

Magistrate Teresa O'Sullivan
NSW State Coroner



Inquests and Inquiries into the 2019/2020 NSW Bushfire Season

Findings and Recommendations
Volume 2



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'Guwiyang the Lightning Fire Tree' (2020), Belenje.

The storyline is how an old tree takes on the form of lightning which glows at night within its stem and leaves. Guwiyang means fire and talks about the importance of Indigenous cultural burning that prevent uncontrollable wildfires and rejuvenates the earth surface for renewal. The tree represents lightning to remind us of caring for our Country – through fire burning practices that are essential for a healthy environment. Since Colonisation – we have ignored the inherent capabilities of thousands of years of practice in best ways to manage the land and seas. We have witnessed the devastation that has resulted from this. It is time to care for the needs of not only humans but the animals, plants and our unique cultural landscapes.

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Part 8

Counsel Assisting's
Summary Papers



1. Introduction

Purpose and preparation

1. In an effort to capture the important work performed by the Earlier Inquiries and the Audit, and the progress made on responses to recommendations arising out of those matters, a number of summary papers were prepared by the Counsel Assisting Team concerning issues that were not examined by way of a Stage 2 general coronial inquiry, including:
 - a. 'Summary of findings and recommendations from Earlier Inquiries' dated 13 August 2021;
 - b. 'Summary of findings and recommendations concerning Indigenous Land and Fire Management Practices' dated 2 September 2021;
 - c. 'Summary of findings and recommendations concerning Climate Change' dated 5 August 2022;
 - d. 'Summary of Chapter 11 of the Intergovernmental Panel on Climate Change (IPCC) Climate Change 2022 Report' dated 5 May 2023; and
 - e. 'Summary of findings and recommendations concerning Aerial Resources' dated 8 May 2023.
2. It is important to note that each of the summary papers referred to above were prepared at a point in time and were based on the current and available information at the time of preparation.

Consultation with parties

3. In these proceedings, Counsel Assisting's summary papers, as referred to above, formed part of the Stage 1 – Southern, Northern and Central/Metro Region General Briefs of Evidence (in part) and also the Stage 2 – General Brief of Evidence. No objections were raised by parties granted leave to appear on their inclusion into evidence.
4. In July 2023, parties granted leave to appear were informed that Counsel Assisting's summary papers may be the subject of written findings and were invited to provide submissions in relation to same. There were no submissions received, save the following from the RFS in its submissions in reply:
 - a. with respect to Counsel Assisting's summary of findings and recommendations concerning Climate Change:
 - i. in relation to the 2020 State of the Climate Report referred to in the summary, the Bureau and the Commonwealth Scientific and Industrial Research Organisation (**CSIRO**) had since released the 2022 State of the Climate Report with up-to-date figures.
 - ii. reference is made in the summary to extracts of an opinion expressed by Professor Andy Pitman AO regarding the impact of climate change on the extent and severity of the drought in NSW preceding the 2019/2020 bushfire season, which the RFS submitted should be read as a whole as follows:

“Professor Pitman explained that while climate change, in particular increases in temperature that have been attributed to increased carbon dioxide emissions, is clearly a contributing factor to the type of bush fires seen in the 2019-20 season, it does not provide the full explanation for why they were so bad.”

- b. with respect to Counsel Assisting's summary of findings and recommendations concerning Aerial Resources:
- i. that summary refers at various points to further information having been sought from the RFS on night-time aerial firefighting capabilities to which the RFS subsequently responded, and which should be incorporated into any findings (see further under the heading 'Aerial resources' below).
 - ii. reference is made in the summary to the RFS' night-time aerial operations trial during the 2016/2017 bushfire season and the results of which was not documented. The RFS submitted that the 2016/2017 trials were single missions only and therefore were not part of a comprehensive, structured trial.
 - iii. since the NSW Bushfire Inquiry, the RFS had also undertaken Medium Remote Piloted Aircraft Systems trials.
 - iv. the Aviation Centre of Excellence was scheduled to be open in September 2023. The expansion of the RFS' aviation simulator program since the NSW Bushfire Inquiry was also canvassed in the statement of Deputy Commissioner McKechnie in the coronial inquest into the deaths of Rick DeMorgan Jnr, Paul Hudson, and Ian McBeth.

2. General paper

1. In deciding whether or not a fire during the 2019/2020 bushfire season proceeded to a coronial inquiry, key findings arising out of the NSW Bushfire Inquiry and the Royal Commission were considered by the Court noting that at the time, the Senate Inquiry had not yet published its Final Report. The work of the NSW Bushfire Inquiry was particularly important in informing the approach the Court took to the coronial inquests and inquiries that proceeded to hearing.
2. Based on the key findings of the NSW Bushfire Inquiry and the Royal Commission, the 'Summary of findings and recommendations from Earlier Inquiries dated 13 August 2021 (and updated in February 2022) was prepared, a copy of which is in Part 11, Appendix 9.
3. In particular, a constellation of factors that contributed to conditions across NSW leading up to and during the 2019/2020 bushfire season were considered, as follows:
 - a. **Scale and progression of the bushfires:** the 2019/2020 bushfire season resulted in the largest recorded area of land burnt by bushfires in NSW history: 5.5 million hectares (approximately 7 per cent of the land in NSW). In a typical bushfire season, the fires move from north to south. In the 2019/2020 bushfire season, the fires commenced in central and southern NSW regions earlier than usual, the season was longer than the typical duration, and many fires burned throughout NSW simultaneously.¹
 - b. **Severity of the bushfires:** the severity of the bushfires, the measurement for which ranges from 'unburnt' to 'severe' canopy destruction, impacted upon approximately 800,600 hectares (around 15 per cent of the total area burnt in NSW) and was categorised as high or severe.² The FFDI, the measurement for which ranges from 'low-moderate' to 'catastrophic' fire danger, reached a catastrophic rating on 6 September 2019. This is the earliest catastrophic rating since the scale was introduced.³
 - c. **Very dry fuel:** due to prolonged and widespread drought and increased temperatures, the fuel throughout NSW was extremely dry.⁴ It was much drier than average and likely the driest fuel on record in the State.⁵
 - d. **Fuel load:** while fuel loads were generally high across most of the fire-affected areas in NSW, in the 2019/2020 season it was no higher on average than the previous 30 years. It was acknