a random number': it is the 'sort of size we are thinking of would be needed to capture the majority of embers falling within three kilometres of a wildfire'. It is not just to achieve a target of so many hectares.<sup>201</sup> Professor Bradstock stated, '... bigger is better and if you are going to push ahead with a more vigorous approach to prescribed burning it is inexorable that you are going to have to achieve that by treating larger slabs of country'.<sup>202</sup>
- Mr Sneeuwjagt explained that, for prescribed burns to be effective as buffers, they should have minimum dimensions of area (greater than 1500 hectares), depth (greater than 3 kilometres) and width (greater than 3 kilometres). He said that small, narrow burns do not allow time 'for a wildfire to pull up'.<sup>203</sup>
- The expert panel's summary noted that ideally a prescribed burn should achieve a burn of 70–90 per cent of the area being subjected to the burn.<sup>204</sup> Dr Tolhurst noted that it should be no more than 90 per cent to allow recovery of the fauna and flora in that area afterwards.<sup>205</sup> Dr Clarke explained that 'patchily burning landscape at a percentage less than 70 per cent' allows animals to navigate through the burnt areas and have necessary cover or resources for recolonising the area after fire.<sup>206</sup>

The 'fuel hazard' is defined as the sum of the influences of bark hazard plus elevated fuel hazards plus surface fine fuel hazards. These can be quantitatively measured before and after burning, according to the technical guide called the *Overall Fuel Hazard Guide*. Measuring the bark and elevated fuels is important because these are the elements that are mainly responsible for first attack failure and also general suppression difficulty.<sup>207</sup>



The panel members advocated that the treated area be left with an overall fuel hazard of 'high' or less where the goal of prescribed burning is fuel reduction. The term 'high' comes from the guide.<sup>208</sup> Dr Tolhurst explained that in a foothill dry eucalypt forest a 'high' fuel level would be a situation where there are few embers able to be produced by the trees, the shrub layer would be minimal with a small component of dead material, and the amount of litter on the ground would be less than 25 millimetres deep and less than 8 tonnes a hectare.<sup>209</sup>

The Code of Practice refers to terms such as 'intense' treatment, but there is no guidance about fuel hazard levels. In contrast, in Western Australia the level of treatment for different forest fuels is explicit and expressed in terms of tonnes per hectare. Mr Sneeuwjagt explained that the approach in Western Australia is to aim to maintain fine surface fuel quantity below about 8 to 9 tonnes per hectare for jarrah forests and at 15 to 19 tonnes per hectare for karri forests over about 50 per cent of the forest area. As a result, during fuel-reduction burns the aim in the jarrah forests is to bring fuels down to about 2 tonnes a hectare and in karri forest the threshold is about 5 tonnes a hectare. He explained that a fuel-reduction burn would see the near-surface and surface fuels reduced and a burn of sufficient intensity to affect the bark up to 3 or 4 metres. He noted that bark removal is important 'when it comes to minimising ember attack or spotting'. In some parts of the treated area, he said, one would be looking to see some scorching but almost no defoliation.<sup>210</sup>

Mr Cheney confirmed that, if the fire protection objective in a particular area is to reduce the amount of bark on the trees, the treatment needs to be of higher intensity than in other areas since it will be necessary to take the fire into the upper parts of the tree.<sup>211</sup> Dr Tolhurst noted that one of the most 'enduring benefits' of prescribed burning is a reduction in bark hazard.<sup>212</sup>

Overall, the information elicited confirms the suitability and sense of designating Asset Protection Zones and Strategic Wildfire Moderation Zones in a manner that allows the two zones to work together and to be of sufficient depth to provide layers of protection to townships and other settlements. The Commission is, however, concerned that there is a lack of clear guidance to ensure that the location of burns, the size of the burns, the percentage burnt and the intensity of the burn effectively support the use of prescribed burning for adequate risk mitigation.

The Commission considers that the Code of Practice should be revised so that it provides sufficient explicit guidance about the recommended size of a treatment block and intensity of treatment for each fire management zone. The Code of Practice ought make explicit the following:

- Where the aim is to reduce risk from bushfire (principally in the Asset Protection Zone and the Strategic Wildfire Moderation Zone) prescribed burns should be between 500 and 1,000 hectares in size. Protection near towns may require very large areas for prescribed burning in order to significantly reduce the risk of bushfire.
- In the fire management zones where the aim is to reduce risk from bushfire, between 70 and 90 per cent of an area selected for a prescribed burn should be burned.
- In fire management zones where the aim is to reduce risk from bushfire, the residual fuel load should be brought down to 'high' within the meaning of the *Overall Fuel Hazard Guide*. When the aim is to protect human life, it is desirable to ensure highly flammable bark is removed during prescribed burning in order to reduce the risk of firebrands and spotting.
- The purpose of landscape mosaic burns is clarified and described in the Code of Practice, and understanding is developed about their interaction with biodiversity values.

#### RECOMMENDATION 59

The Department of Sustainability and Environment amend the Code of Practice for Fire Management on Public Land in order to achieve the following:

- provide a clear statement of objectives, expressed as measurable outcomes
- include an explicit risk-analysis model for more objective and transparent resolution of competing objectives, where human life is the highest priority
- specify the characteristics of fire management zones—including burn size, percentage area burnt within the prescribed burn, and residual fuel loading
- adopt the use of the term 'bushfire' rather than 'wildfire'.

In the light of the proposed changes to the Code of Practice the operational manuals and guides for DSE staff should also be revised with respect to the characteristics of fuel management zones.

### Fire Management Plans/Fire Operations Plans

The District Fire Management Plans and Fire Operations Plans are prepared by DSE at the fire district level and sit below the Code of Practice.

Fire management plans must have overarching fire management goals, objectives and strategies. They should include fire protection strategies for bushfire prevention and suppression, fire ecology strategies that outline ecological and cultural protection goals, and demonstrable links and alignment with municipal fire prevention plans. Draft fire management plans have to be made available for discussion at regional and municipal fire prevention committee meetings as part of community consultation. Following consultation, the plans are reviewed by senior managers before being approved by the Secretary of DSE.<sup>213</sup>

Fire operations plans contain the detail for implementation of the strategy enunciated in a fire management plan. They are prepared each year for each fire district and must be consistent with the applicable fire management plan. Proposed fire operations plans are made available in draft form for 28 days for public comment.<sup>214</sup> A fire operations plan must contain the following:

- a three-year forward program comprising a schedule and maps for fuel-reduction and ecological burns and any new preparedness works prescribed for the three-year period
- a detailed schedule of prevention and preparedness works prescribed for the immediate 12-month budget period.<sup>215</sup>

Fire operations plans are required to detail the 'priority areas selected for burning for fuel and ecological management purposes'.<sup>216</sup>

Mr Lawlor, explained that the development and implementation of fire operations plans requires 'ongoing management and communication with the relevant stakeholders'.<sup>217</sup> Steps are also taken to identify cultural sites, particularly sites of significance to Indigenous Australians, to ensure protection measures can be implemented. In Mr Lawlor's experience there was little community participation in the Ovens district in relation to prescribed burns before 7 February. Since the fires, however, there has been a significant increase in community interest in the program.<sup>218</sup> Dr Tolhurst said the public engagement process for developing fire management plans and annual operations plans is 'complex and time consuming' and could be significantly improved so that all parties can 'have a good appreciation of each other's perspective'.<sup>219</sup>

The underlying principles and approach of the fire operations plans are similar to those of the Wildfire Threat Analysis tool in Western Australia, where the community can have input into the proposed prevention activities occurring on public land.<sup>220</sup> Community consultation is valuable but should not degenerate into simply providing information to the community or become a conflict-resolution process. Developing ongoing community knowledge and participation needs more sophistication. The Commission is of the view that DSE, as the lead agency, needs to be a stronger advocate of an enhanced prescribed burning program with a stress on protecting human life and with sensitivity to biodiversity vulnerabilities.

The Commission considers that fire management plans and fire operations plans should reflect significant risk reduction by prescribed burning and other prevention activities, particularly for populations near forested areas.

## 7.5 FUEL BREAKS

A 'fuel break is any piece of land where fuel has been physically removed to create a gap in an area of uninterrupted fuel'.<sup>221</sup> The primary role of fuel breaks, which typically include roads and tracks, is to allow firefighters and equipment to be safely and rapidly deployed to control a fire. Mr Fogarty commented that the major uses of fuel breaks are during bushfire suppression, including doing back-burns or burning out, and also for prescribed burns. In extreme fire conditions fuel-break networks can enable quick access for rapid attack, provide an anchor point for firefighters engaged in suppression, and help restrict the lateral spread of the fire once the head fire becomes uncontrollable.<sup>222</sup>

Fuel-break location should be carefully selected and maintained to ensure that environmental and Indigenous cultural values are protected.<sup>223</sup> In terms of a road as a fuel break, roadside vegetation may be additionally reduced to widen the break already provided by the road, which also helps reduce the risk of fires starting.

The terms 'fuel break' and 'fire break' were used interchangeably in the evidence. DSE uses 'fuel break' as an umbrella term, although it differentiates definitions for fuel break, strategic fuel break, fire break and access road and track.<sup>224</sup> The Commission found the definitions DSE used confusing.

### 7.5.1 VICTORIA PLANNING PROVISIONS EXEMPTIONS

The fire protection exemption for the removal of native vegetation in clause 52.17-6 of the Victoria Planning Provisions prepared under the *Planning and Environment Act 1987* has two parts that specifically exempt fuel breaks from planning permit requirements. First, native vegetation can be removed, destroyed or lopped for firefighting measures, for periodic fuel-reduction burning, or for a fuel break or firefighting access track up to 6 metres wide. These can be constructed on public or private land, by a public authority or an individual.<sup>225</sup> Second, native vegetation can be removed, destroyed or lopped for fuel-break construction by or on behalf of a public authority in accordance with a strategic fuel-break plan approved by the Secretary of DSE. These fuel breaks can have a maximum width of 40 metres.<sup>226</sup>

In evidence before the Commission there appeared to be limited use of the first exemption for the 6-metre fuel break. Three council representatives, who gave evidence to the Commission in a panel format, indicated that the 6-metre fuel-break exemption does not appear to be actively used by Yarra Ranges Shire, Latrobe City Council and Colac Otway Shire, although there are some fuel breaks in Colac Otway Shire that have been in place for some years.<sup>227</sup> Mr Stephen Brown, Executive Director, Regional Services, Roads Corporation, said there are examples of VicRoads using the provision.<sup>228</sup> There was also one example of a lay witness, Mr Ray Maino, who had made use of this exemption as a private citizen.<sup>229</sup>

The Secretary of DSE approved plans for construction of fuel breaks by DSE, Parks Victoria and Melbourne Water to protect Melbourne's water catchments, based on the 'strategic fuelbreak plan' exemption of clause 52.17-6 of the Victoria Planning Provisions. Mr Fogarty said the water catchments were seen as 'being of high priority' and that new approaches were being modelled and trialled, based on initial work in 2007 in the Otway Ranges.<sup>230</sup> These forests are fire intolerant, and the occurrence of bushfire would damage water quality and yield in the short and long term.<sup>231</sup> When completed, this network of fuel breaks will extend 600 kilometres.

The Otways fuel breaks were designed to provide essential linkages across the landscape. They vary in width depending on location, forest type, expected fire behaviour and land management objectives, from 6 metres to greater than 20 metres with fuel-reduced zones on either side.<sup>232</sup> In this context the fuel breaks are really to enable rapid access by firefighters charged with protecting the state's water resources.

The fuel breaks were designed with environmental conservation in mind. Vegetation coverage is retained on the ground, and 30 per cent canopy cover from trees is retained to allow wildlife connection and shade. Although not required by the exemption, DSE provided offsets for native vegetation affected by the construction of the breaks. DSE referred to the Department of the Environment, Water, Heritage and the Arts with respect to compliance of intended works for fuel-break construction and asset-protection zones under the Environment Protection and Biodiversity Conservation Act. No assessment was required if the works were carried out as described in the referral.<sup>233</sup>

In 2009 the Victorian Government developed and funded the Melbourne Bushfire Protection Program Project, which builds on work already started for Melbourne's water catchments. This is a four-year project intended to deliver additional fire protection for Melbourne's urban interface areas, such as the Mornington Peninsula, the Dandenong Ranges, the Lower Yarra Valley and grassland reserves. Parks Victoria will lead the activities, which include planned construction of 100 kilometres of fuel breaks on public land.<sup>234</sup> The Commission supports ongoing fuel-break construction and maintenance to supplement the bushfire protection measures of townships, and it is pleased that threatened townships are being treated in the same manner as water catchments.

### 7.5.2 THE PRO FORMA OFFER

In January 2010 DSE prepared a pro forma agreement for use at the local level. This was to encourage councils to submit 'local strategic fuelbreak plans' for approval by the Secretary of DSE as part of fire protection works. Under these plans, vegetation offsets are required for fuel breaks located on public land, and fuel breaks wider than 20 metres are unlikely to be approved unless 'exceptional circumstances' can be demonstrated.<sup>235</sup>

At the time of the hearings only two councils had responded to DSE's offer, and both indicated they did not intend to submit these plans. It also appears that the Municipal Association of Victoria was not consulted before the offer being made to councils. Mr Robert Spence, Chief Executive Officer of MAV, said councils had concerns about the offsets requirement in the offer.<sup>236</sup>

The 20-metre restriction and the requirement for an offset imposed for the 'local strategic fuelbreak plans' is difficult to reconcile with the 40-metre fuel-break exemption without an offset requirement in clause 52.17-6 of the Victoria Planning Provisions. The differences between the regulations and local agreements for fuel-break widths appear arbitrary. The Commission considers that DSE should withdraw its 'offer' to councils in relation to proposed fuel breaks up to 20 metres wide and allow all public authorities to rely on the full scope of the exemption in relation to 40-metre fuel breaks in clause 52.17-6.

## 7.6 ROADSIDE CLEARING

The extreme conditions of 7 February meant that roadside fuels had minimal impact on fire spread.<sup>237</sup> The Commission heard evidence that on less severe days roadside fuels could contribute to fire behaviour, although it is unlikely they would have a major impact.<sup>238</sup> Nevertheless, a number of matters were raised in connection with roadside vegetation and clearing during the course of the Commission's work:

- the need to strike a balance between the complex and competing objectives of reducing bushfire risk and maintaining important environmental values
- the complexity of the current regulatory framework governing road management and roadside clearing, which involves various Victorian and Commonwealth Acts
- roadside clearing processes being resource intensive and the regulatory process being time consuming. This particularly affects councils, especially those in some regional areas. The objectives and obligations in various pieces of legislation that affect roadside clearing are also difficult for road managers to reconcile. There is an apparent emphasis on environmental protection rather than bushfire risk reduction
- roadside vegetation, particularly fallen trees, presenting a risk for firefighters and other emergency workers, who need access to roads to perform suppression activities, as well as residents seeking safety.

The Commission's recommendations in this area aim to redress the regulatory complexity in order to facilitate the process of roadside clearing and ease the administrative burden for road managers. Protection of human life is considered the highest priority, although the Commission is also mindful of the importance of environmental protection.



### 7.6.1 MANAGEMENT OF ROADS

Under Victoria's *Road Management Act 2004* responsibility for the management of roads is shared. Generally, VicRoads is responsible for rural freeways and arterial roads and councils are responsible for some local roads and some arterial roads within their municipality. DSE is responsible for roads on public land, including those in state forests and national parks. The objectives of the Act focus on safe and efficient road use, management of the road system and road users' rights.<sup>239</sup> They do not directly refer to bushfire risk reduction.

### 7.6.2 THE OBLIGATION TO REDUCE BUSHFIRE RISK

Section 43 of the *Country Fire Authority Act 1958* requires public authorities, councils and VicRoads to take all practicable steps to prevent and minimise fires, or the spread of fires, on land or roads under their control or management. It does not apply to roads on public land for which DSE has responsibility.<sup>240</sup>

Councils have tried to accommodate this obligation in close consultation with the CFA through municipal fire prevention plans, road management plans and roadside vegetation management plans. In contrast, VicRoads has adopted a minimalist approach, focusing on mowing or slashing roadside grass and deferring to CFA and DSE fire experts regarding other roadside risk management works. VicRoads has not developed its own comprehensive and proactive risk assessment program.<sup>241</sup>

Despite their obligations under the CFA Act, neither councils nor VicRoads appear to consider the bushfire risk posed by trees outside the regulated clearance space around power lines. Trees can cause fires by contacting power lines when they break or fall, as occurred with the Beechworth fire, for example. Such 'hazard trees' are discussed in Chapter 4.

### 7.6.3 THE OBLIGATION TO PROTECT THE ENVIRONMENT

#### The environmental importance of roadsides

In some parts of Victoria, particularly where there has been extensive clearing of land, roadsides might provide the only example of remnant native vegetation. Some flora and fauna species rely on roadside remnant native vegetation as habitat or to move across the landscape 'along the corridors', which are sometimes referred to as 'wildlife corridors'.<sup>242</sup>

Fallen logs and coarse woody debris on forest floors or along roadsides are particularly valuable remnant vegetation. They offer protection and shelter for animals, protect small plants from grazing and stormy weather and contribute to soil building as the debris breaks down. Fallen trees and branches can provide tree hollows, which are particularly important for some species, and generally take 100 to 150 years to develop.<sup>243</sup>

The Flora and Fauna Guarantee Act, the Environment Protection and Biodiversity Conservation Act, and the Victoria Planning Provisions under the Planning and Environment Act protect some native flora and fauna found along roadsides.

#### Commonwealth and state environment protection legislation

Before engaging in roadside clearing, road managers must consider the implications of the Commonwealth Environment Protection and Biodiversity Conservation Act and the Victorian Flora and Fauna Guarantee Act. These Acts have different processes to regulate activities that could affect native flora and fauna. The species protected under the Acts are also slightly different, and this adds to the complexity for road managers, although generally similar information is required for both processes.<sup>244</sup> The Environment Protection and Biodiversity Conservation Act includes exemptions for bushfire risk, but these are complex and do not sit well with road managers' obligations to manage bushfire risk.

Under s. 146 of the Environment Protection and Biodiversity Conservation Act the minister may assess the impacts of proposed actions under a policy, plan or program on matters of national environmental significance. This is known as a strategic assessment. Such an assessment provides greater certainty and reduces the administrative burden on road managers, who take action on an ongoing basis under a policy or plan.<sup>245</sup> The Commission considers that a strategic assessment should be sought in relation to roadside vegetation and bushfire risk in Victoria.

The State, DSE, the CFA, the Municipal Association of Victoria, and the Department of the Environment, Water, Heritage and the Arts will need to collaborate to facilitate this process. The Commission notes that in 2009 the State indicated it intended to repeal the Flora and Fauna Guarantee Act.<sup>246</sup> It encourages the State to ensure that any new legislation it introduces to protect native flora and fauna enables vegetation management for bushfire risk reduction.

### The Victoria Planning Provisions

Clause 52.17 of the Victoria Planning Provisions under the Planning and Environment Act aims to avoid or minimise, through planning and design, native vegetation removal and offset any native vegetation losses. Road managers require a permit to 'remove destroy or lop native vegetation' on roadsides unless one of the exemptions in clause 52.17-6 applies. The exemptions include grasses, dead vegetation, weeds, fire protection and public roads.<sup>247</sup> The exemptions are, however, complex and difficult to interpret. For example:

- The grasses exemption applies where the mowing or slashing is for 'maintenance only'. It appears to include maintenance undertaken for bushfire risk reduction, but this is not explicit.<sup>248</sup>
- Under the fire protection exemption DSE treats removal 'for firefighting measures' as restricted to urgent measures taken to control an active fire.<sup>249</sup> It does not provide scope for roadside fuel-reduction works undertaken in anticipation of a fire or to reduce bushfire risk.
- The public roads exemption covers activities to provide safe and efficient roads. DSE offered a pro forma agreement to VicRoads and councils covering all works within this exemption, with the process to be implemented by the road manager. Works under the agreement include 'fire prevention maintenance', but this phrase is broader in scope than the fire protection exemption in clause 52.17-6. A number of councils expressed reluctance to sign the agreement because of concerns about the onerous reporting and record-keeping obligations.<sup>250</sup>

In terms of effective fire risk reduction, these exemptions are overly complex and lack clarity, and this is of concern to the Commission. In relation to the exemptions in clause 52.17-6, Mr Spence said, 'I think the thing that's missing out of it is we've got road safety and we've got environment as strong influences for the direction of the policy, but fire prevention isn't strong enough'.<sup>251</sup>

The Commission considers the exemptions in clause 52.17-6 of the Victoria Planning Provisions particularly problematic. As currently drafted, the exemptions do not enable road managers to meet their bushfire risk-reduction obligations. The VPPs also fail to provide clear guidance for councils trying to balance their competing bushfire risk-reduction and environmental obligations. The Commission considers that the exemptions in clause 52.17-6 should be changed in order to achieve the following goals:

- reflect the bushfire risk-reduction obligations that s. 43 of the Country Fire Authority Act imposes on road managers
- meet community bushfire risk-reduction expectations
- simplify the task for road managers seeking to rely on the exemptions.

In the Commission's view it is possible to frame an exemption that achieves these objectives, along the following lines:

#### Exemption: Roadside fuel fire risk-reduction works

Work on roadsides by councils, VicRoads or the Department of Sustainability and Environment that is performed for the purpose of reducing fuel levels on roadsides, or for the purpose of reducing the risk of fires starting on or spreading from or along roadsides where such work is approved, be recommended or requested by a municipal fire prevention committee, a municipal fire management planning committee, a CFA brigade or DSE.

Notwithstanding the terms of any other provision of the planning scheme, no permit is required under any such other provision for the removal, destruction or lopping of vegetation, provided the removal, destruction or lopping is undertaken in accordance with this exemption.

**RECOMMENDATION 60**

The State amend the exemptions in clause 52.17-6 of the Victoria Planning Provisions to ensure that the provisions allow for a broad range of roadside works capable of reducing fire risk and provide specifically for a new exemption where the purpose of the works is to reduce bushfire risk.

**7.6.4 COMPLEXITY AND COMPETING OBJECTIVES**

The Municipal Association of Victoria's submission to the Commission highlighted the difficulties councils face in adhering to the different and competing obligations in the legislation just outlined. The submission stated that there is little legislative prescription or policy guidance for councils to assist them with resolving the competing tensions between fire protection and conservation of native vegetation.<sup>252</sup> The Commission considers the current processes cumbersome. In addition, the scope of activities does not fully account for bushfire risk reduction.

The regime constituted by the Country Fire Authority Act, clause 52.17 of the Victoria Planning Provisions, the Flora and Fauna Guarantee Act and the Environment Protection and Biodiversity Conservation Act is also likely to result in high administrative and compliance costs. The cost to councils of discharging their road management responsibilities is a significant burden, particularly on rural councils with a lower ratepayer base. It is essential that local government is adequately resourced to discharge its responsibilities in relation to roads and roadsides. This is discussed further in the next section.

**RECOMMENDATION 61**

The State and Commonwealth provide for municipal councils adequate guidance on resolving the competing tensions arising from the legislation affecting roadside clearing and, where necessary, amend environment protection legislation to facilitate annual bushfire-prevention activities by the appropriate agencies.

The State, working with DSE, the CFA and the Municipal Association of Victoria, should also adopt a collaborative approach and seek the most effective way to cover bushfire risk measures undertaken in Victoria, including the conduct of prescribed burning, construction of fuel breaks and roadside vegetation works whilst meeting environmental obligations.

**7.6.5 MANAGEMENT OF FIRE RISK BY COUNCILS**

Councils manage roadside bushfire risk by means of a number of instruments, including municipal fire prevention plans, road management plans, road vegetation management plans and local laws. MFPPs focus primarily on bushfire prevention and fire management, whereas RMPs and RVMPs cover overall policies for roads.<sup>253</sup> Mr Spence of the Municipal Association of Victoria and the panel of council representatives presented a large body of material to the Commission about roads and roadsides. It included information drawn from surveys that demonstrated great variation in how councils manage roads and roadsides, particularly for bushfire prevention.<sup>254</sup> A particular council's practice appears to depend on its rural and urban mix, approach to road safety maintenance, and commitment to fire prevention goals. A number of councils' MFPPs identify roads as 'strategic firebreaks' and usually specify that these roads receive wider slashing of grasses than other shire roads.<sup>255</sup>

The majority of councils have regard to the CFA Roadside Fire Management Guidelines 2001, either in the development of their MFPP or when resolving roadside vegetation problems. The Commission recommends in Chapter 4 that councils include in their MFPPs identification of hazard trees and coordination with entities responsible for removing such trees. Many power lines run alongside roads where councils and other road managers undertake bushfire risk reduction. This provides an opportunity to inform municipal fire prevention committees about hazard trees and notify entities responsible for responding to this risk.

### Competing objectives and limited resources

Councils are the road managers affected by the current roadside clearing regime. Mr Spence explained that local government carries heavy responsibilities for bushfire risk management in relation to land-use planning, municipal fire prevention, municipal emergency management and management of roads and roadsides. Councils currently manage 129,235 kilometres of roads, most of which fall within rural and regional municipalities covered by the CFA and in the areas of greatest bushfire risk. These municipalities are often where resources are scarce. Most of the councils in CFA areas of Victoria have long road networks, very dispersed populations, large areas of state park and the lowest revenue relative to metropolitan councils.<sup>256</sup>

The State should ensure that councils are adequately supported through funding, training and technical assistance to discharge their bushfire risk management functions in relation to roads and roadsides and the safe use of roads during bushfires.

### Community views

The council panel representatives told the Commission there had been ‘significant shift’ in people’s attitudes to roadsides since the January–February 2009 fires, which had resulted in a ‘significant increase in requests and awareness and activism’. For example, arborists in the Shire of Yarra Ranges had experienced a 160 per cent workload increase in the year following the fires. Further, council officers had received a 200 per cent increase in requests for roadside slashing.<sup>257</sup>

Residents were now calling for Latrobe City Council to ‘get as much stuff off the roadside as you possibly can’.<sup>258</sup> Mr Grant Jack, Manager, Asset Maintenance and Services, Yarra Ranges Shire, noted that since the fires council staff had been dealing with ‘very emotional people’ seeking works, while others were still asking that native vegetation not be touched.<sup>259</sup> Councils are no doubt engaged in a delicate balancing act in trying to meet their obligations under competing regulatory regimes and also satisfy the divergent interests of community sectors.

## 7.6.6 VICROADS AND MANAGEMENT OF FIRE RISK

### The 1985 Code of Practice

VicRoads manages about 80,000 hectares of roadside running along 22,300 kilometres of freeways and arterial roads. To meet its fire prevention obligations, VicRoads, in conjunction with the CFA, devised the VicRoads Code of Practice for Fire Prevention on Declared Roads Reserves in Rural Areas.<sup>260</sup> The code recites s. 43 of the CFA Act and notes that it (the code) is governed by a number of principles, among them the following:

[VicRoads] prefers the provision of fire control measures by slashing, mowing or ploughing rather than burning but accepts that, in some situations, burning may be the only practical means. [VicRoads] will normally construct fire breaks immediately behind the guideposts to minimise the spread of fire caused by road makers or users or vehicles.

It is important that, as far as possible, damage to trees, shrubs, grass and natural features of the landscape be avoided to preserve the appearance of the roadside and prevent erosion. The value of the roadside as a habitat area for wildlife is also considered.<sup>261</sup>

Significantly, the code gives primacy to fire prevention objectives.<sup>262</sup> It also requires protection and promotion of environmental values but makes it clear that the obligation to reduce bushfire risk prevails in the event of competing objectives. The code also contains valuable information and advice and should be reviewed to ensure that it is up to date and conforms to VicRoads’ obligations under s. 43 of the CFA Act.



### Roadside conservation management plans

VicRoads develops roadside conservation management plans (previously known as road management plans) based on the principles in the code. RCMPs are specific plans for a particular roadside that take into account VicRoads' broader roadside management objectives and local requirements. VicRoads prepares RCMPs for those road reserves with the most significant assets.<sup>263</sup> Overwhelmingly, these plans focus on protecting environmental values. It appears they have drifted from the clear fire prevention objectives expressed in the code. Further, VicRoads' RCMPs and RMPs do not demonstrate a risk assessment approach.

### VicRoads involvement in municipal fire planning

Mr Stephen Brown noted that some roadsides managed by VicRoads are included in MFPPs. VicRoads' representatives attend municipal fire prevention committee meetings when invited but are not members of the committee and do not routinely attend. This means they might not be in attendance when the committee raises municipal fire planning matters that relate to roadside works on VicRoads' freeways and arterial roads. VicRoads staff have minimal involvement in the development of MFPPs.<sup>264</sup> The Commission considers it desirable that VicRoads representatives participate in such committees—at least for those councils where VicRoads is responsible for substantial parts of the road network.

### Risk assessment and the use of contractors

VicRoads seeks to discharge its roadside fire prevention obligations using standard mowing and slashing contracts that require contractors to mow 3 metres behind the guideposts. Mr Brown stated that, as a general rule, VicRoads defers to the CFA, DSE or the relevant municipal fire prevention committee for any other treatments required to reduce roadside fire hazards from trees. The Commission also heard that VicRoads' mowing and slashing contracts are not always adhered to.<sup>265</sup> The Commission considers that VicRoads should review its standard contracts for mowing and slashing grasses and determine whether additional works to reduce bushfire risk are required (including in relation to shrubs and trees with flammable bark). VicRoads should also ensure that contractors engaged for this purpose meet their contractual obligations.

The Commission is concerned that VicRoads does not carry out any systematic roadside bushfire risk assessment. It appears not to have considered whether particular stretches of road carry increased fire risks and require different or additional treatments, but it 'would take advice from fire experts'.<sup>266</sup> It has also been suggested to the Commission that the trigger for seeking such expert advice is public complaint. The evidence suggested that VicRoads has adopted an inconsistent approach from year to year and for different sections of the Hume freeway.<sup>267</sup> This should be dealt with as a priority.

#### RECOMMENDATION 62

VicRoads implement a systematic statewide program of bushfire risk assessment for all roads for which it is responsible, to ensure conformity with the obligations in s. 43 of the *Country Fire Authority Act 1958* and with the objectives expressed in the VicRoads 1985 Code of Practice.

Such a program should demonstrate a commitment to reducing the fire risk posed by roadside vegetation. It should also entail a review of the content of VicRoads' road management plans and roadside conservation management plans.

### 7.6.7 THE CFA AND ROADSIDE WORKS

Under s. 42 of the Country Fire Authority Act, CFA brigades are empowered but not obliged to engage in roadside fuel-reduction works, including prescribed burning. These works must be carried out with the consent of, or at the request of, the road manager. If the road manager requests the works it is obliged to pay the CFA for the work carried out.

Mr Leonard Leslie, a CFA Fire Planning Coordinator, explained that the CFA generally does roadside works at its own expense (often through the use of its volunteers) and rarely enforces the payment provisions in the Country Fire Authority Act. Usually there is no formal 'request' for the works, which are often prompted 'from the field'.<sup>268</sup> The Commission commends the CFA for devoting considerable resources, including volunteer time, to roadside works, despite not being principally responsible for roadsides under the Act.

The CFA's 2001 guidelines, although not formally in force, continue to influence the CFA's policy and its performance of bushfire prevention works, including on roadsides. In relation to roadside fuel management, the guidelines contain useful scientific and practical guidance that supports VicRoads' and councils' approaches to roadside works. This includes the standard 3-metre slashing as a 'fuel free area' and cutting grass to a maximum height of 10 centimetres.<sup>269</sup>

Since 2005 the CFA has altered its ad hoc roadside bushfire risk-reduction practices in response to legislative changes. It has tried to develop a comprehensive and uniform approach to fire management on roadsides. Mr Leslie explained that the CFA has spent significant funds and relied on volunteers' expertise and time to do this.<sup>270</sup>

The Commission acknowledges Mr Leslie's assertion that the process for approval of roadside vegetation works is 'complex, time consuming and costly for the CFA. Clear, transparent and accountable arrangements, supported by appropriate public compliance reporting against responsibilities, are needed to facilitate roadside vegetation management work'.<sup>271</sup> The CFA is canvassing initiatives to streamline roadside vegetation management and hopes to use DSE's biodiversity data in the early stages of planning roadside works to identify biodiversity concerns.<sup>272</sup>

Another burden on CFA resources is the need to pay external contractors to provide traffic management training to CFA staff and volunteers. Traffic management is required during bushfire risk-reduction works. Mr Leslie said the CFA would like to investigate ways of alleviating this burden, with traffic management services being provided by VicRoads or some other road authority.<sup>273</sup>

The Commission considers that CFA volunteers should be suitably supported to allow them to focus on core bushfire risk-reduction works along roadsides. The State should ensure that the CFA is satisfied that its volunteers are appropriately deployed when carrying out bushfire-related works and not completing administration or traffic management responsibilities on behalf of others. VicRoads could consider an annual contribution recognising the important work done by the CFA; alternatively, other emergency services could provide traffic management support.

#### 7.6.8 ROAD SAFETY DURING FIRES

A number of public submissions raised the question of safe road use during fires. This affects members of the community seeking to escape fires as well as emergency services trying to obtain access. The Commission heard from Mr Chris Petreis evidence about his frightening escape along a virtually impassable section of Coombs Road, Kinglake West, a road on which six residents died.<sup>274</sup> There were a number of other instances during the late January and February 2009 fires when residents and emergency services workers experienced difficulties with safe road use. Mr Roger Strickland, a CFA Fire Investigator, said, '... falling trees during and after fires is probably one of the biggest hazards that firefighters face'.<sup>275</sup> He also provided several examples where access or safety concerns arising from fallen or unstable trees compromised firefighters' capacity to suppress fires safely.<sup>276</sup>

The Commission acknowledges that individuals' capacity to escape from a fire or a fire-affected area and firefighters' capacity to render assistance and engage in suppression are compromised if roads are impassable, poorly maintained or blocked by fallen trees. Tackling this problem calls for a cooperative and collaborative approach.

### Box 7.1 Township Protection Plan—Essential Access and Egress Roads

Since February 2009 VicRoads, the Municipal Association of Victoria, DSE and the CFA have developed the Township Protection Plan—Essential Access and Egress Roads. The initial aim was to analyse the first 52 towns to be provided with township protection plans. The roads of these towns have been assessed to determine which locations have only 'one road in and one road out, and are therefore particularly vulnerable. For each town the project considered the applicable township protection plan, whether the town had a 'neighbourhood safer place' and its risk and road access generally.<sup>277</sup>

By February 2010 the project had identified 15 high-risk roads requiring urgent critical works, including removing dangerous trees and built-up debris. The aim is to make the 'one road out' safe and to carry out fuel reduction. To expedite action, DSE issued a general permit under the Flora and Fauna Guarantee Act to the CFA, to enable it to undertake the crucial works, and offered councils an agreement providing them an exemption under clause 52.17 of the Victoria Planning Provisions.<sup>278</sup>

The project has been very successful in meeting the needs of towns in high-risk areas and with limited road access. The Commission commends the parties for their swift and cooperative approach.

#### 7.6.9 ROADSIDE VEGETATION AND FIRE BEHAVIOUR

The evidence suggests that if conditions had been less severe on 7 February roadside vegetation is likely to have affected fire behaviour more significantly.<sup>279</sup> For that reason the management of roadside vegetation to reduce fire intensity remains important. In particular, reduction of flame height (that is, by slashing or mowing grass) will be an important feature in reducing fire intensity and radiant heat, both of which assist suppression efforts.<sup>280</sup>

Mr Strickland provided a detailed report and expert advice about nominated locations where roads and roadsides might have been relevant to the late January and February 2009 fires. He reviewed fire investigation reports, fire progression reports, maps and photographs of locations and the witness statements of fire investigators, interviewed eyewitnesses and conducted field investigations. Significantly, he did not find any instance where roadside vegetation changed the overall shape or forward rate of spread of a fire. He noted, however, that there were some instances where roadside vegetation contributed to the spread, speed or intensity of a fire on 7 February. This usually involved the roadside vegetation burning more intensely than surrounding fuels and a contribution only to lateral, not forward, spread.<sup>281</sup>

Mr Strickland's evidence suggested that in some limited instances roadside vegetation:

- caused a temporary or localised change in fire behaviour by increasing flame height or spotting, which might appear to increase the fire's rate of spread near the roadside. Roadside vegetation might have precipitated, 'a shower of embers across the road, allowing the fire to spread across the road and perhaps even giving the fire a momentary increased rate of spread by virtue of that spotting'<sup>282</sup>
- may have caused the fires to move faster than in surrounding pasture because the roadside vegetation was a heavier fuel load and was in more continuous form than the surrounding vegetation<sup>283</sup>
- caused increased lateral spread of the fire for a period. He also found examples where roadside vegetation retarded fire spread or speed or acted as a wind break. O'Gradys Road in Kilmore East appeared to have acted as a fuel break by providing a wind break. During the Bunyip fire the positioning of a run of oak trees on Labertouche North Road provided a wind break and also acted as a 'water jacket' radiation barrier because of the high moisture content of the oak leaves.<sup>284</sup>

In relation to the suggestion in public submissions that roadside vegetation acted as a 'fuse' or 'wick' along certain roads, Mr Strickland made a number of observations:

- Roadside vegetation itself did not contribute substantially to fire spread where the fire crossed the road.<sup>285</sup>
- Higher intensity fires on some roadsides were due to more fine fuels along the roadsides than in the adjacent pastures (particularly where the pastures were eaten out), resulting in the fire moving in uneven tongues, which may have given the perception of a fuse effect.<sup>286</sup>

- Roadside vegetation contributed to forward fire spread by increasing flame height and spotting but did not contribute to lateral fire spread.<sup>287</sup>
- The presence of trees on the southern side of the road increased spotting distance and assisted the spread of the Coleraine fire on the Glenelg Highway.<sup>288</sup>
- Aspects of the roads other than vegetation contributed to fire spread—for example, the position of a road in a gully system, the presence of a ridge throwing massive firebrands showering down on the road, and spotting from nearby plantation fuels creating a ‘surge forwards’ like a fireball just before the fire crossed the highway.<sup>289</sup>

Mr Fogarty also considered roads relevant to the fires for which DSE was the control agency. He concluded that roadside vegetation was ‘largely inconsequential with fires of the intensity of 7 February’.<sup>290</sup> He agreed in evidence with the opinions expressed by Mr Strickland and confirmed that, although he had found some localised contribution or change in fire behaviour, he had not found any example of roadside vegetation affecting overall fire spread.<sup>291</sup>

Mr Strickland said that had the fire conditions had been less severe the fuel on roadsides would have played a ‘greater role’.<sup>292</sup> Mr Fogarty also said that in less severe conditions roadside vegetation ‘could’ have an impact, although it was unlikely to be ‘major’ given the localised nature of the impact of such fuels.<sup>293</sup>

#### 7.6.10 FIREWOOD

Public submissions suggested that allowing people to collect more firewood from roadsides could assist in fuel reduction and consequently diminish bushfire risk. The Commission also heard that fallen logs and tree hollows can provide an important native habitat for some species and that roadside vegetation can contain highly significant remnant ecological values and can act as wildlife corridors.<sup>294</sup> It explored the role of firewood during the hearings. Mr Lee Miezi, Director of Forests, Forests and Parks Division, DSE, said DSE’s research showed that firewood collected on roadsides tended to be larger than 10 centimetres in diameter. He explained that fire behaviour is primarily determined by the fine fuels that are less than 6 millimetres in size, so removing firewood or ‘coarse woody debris’ does not significantly affect rate of spread or flame height.<sup>295</sup> This was confirmed by Mr Strickland, who said heavy logs do not usually ‘carry’ fire. They might impede suppression and mopping up because they tend to smoulder, but they do not contribute to fire behaviour in the same way as fine fuels, which ignite quickly.<sup>296</sup>

All forest produce in Victoria is the property of the Crown. There is no freestanding public entitlement to take firewood from state forests, from other public land or from roadsides.<sup>297</sup> Before the late January and February 2009 fires firewood could be collected from public land and roads managed by DSE only under a domestic firewood permit issued by the Secretary of DSE.<sup>298</sup> In September 2009 the State announced a new firewood policy, relaxing the requirements for members of the public wanting to take firewood from roadsides. The new policy allows people to remove firewood from certain roadsides without a permit during ‘firewood collection periods’. The periods are advertised in local papers and occur in the two weeks before prescribed burning takes place. The public must still obtain permits to collect firewood outside the advertised periods.<sup>299</sup>

The Commission considers the introduction of new measures permitting firewood removal from roadsides earmarked for prescribed burning a pragmatic step aimed at promoting efficient public use of firewood fuel, while making a small contribution to reducing fuel loads on roadside vegetation.

1 Tolhurst T15175:2–T15175:18

2 Exhibit 716 – Supplementary Statement of Fogarty (WIT.3024.005.0143) [6]–[7]

3 Exhibit 801 – Clarification of Clarke Report (EXP.016.002.0001) at 0001; Exhibit 738 – Williams Report, Part B (EXP.014.001.0021) at 0021

4 Exhibit 746 – Statement of Brown (WIT.3027.001.0070) [16]–[18]; Exhibit 748 – Statement of Leslie (WIT.3004.028.0001) [30], [42], Annexure 4 (WIT.3004.028.0086); Brown T15544:23–T15545:4

5 Mitchell T15648:20–T15649:9

6 Exhibit 759 – Statement of Strickland (WIT.3004.034.0025) [1], [3], [9]–[12], [16.4], [21]–[24]; Exhibit 761 – Statement of Fogarty (WIT.3024.004.0331) [34], [37]–[43]; Strickland T15773:1–T15774:10

7 Exhibit 754 – Statement of Spence, Attachment 4 (WIT.4014.001.0037) at 0038

8 Exhibit 745 – Statement of Liddle (WIT.3027.001.0001) [21]; Exhibit 154 – General Submission by Local Government in Victoria (SUBM.002.040.0002) at 0090



- 9 Exhibit 739 – Fuel Management Topic – Facilitated Expert Conference, Expert Panel Summary (TEN.227.001.0001). Additional comment supplied by Dr Michael Clarke dated 28 February 2010: Exhibit 801 – Clarification of Clarke Report (EXP.016.002.0001)
- 10 Exhibit 734 – Cheney Report (EXP.017.001.0001) at 0003
- 11 Exhibit 737 – Tolhurst Report (EXP.013.001.0001) at 0002; Dr Tolhurst stated that whilst humans can control fuel, the other sources of energy and their contribution to fire should not be underestimated, for example weather: Exhibit 720 – DSE Code of Practice For Fire Management on Public Land (DSE.HDD.0012.1267) at 1326
- 12 Exhibit 1002 – Australian Emergency Management Glossary (TEN.316.001.0001) at 0101
- 13 Exhibit 720 – DSE Code of Practice For Fire Management on Public Land (DSE.HDD.0012.1267) [183]
- 14 Exhibit 734 – Cheney Report (EXP.017.001.0001) at 0006; Exhibit 721 – Supplementary Statement of Lawlor (WIT.3024.005.0199) at 0207; Cheney T15164:21–T15164:23; Williams T15165:12–T15165:16; Adams T15167:3–T15167:10
- 15 Exhibit 735 – Clarke Report (EXP.016.001.0002) at 0010
- 16 Exhibit 737 – Tolhurst Report (EXP.013.001.0001) at 0029
- 17 Exhibit 722 – McCaw Report (EXP.026.001.0001) at 0004; Clarke T15169:5–T15169:7
- 18 Exhibit 720 – A Review of Prescribed Burning Effectiveness in Hazard Reduction (TEN.223.001.0001) at 0008
- 19 Exhibit 737 – Tolhurst Report (EXP.013.001.0001) at 0014; Exhibit 735 – Clarke Report (EXP.016.001.0002) at 0006
- 20 McCarthy and Tolhurst (2001), *Effectiveness of broadscale fuel reduction burning*, cited in Exhibit 737 – Tolhurst Report (EXP.013.001.0001) at 0006–0007, 0014–0019
- 21 Exhibit 737 – Tolhurst Report (EXP.013.001.0001) at 0006–0009
- 22 Tolhurst T15172:1–T15173:5
- 23 Sneeuwjagt T14974:25–T14974:30
- 24 Tolhurst T15172:4–T15173:5; Sneeuwjagt T14974:21–T14975:21; Cheney T15164:28–T15165:1
- 25 Exhibit 725 – Statement of Sneeuwjagt (WIT.135.001.0001\_R) [90]–[99]
- 26 Exhibit 725 – Statement of Sneeuwjagt, Attachment 4 (WIT.135.001.0099) at 0107
- 27 McCaw, Gould and Cheney (2008), *Quantifying the effectiveness of fuel management in modifying wildfire behaviour*, cited in Exhibit 725 – Statement of Sneeuwjagt (WIT.135.001.0001\_R) [105]
- 28 Exhibit 716 – Supplementary Statement of Fogarty, Annexure 7 (DSE.0179.1449.0001) at 0004–0005
- 29 Exhibit 716 – Supplementary Statement of Fogarty, Annexure 7 (DSE.0179.1449.0001) at 0005–0006
- 30 Exhibit 720 – Long-Term Impacts of Prescribed Burning on Regional Extent and Incidence of Wildfires (TEN.175.001.0002) at 0002, 0010
- 31 Exhibit 733 – Bradstock Report (EXP.012.001.0001) at 0015–0019, 0031–0032; Bradstock T15187:17–T15187:29
- 32 Exhibit 736 – Gill Report, Part B: Issues (EXP.015.001.0016) at 0036–0037; Exhibit 737 – Tolhurst Report (EXP.013.001.0001) at 0023–0024; Exhibit 720 – A Review of Prescribed Burning Effectiveness in Hazard Reduction (TEN.223.001.0001) at 0003
- 33 Tolhurst T15167:12–T15168:8
- 34 Exhibit 722 – McCaw Report (EXP.026.001.0001); Exhibit 723 – Bradstock and Price Report (EXP.025.001.0001); Bradstock T14950:11–T14950:17, T14951:24–T14952:6
- 35 Exhibit 723 – Bradstock and Price Report (EXP.025.001.0001) at 0003–0005; Bradstock T14924:13–T14924:23, T14926:4–T14926:7
- 36 Exhibit 723 – Bradstock and Price Report (EXP.025.001.0001) at 0017–0018; Bradstock T14945:3–T14945:31
- 37 Exhibit 723 – Bradstock and Price Report (EXP.025.001.0001) at 0014, 0018; Bradstock T14946:9–T14947:23, T15165:17–T15166:1
- 38 Exhibit 723 – Bradstock and Price Report (EXP.025.001.0001) at 0018; McCaw T14912:22–T14913:3
- 39 Exhibit 723 – Bradstock and Price Report (EXP.025.001.0001) at 0015; Bradstock T14939:3–T14939:24, T14940:3–T14940:25
- 40 Exhibit 723 – Bradstock and Price Report (EXP.025.001.0001) at 0017–0018; Bradstock T14941:19–T14942:18
- 41 Exhibit 722 – McCaw Report (EXP.026.001.0001) at 0008–0009; McCaw T14887:30–T14889:2, T14885:26–T14886:1, T14910:23–T14911:7
- 42 Exhibit 740 – Beechworth Hypothetical (EXH.740.0001) at 0001–0011; Tolhurst T15339:4–T15340:15
- 43 Tolhurst T15341:30–T15342:10
- 44 Exhibit 723 – Bradstock and Price Report (EXP.025.001.0001) at 0015; Bradstock T14939:2–T14939:24, T14940:3–T14940:25
- 45 Cheney T15164:21–T15164:24, T15171:24–T15171:31; Williams T15165:12–T15165:16; Adams T15167:3–T15167:10
- 46 Tolhurst T15162:2–T15162:13
- 47 Exhibit 733 – Bradstock Report (EXP.012.001.0001) at 0020; Adams T15161:27–T15161:30
- 48 Cheney T15164:3–T15165:1; Bradstock T15177:22–T15178:11
- 49 Exhibit 716 – Supplementary Statement of Fogarty (WIT.3024.005.0143) [7]; Tolhurst T15210:4–T15210:17; Cheney T15211:12–T15211:25
- 50 Exhibit 725 – Statement of Sneeuwjagt (WIT.135.001.0001\_R) [71]
- 51 Exhibit 725 – Statement of Sneeuwjagt (WIT.135.001.0001\_R) [16], [28], [30]
- 52 Exhibit 725 – Statement of Sneeuwjagt (WIT.135.001.0001\_R) [25], [36]–[39], [71]; Sneeuwjagt T14976:13–T14976:18
- 53 Exhibit 725 – Statement of Sneeuwjagt (WIT.135.001.0001\_R) [50], [86]–[88]
- 54 Exhibit 725 – Statement of Sneeuwjagt (WIT.135.001.0001\_R) [66]; Sneeuwjagt T14982:5–T14982:13, T14969:29–T14969:31

- 55 Cheney T15362:22–T15363:3
- 56 Sneeuwjagt T14971:29–T14972:26, T14974:25–T14974:30, T14989:21–T14990:6
- 57 Sneeuwjagt T14970:31–T14971:11
- 58 Exhibit 725 – Statement of Sneeuwjagt (WIT.135.001.0001\_R) [89]
- 59 Gill T15287:16–T15287:21; Tolhurst T15288:9–T15288:11
- 60 Bradstock T15350:9–T15350:24
- 61 Cheney T15348:25–T15349:16
- 62 Tolhurst T15346:27–T15346:31, T15353:16–T15353:23
- 63 Adams T15352:1–T15352:10
- 64 Williams T15352:18–T15352:27
- 65 Exhibit 738 – Williams Report (EXP.014.001.0001)
- 66 Exhibit 738 – Williams Report (EXP.014.001.0001) at 0001; Williams T15387:16–T15387:20
- 67 Williams T15389:3–T15389:19
- 68 Pyne T18438:4–T18439:8
- 69 Exhibit 738 – Williams Report (EXP.014.001.0001) at 0006–0007; Williams T15395:12–T15396:11
- 70 Williams T15403:5–T15403:10
- 71 Exhibit 738 – Williams Report (EXP.014.001.0001) at 0009; Williams T15391:28–T15392:7
- 72 Williams T15392:23–T15393:4, T15396:1–T15396:11
- 73 Williams T15412:28–T15413:3
- 74 Exhibit 738 – Williams Report (EXP.014.001.0001) at 0012
- 75 Exhibit 738 – Williams Report (EXP.014.001.0001) at 0013; Williams T15352:11–T15352:13, T15385:23–T15386:3, T15404:9–T15405:23
- 76 Sneeuwjagt T15018:7–T15018:19; Williams T15416:27–T15417:16
- 77 Exhibit 698 – Further Statement of Rogers (WIT.132.001.0001) at 0003–0004
- 78 Exhibit 716 – Supplementary Statement of Fogarty (WIT.3024.005.0143) [6]; Exhibit 739 – Fuel Management Topic – Facilitated Expert Conference, Expert Panel Summary (TEN.227.001.0001) at 0003; Submissions of the State of Victoria – Planned Burning (RESP.3000.006.0060) [29]; Fogarty T14747:8–T14748:2
- 79 Exhibit 794 – Ecological Burning in Box Ironbark Forests – Literature Review (DSE.HDD.0021.1896) at 1904, 1911
- 80 Exhibit 716 – Supplementary Statement of Fogarty (WIT.3024.005.0143) [9]; Exhibit 720 – ENRC Report (TEN.090.001.0001) at 0068
- 81 Exhibit 720 – Submissions of Forest Fire Victoria (SUBM.002.026.0002\_R) at 0008\_R
- 82 Exhibit 795 – Rawson Report (DSE.HDD.0021.0325) at 0328
- 83 Exhibit 795 – Rawson Report (DSE.HDD.0021.0325) at 0328
- 84 Exhibit 81 – 1939 Victorian Bushfires Royal Commission Report (TEN.028.001.0001) at 0015
- 85 Exhibit 720 – 2002–03 Victorian Bushfires Inquiry Report (INF.018.002.0001) [11.71]–[11.72]
- 86 Exhibit 716 – Supplementary Statement of Fogarty (WIT.3024.005.0143) [88]
- 87 Exhibit 720 – Fire Prevention and Preparedness (TEN.216.001.0001) at 0059
- 88 Exhibit 720 – Fire Prevention and Preparedness (TEN.216.001.0001) at 0059, recognising that a number of forest types for technical and ecological reasons cannot be fuel reduced using prescribed fire
- 89 Wilson T15073:12–T15074:5
- 90 Fogarty T14747:19–T14748:2
- 91 Exhibit 720 – Fire Prevention and Preparedness (TEN.216.001.0001) at 0013
- 92 Exhibit 720 – ENRC Report (TEN.090.001.0001) at 0125, 0131, 0134, 0137, 0139–0140, 0144
- 93 Exhibit 720 – ENRC Report (TEN.090.001.0001) at 0131
- 94 Exhibit 729 – Statement of Wilson (WIT.3024.005.0265) [6]
- 95 Exhibit 720 – ENRC Report (TEN.090.001.0001) at 0133; Fogarty T14740:23–T14741:9
- 96 Exhibit 720 – ENRC Report (TEN.090.001.0001) at 0144
- 97 Exhibit 734 – Cheney Report (EXP.017.001.0001) at 0017; Exhibit 732 – Adams Report (EXP.018.001.0002) [7]
- 98 Williamson T4428:1–T4428:14
- 99 Woods T11448:22–T11448:25
- 100 Exhibit 679 – Statement of Gilmore, Attachment 89 (WIT.3018.001.1559) at 1562, 1565, 1573
- 101 Exhibit 716 – Supplementary Statement of Fogarty (WIT.3024.005.0143) at 0147
- 102 Exhibit 11 – Statement of Esplin, Attachment 12 (WIT.005.001.1393) at 1396, 1447
- 103 Exhibit 734 – Cheney Report (EXP.017.001.0001) at 0013; Exhibit 732 – Adams Report (EXP.018.001.0002) at 0005–0006
- 104 Exhibit 721 – Supplementary Statement of Lawlor (WIT.3024.005.0199) [21]–[24]

- 105 Exhibit 716 – Supplementary Statement of Fogarty (WIT.3024.005.0143) [34]
- 106 Exhibit 721 – Supplementary Statement of Lawlor (WIT.3024.005.0199) [14]–[16], [39], [48]; Exhibit 719 – Supplementary Statement of Tainsh (WIT.3024.005.0182) [11]–[12]; Exhibit 716 – Supplementary Statement of Fogarty (WIT.3024.005.0143) [89]; Lawlor T14857:28–T14858:4
- 107 Exhibit 720 – 2002–03 Victorian Bushfires Inquiry Report (INF.018.002.0001) at 0020
- 108 Exhibit 720 – Fire Management Manual 10.1 – Prescribed Burning (DSE.HDD.0021.0340) at 0368–0386, 0418–0420, 0434–0438; Exhibit 719 – Supplementary Statement of Tainsh (WIT.3024.005.0182) [35], [42]–[49]
- 109 Exhibit 720 – Fire Management Manual 10.1 – Prescribed Burning (DSE.HDD.0021.0340) at 0450; Exhibit 721 – Supplementary Statement of Lawlor (WIT.3024.005.0199) [43]
- 110 Exhibit 721 – Supplementary Statement of Lawlor (WIT.3024.005.0199) [54]
- 111 Exhibit 730 – Statement of Harris, Annexure 2 (WIT.006.001.0012) at 0016; Exhibit 716 – Supplementary Statement of Fogarty, Annexure 1 (DSE.HDD.0082.0955) at 0958
- 112 Exhibit 716 – Supplementary Statement of Fogarty, Annexure 4 (WIT.002.001.0137)
- 113 Exhibit 730 – Statement of Harris (WIT.006.001.0001) [12]–[13]
- 114 Exhibit 716 – Supplementary Statement of Fogarty, Annexure 4 (WIT.002.001.0137) at 0140, 0147; Exhibit 730 – Statement of Harris, Annexure 2 (WIT.006.001.0012) at 0016
- 115 Exhibit 730 – Statement of Harris, Annexure 2 (WIT.006.001.0012) at 0016
- 116 Exhibit 730 – Statement of Harris, Annexure 2 (WIT.006.001.0012) at 0016
- 117 Wilson T15074:6–T15074:18
- 118 Wilson T15075:19–T15076:16
- 119 Wilson T15081:7–T15081:9
- 120 Exhibit 716 – Supplementary Statement of Fogarty (WIT.3024.005.0143) [17]
- 121 Fogarty T14747:8–T14748:2
- 122 Exhibit 716 – Supplementary Statement of Fogarty, Annexure 1 (DSE.HDD.0082.0955) at 0958
- 123 Exhibit 729 – Statement of Wilson (WIT.3024.005.0265) [8]; Wilson T15068:20–T15069:2
- 124 Fogarty T14740:19–T14740:22
- 125 Fogarty T14748:17–T14748:26
- 126 Submissions of the State of Victoria – Planned Burning (RESP.3000.006.0060) [29]
- 127 Exhibit 739 – Fuel Management Topic – Facilitated Expert Conference, Expert Panel Summary (TEN.227.001.0001) [11], [13]–[14]; Bradstock T15195:18–T15195:24, T15217:19–T15217:27
- 128 Exhibit 801 – Clarification of Clarke Report (EXP.016.002.0001); Tolhurst T15249:6–T15249:18
- 129 Tolhurst T15246:21–T15247:3; Adams T15250:19–T15251:7
- 130 Cheney T15250:8–T15250:16
- 131 Bradstock T15249:23–T15249:27
- 132 Exhibit 739 – Fuel Management Topic – Facilitated Expert Conference, Expert Panel Summary (TEN.227.001.0001) [10]
- 133 Exhibit 739 – Fuel Management Topic – Facilitated Expert Conference, Expert Panel Summary (TEN.227.001.0001) [12]
- 134 Exhibit 742 – Statement of Marty (WIT.7537.001.0001) [129(b)]
- 135 Marty T15465:12–T15465:15
- 136 Exhibit 742 – Statement of Marty (WIT.7537.001.0001) [129]
- 137 Mr Hodgson's very extensive experience in the fields of forestry and fire management is set out at Hodgson T15040:23–T15044:15. His previous roles include Chief of the Division of Forest Management with the Forests Commission, 1977 to 1983; Commissioner of Forests, 1983 to 1984, and Chief Fire Officer with what became the Department of Conservation Forests and Lands between 1984 and 1987. He is a member of Forest Fire Victoria Inc., a group that describes itself as comprising 'like-minded and concerned practitioners and scientists'. The members of Forest Fire Inc. include other former fire officers, board members, scientists, forest ecologists, authors in the field and persons involved in the forestry industry, among them Ron Incoll, Phil Cheney, David Packham, Bob Graham, Peter Attiwill, Bill Middleton, Tony Manderson, Kevin Wareling and Brian Gibson: Exhibit 720 – Submissions of Forest Fire Victoria (SUBM.002.026.0002\_R) at 0002\_R–0003\_R
- 138 Exhibit 720 – Forest Fire Victoria Inc Policy on Increased Fuel Reduction Burning and Ecological Burns (TEN.185.001.0001)
- 139 Exhibit 720 – Forest Fire Victoria Inc Policy on Increased Fuel Reduction Burning and Ecological Burns (TEN.185.001.0001)
- 140 Exhibit 727 – Statement of Melhem (WIT.7535.001.0001) [11], [14]
- 141 Exhibit 739 – Fuel Management Topic – Facilitated Expert Conference, Expert Panel Summary (TEN.227.001.0001) [20]; Adams T15199:16–T15199:24; Tolhurst T15200:6–T15200:11
- 142 Exhibit 733 – Bradstock Report (EXP.012.001.0001) at 0019
- 143 Wilson T15125:1–T15125:23
- 144 Exhibit 720 – DSE Code of Practice for Fire Management on Public Land (DSE.HDD.0012.1267) [231], [543]
- 145 Exhibit 725 – Statement of Sneeuwjagt (WIT.135.001.0001\_R) [49]
- 146 Exhibit 737 – Tolhurst Report (EXP.013.001.0001) at 0029; Exhibit 735 – Clarke Report (EXP.016.001.0002) at 0010, 0018
- 147 Exhibit 720 – Fire Ecology Program Strategic Directions 2009–2011 (DSE.USB9.0050.0163) at 0164

- 148 Exhibit 720 – Fire Ecology Program Strategic Directions 2009–2011 (DSE.USB9.0050.0163) at 0165
- 149 Exhibit 720 – Fire Ecology Program Strategic Directions 2009–2011 (DSE.USB9.0050.0163) at 0166–0169
- 150 Wilson T15139:8–T15139:12
- 151 Bradstock T15368:14–T15368:26
- 152 Exhibit 719 – Supplementary Statement of Tainsh (WIT.3024.005.0182) [8]
- 153 Exhibit 735 – Clarke Report (EXP.016.001.0002) at 0017, 0019
- 154 Exhibit 735 – Clarke Report (EXP.016.001.0002) at 0018; Clarke T15364:1–T15364:16
- 155 Exhibit 720 – Securing Our Natural Future (DSE.HDD.0137.0081) at 0100–0104
- 156 Exhibit 733 – Bradstock Report (EXP.012.001.0001) at 0027; Exhibit 716 – Supplementary Statement of Fogarty (WIT.3024.005.0143) [29], [32]–[33]
- 157 Ingamells T15451:6–T15451:10
- 158 Exhibit 739 – Fuel Management Topic – Facilitated Expert Conference, Expert Panel Summary (TEN.227.001.0001) at 0001, 0004
- 159 *Flora and Fauna Guarantee Act 1988*, ss. 3(1), 7(1), 10(2)
- 160 Clarke T15371:29–T15373:6; Victorian Government Gazette, No. S247, Friday 26 November 2004
- 161 *Flora and Fauna Guarantee Act 1988*, ss. 17, 19
- 162 Exhibit 720 – Administration of the Flora and Fauna Guarantee Act 1988, Victorian Auditor General's Report April 2009 (TEN.222.001.0001) at 0010, 0014, 0039
- 163 Exhibit 720 – Administration of the Flora and Fauna Guarantee Act 1988, Victorian Auditor General's Report April 2009 (TEN.222.001.0001) at 0012
- 164 Exhibit 720 – Administration of the Flora and Fauna Guarantee Act 1988, Victorian Auditor General's Report April 2009 (TEN.222.001.0001) at 0014–0016; Exhibit 720 – Securing Our Natural Future (DSE.HDD.0137.0081) at 0139
- 165 Clarke T15329:20–T15329:30; Adams T15330:2–T15330:18
- 166 Exhibit 720 – Administration of the Flora and Fauna Guarantee Act 1988, Victorian Auditor General's Report April 2009 (TEN.222.001.0001) at 0015
- 167 Wilson T15146:23–T15147:10
- 168 Wilson T15146:11–T15147:12
- 169 Exhibit 800 – Statement of Burnett (WIT.6007.001.0001) [11]
- 170 Exhibit 720 – DSE Code of Practice For Fire Management on Public Land (DSE.HDD.0012.1267) at 1275–1277
- 171 Exhibit 720 – DSE Code of Practice For Fire Management on Public Land (DSE.HDD.0012.1267) at 1289
- 172 Exhibit 720 – DSE Code of Practice For Fire Management on Public Land (DSE.HDD.0012.1267) at 1275
- 173 The reference by the Panel to the 'governing code' is a reference to the Code of Practice for Fire Management on Public Land February 2006: Exhibit 720 – DSE Code of Practice For Fire Management on Public Land (DSE.HDD.0012.1267); Exhibit 739 – Fuel Management Topic – Facilitated Expert Conference, Expert Panel Summary (TEN.227.001.0001) [1]
- 174 Exhibit 739 – Fuel Management Topic – Facilitated Expert Conference, Expert Panel Summary (TEN.227.001.0001) [1]; Cheney T15269:1–T15269:24; Bradstock T15269:27–T15270:8; Gill T15223:19–T15223:20
- 175 Exhibit 740 – Choice in Land Management – Managing Fire for Multiple Purposes (EXH.740.0012) at 0013–0019
- 176 Tolhurst T15326:2–T15326:22
- 177 Exhibit 725 – Statement of Sneeuwjagt (WIT.135.001.0001\_R) [73]
- 178 Tolhurst T15359:1–T15359:9; Cheney T15324:4–T15324:13, T15324:29–T15325:1
- 179 Williams T15220:7–T15220:18, T15223:2–T15223:16
- 180 Exhibit 720 – DSE Code of Practice For Fire Management on Public Land (DSE.HDD.0012.1267) [147]–[153]
- 181 Exhibit 720 – DSE Code of Practice For Fire Management on Public Land (DSE.HDD.0012.1267) [156]
- 182 Exhibit 720 – DSE Code of Practice For Fire Management on Public Land (DSE.HDD.0012.1267) [162]–[164]
- 183 Exhibit 720 – DSE Code of Practice For Fire Management on Public Land (DSE.HDD.0012.1267) [167]–[169]
- 184 Exhibit 720 – DSE Code of Practice For Fire Management on Public Land (DSE.HDD.0012.1267) [173]–[174]
- 185 Exhibit 716 – Supplementary Statement of Fogarty (WIT.3024.005.0143) [89]; Fogarty T14762:20–T14763:10
- 186 Exhibit 716 – Supplementary Statement of Fogarty (WIT.3024.005.0143) [90]
- 187 Exhibit 735 – Clarke Report (EXP.016.001.0002) at 0011
- 188 Exhibit 716 – Marysville (EXH.716.0002); Exhibit 716 – Flowerdale (EXH.716.0003); Exhibit 716 – Humevale & Kinglake West (EXH.716.0004); Exhibit 716 – Strathewen & Kinglake (EXH.716.0005); Exhibit 716 – St Andrews (EXH.716.0006); Exhibit 716 – Callignee (EXH.716.0007); Exhibit 716 – Mudgegonga (EXH.716.0008); Fogarty T14823:24–T14824:31
- 189 Fogarty T14837:17–T14838:4
- 190 Fogarty T14825:3–T14825:21; Nichols T17761:5–T17761:7
- 191 Fogarty T15861:5–T15861:27
- 192 Exhibit 678 – Marysville Pre Fire Aerial Photograph (EXH.678.0005); Fogarty T14753:31–T14754:14, T14757:6–T14757:17, T14838:31–T14839:14, T15819:1–T15819:8; Parsons T14290:12–T14290:28

- 193 Tolhurst T15266:1–T15266:12
- 194 Tolhurst T15267:11–T15267:23; Clarke T15285:1–T15285:23
- 195 Adams T15272:29–T15273:13
- 196 Tolhurst T15283:20–T15284:31
- 197 Clarke T15285:1–T15285:12
- 198 Exhibit 733 – Bradstock Report (EXP.012.001.0001) at 0037
- 199 Cheney T15171:24–T15171:31
- 200 Exhibit 739 – Fuel Management Topic – Facilitated Expert Conference, Expert Panel Summary (TEN.227.001.0001) [16]
- 201 Dr Tolhurst also said in his report that strategic landscape firebreaks in eucalypt forest need to be 3 to 5km wide if they are to collect the majority of spot fires potentially occurring on hot windy days: Exhibit 737 – Tolhurst Report (EXP.013.001.0001) at 0039; Tolhurst T15191:25–T15192:1
- 202 Bradstock T15188:23–T15188:31
- 203 Exhibit 725 – Statement of Sneeuwjagt (WIT.135.001.0001\_R) [68]; Sneeuwjagt T14998:15–T14998:19
- 204 Exhibit 739 – Fuel Management Topic – Facilitated Expert Conference, Expert Panel Summary (TEN.227.001.0001) [17]. It is noted that this applies in relation to burning undertaken for the purpose of reducing fuel—as Dr Clarke noted that in circumstances where burning is conducted for other purposes (for example, in the Ecological Management Zone) then one might employ rates of treatment of 30–50 per cent to ensure survival of relevant species: Clarke T15270:24–T15271:7
- 205 Tolhurst T15192:3–T15192:16
- 206 Clarke T15271:10–T15271:22
- 207 Exhibit 720 – Overall Fuel Hazard Guide – Third Edition – Fire Management – Research Report No: 47 (DSE.0106.1220.0001) at 0004
- 208 Exhibit 739 – Fuel Management Topic – Facilitated Expert Conference, Expert Panel Summary (TEN.227.001.0001) [18]
- 209 Tolhurst T15280:23–T15281:4
- 210 Exhibit 725 – Statement of Sneeuwjagt (WIT.135.001.0001\_R) [67]; Sneeuwjagt T14974:3–T14974:14, T14974:25–T14975:21
- 211 Cheney T15268:20–T15268:26
- 212 Tolhurst T15173:2–T15173:5
- 213 Exhibit 720 – DSE Code of Practice For Fire Management on Public Land (DSE.HDD.0012.1267) [90]–[93], [104], [108]
- 214 Exhibit 720 – DSE Code of Practice For Fire Management on Public Land (DSE.HDD.0012.1267) [141]; Exhibit 719 – Supplementary Statement of Tainsh (WIT.3024.005.0182) [19], [27]
- 215 Exhibit 720 – DSE Code of Practice For Fire Management on Public Land (DSE.HDD.0012.1267) [141]–[143]
- 216 Exhibit 720 – DSE Code of Practice For Fire Management on Public Land (DSE.HDD.0012.1267) [145]
- 217 Exhibit 721 – Supplementary Statement of Lawlor (WIT.3024.005.0199) [18]
- 218 Exhibit 721 – Supplementary Statement of Lawlor (WIT.3024.005.0199) [19], [28]–[30]
- 219 Exhibit 737 – Tolhurst Report (EXP.013.001.0001) at 0037
- 220 Sneeuwjagt T15004:13–T15004:27
- 221 Exhibit 761 – Statement of Fogarty (WIT.3024.004.0331) at 0337
- 222 Exhibit 761 – Statement of Fogarty, Attachment 4 (DSE.HDD.0052.1751) at 1754, 1756, 1762; Fogarty T15849:13–T15849:31
- 223 Exhibit 761 – Statement of Fogarty, Attachment 4 (DSE.HDD.0052.1751) at 1754–1756, 1762–1764, 1776
- 224 Exhibit 761 – Statement of Fogarty, Attachment 4 (DSE.HDD.0052.1751) at 1754
- 225 Dripps T15586:21–T15586:27
- 226 Exhibit 678 – Clause 52.17 – Native Vegetation (TEN.111.001.0041) at 0045
- 227 Council Panel: Mr Grant Jack, Manager Asset Maintenance and Services of Yarra Ranges Shire; Mr Paul Buckley, Chief Executive Officer of Latrobe City Council; and Mr Jack Green, General Manager Sustainable Planning and Development of Colac Otway Shire; Council Panel T15729:10–T15730:21
- 228 Brown T15535:7–T15535:31
- 229 Exhibit 724 – Statement of Maino (WIT.138.001.0001\_R) [4], [7]; Maino T14955:5–T14965:11
- 230 Dripps T15587:7–T15587:30; Fogarty T15851:22–T15852:14
- 231 Exhibit 733 – Bradstock Report (EXP.012.001.0001) at 0029; Exhibit 734 – Cheney Report (EXP.017.001.0001) at 0013; Exhibit 737 – Tolhurst Report (EXP.013.001.0001) at 0034–0036; Exhibit 989 – Submission of Victorian Association of Forest Industries (SUBM.002.028.0179\_R) at 0197\_R, 0202\_R
- 232 Exhibit 761 – Statement of Fogarty, Attachment 4 (DSE.HDD.0052.1751) at 1755
- 233 Exhibit 989 – Strategic Fuelbreaks – Protecting Melbourne's Precious Water Supply (TEN.303.001.0001); Exhibit 800 – Statement of Burnett (WIT.6007.001.0001) at 0004, 0009; Dripps T15624:29–T15625:4; Fogarty T15853:11–T15853:31
- 234 Exhibit 931 – Statement of Armytage, Attachment 13 (WIT.3003.002.0177) at 0180–0181
- 235 Exhibit 749 – Supplementary Statement of Dripps, Attachment 8 (DSE.HDD.0142.0037); Dripps T15588:22–T15589:28
- 236 Exhibit 749 – Supplementary Statement of Dripps (WIT.3024.005.0287) [8]; Dripps T15593:1–T15593:5; Spence T15685:12–T15685:29, T15686:1–T15686:15



- 237 Exhibit 761 – Statement of Fogarty (WIT.3024.004.0331) [34], [37]–[43]; Exhibit 759 – Statement of Strickland (WIT.3004.034.0025) [27.3], [27.14], [27.16]
- 238 Fogarty T15843:6–T15843:21
- 239 Exhibit 745 – Statement of Liddle (WIT.3027.001.0001) [21], [24]–[28]; Exhibit 746 – Statement of Brown (WIT.3027.001.0070) [10]; Exhibit 754 – Statement of Spence (WIT.4014.001.0001) [15]–[16]
- 240 Exhibit 748 – Statement of Leslie (WIT.3004.028.0001) [14], [17]; *Country Fire Authority Act 1958*, s. 33
- 241 Exhibit 746 – Statement of Brown (WIT.3027.001.0070) [21]; Exhibit 754 – Statement of Spence (WIT.4014.001.0001) [17]–[26]
- 242 Mitchell T15648:20–T15649:9
- 243 Exhibit 753 – Statement of Miezis, Annexure 6 (DSE.HDD.0052.1169) at 1183; Miezis T15665:8–T15665:27; Mitchell T15650:8–T15650:28
- 244 Dripps T15621:27–T15622:12, T15598:3–T15599:5
- 245 Exhibit 800 – Statement of Burnett (WIT.6007.001.0001) [37]–[39]
- 246 Exhibit 720 – Securing Our Natural Future (DSE.HDD.0137.0081) at 0139
- 247 Exhibit 749 – Supplementary Statement of Dripps (WIT.3024.005.0124) [6]–[7]; Exhibit 685 – Statement of Dripps, Annexure 6 (DSE.HDD.0081.0095) at 0095
- 248 Dripps T15584:26–T15584:31
- 249 Dripps T15585:7–T15585:17
- 250 Exhibit 749 – Supplementary Statement of Dripps (WIT.3024.005.0124) [15]–[21], Annexure 3 (DSE.HDD.0052.1862) at 1864; Exhibit 685 – Statement of Dripps, Annexure 6 (DSE.HDD.0081.0095) at 0101; Dripps T15593:13–T15593:28; Spence T15696:3–T15696:12
- 251 Spence T15697:10–T15697:14
- 252 Exhibit 154 – General Submission by Local Government in Victoria (SUBM.002.040.0002) at 0090
- 253 Green T15717:4–T15717:19; Buckley T15717:27–T15718:2
- 254 Exhibit 754 – Statement of Spence, Attachment 2 (WIT.4014.001.0013), Attachment 3 (WIT.4014.001.0029); Exhibit 754 – Response to VBRC Request for Supplementary Information – Roadside Clearing (CORR.1002.0001); Exhibit 754 – Table Summarising Council Responses to Matters Raised in Witness Statement of Ms Dripps (CORR.1002.0004)
- 255 Exhibit 754 – Statement of Spence (WIT.4014.001.0001) [25], Attachment 2 (WIT.4014.001.0013), Attachment 3 (WIT.4014.001.0029)
- 256 Spence T15677:26–T15678:1, T15679:7–T15679:17
- 257 Buckley T15749:30–T15750:4; Jack T15750:24–T15750:31
- 258 Green T15749:19–T15749:25
- 259 Jack T15750:31–T15751:4
- 260 Exhibit 745 – Statement of Liddle (WIT.3027.001.0001) [16]; Exhibit 746 – Statement of Brown, Annexure 2 (WIT.3027.001.0085); Mr Brown explained in evidence that references in the 1985 Code to the Road Construction Authority (RCA) are to be read as references to VicRoads: Brown T15544:7–T15544:20
- 261 Exhibit 746 – Statement of Brown, Annexure 2 (WIT.3027.001.0085) at 0086
- 262 Brown T15546:10–T15546:25
- 263 Exhibit 746 – Statement of Brown (WIT.3027.001.0070) [12]
- 264 Exhibit 746 – Statement of Brown (WIT.3027.001.0070) [13]
- 265 Exhibit 746 – Statement of Brown (WIT.3027.001.0070) [16]–[18], [21]; Exhibit 746 – Supplementary Statement of Brown, Annexure 10 (WIT.3027.002.0002) at 0032; Brown T15544:23–T15545:4, T15559:1–T15559:13
- 266 Brown T15538:13–T15538:18
- 267 Exhibit 747 – Letter to the Regional Director of VicRoads from Keiran Klemm (SUBM.002.035.0347\_R) at 0347\_R; Brown T15542:22–T15543:3, T15547:26–T15549:7
- 268 Exhibit 748 – Statement of Leslie (WIT.3004.028.0001) [8]; Leslie T15565:1–T15565:13, T15565:22–T15566:7, T15579:24–T15579:31
- 269 Exhibit 748 – Statement of Leslie, Annexure 1 (WIT.3004.028.0029) at 0039
- 270 Exhibit 748 – Statement of Leslie (WIT.3004.028.0001) [23]–[26], [46]–[47]
- 271 Exhibit 748 – Statement of Leslie (WIT.3004.028.0001) [71]
- 272 Exhibit 748 – Statement of Leslie (WIT.3004.028.0001) [70]
- 273 Leslie T15575:10–T15575:30
- 274 Exhibit 750 – Statement of Petreis (WIT.142.001.0001\_R) [16]–[19]; Petreis T15631:22–T15633:3. Further examples of difficulties with road access, include Ms Hainsworth (in relation to the impassable section of Pine Ridge Road): Exhibit 134 – Statement of Hainsworth (WIT.059.001.0001\_R); Dr Fraser (in relation to tree coming down on corner of Lyell and Sedgwick streets, trapping driver): Exhibit 95 – Statement of Fraser (WIT.048.001.0001\_R) [19]; Mr Kennedy (fallen trees along Maroondah Highway): Kennedy T8550:7–T8550:13; Mr David Brown (CFA forced to drive through private property to reach residents in Strathewen when road became blocked): Exhibit 48 – Statement of Brown (WIT.029.001.0001\_R) [13]; Ms Barrow (CFA forced to clear trees with chainsaw): Exhibit 533 – Statement of Barrow (WIT.121.001.0001\_R) [75]–[76]; Mr Wood (CFA led convoy of residents from Callignee oval to Traralgon South blocked by fallen trees): Exhibit 426 – Statement of Wood (WIT.3004.017.0268); Exhibit 883 – Interactive Presentation – INTMEN 001831 (EXH.883.0001); Exhibit 764 – Interactive Presentation INTMEN 001785 and INTMEN 001979 (EXH.764.0001)
- 275 Strickland T15802:18–T15802:20; Hollowood T12543:29–T12543:31

- 276 Exhibit 759 – Statement of Strickland (WIT.3004.034.0025) [51]–[56], Annexure 3 (WIT.3004.034.0073) at 0082–0090
- 277 Exhibit 754 – Statement of Spence, Attachment 4 (WIT.4014.001.0037) at 0038; Spence T15688:2–T15691:14
- 278 Exhibit 754 – Statement of Spence, Attachment 4 (WIT.4014.001.0037) at 0038; Spence T15687:11–T15689:14; Dripps T15605:22–T15606:6
- 279 Strickland T15801:7–T15801:27; Fogarty T15843:6–T15843:21
- 280 Strickland T15777:30–T15778:14
- 281 Mr Strickland is also a Senior Wildfire Instructor, level 3 Planning Officer and near-miss incident investigator who, before joining the CFA, worked with Parks Victoria and DSE, and at Holmesglen TAFE, delivering courses on wildfire behaviour and wildfire suppression. Following the 7 February fires Mr Strickland was seconded to the Bushfire CRC to conduct fire spread mapping in relation to three of the fires that burned on 7 February: Exhibit 759 – Statement of Strickland (WIT.3004.034.0025) [1], [3], [9]–[12], [16.4], [21]–[24], [26.1]–[26.7], [31], [32.1]–[32.12], [64.1]–[64.3], Annexure 3 (WIT.3004.034.0073) at 0075–0077; Strickland T15773:1–T15774:10, T15775:10–T15776:1, T15784:14–T15784:26, T15792:23–T15793:1, T15794:3–T15795:1, T15796:5–T15796:9
- 282 Strickland T15784:15–T15784:26
- 283 Strickland T15784:31–T15785:13
- 284 Exhibit 759 – Statement of Strickland (WIT.3004.034.0025) [35.1]–[35.7], Annexure 3 (WIT.3004.034.0073) at 0080–0081, Annexure 9 (WIT.3004.034.0127) at 0127; Strickland T15785:14–T15785:24, T15799:4–T15799:27
- 285 Exhibit 759 – Statement of Strickland (WIT.3004.034.0025) [37.2]–[37.7]
- 286 Exhibit 759 – Statement of Strickland (WIT.3004.034.0025) [37.9]–[37.12]
- 287 Exhibit 759 – Statement of Strickland (WIT.3004.034.0025) [41.9]–[41.11], Annexure 14 (WIT.3004.034.0137)
- 288 Exhibit 759 – Statement of Strickland (WIT.3004.034.0025) [47.1]–[47.4], Annexure 3 (WIT.3004.034.0073) at 0113, Annexure 18 (WIT.3004.034.0146)
- 289 Exhibit 759 – Statement of Strickland (WIT.3004.034.0025) [37.2]–[37.7], [37.13]–[37.20], Annexure 3 (WIT.3004.034.0073) at 0094, Annexure 10 (WIT.3004.034.0129)
- 290 Exhibit 761 – Statement of Fogarty (WIT.3024.004.0331) [34]
- 291 Fogarty T15842:7–T15842:10
- 292 Strickland T15801:16–T15801:27
- 293 Fogarty T15843:6–T15843:21
- 294 Exhibit 753 – Statement of Mieziš, Annexure 6 (DSE.HDD.0052.1169) at 1180
- 295 Mieziš T15664:25–T15665:7
- 296 Strickland T15800:10–T15800:17
- 297 Exhibit 753 – Statement of Mieziš (WIT.3024.004.0315) [9], [13]–[14]; Mieziš T15662:14–T15662:28
- 298 *Forests Act 1958*, s. 52
- 299 Exhibit 753 – Statement of Mieziš, Annexure 5 (DSE.HDD.0052.1576) at 1576–1577; Mieziš T15667:12–T15667:25, T15668:8–T15668:30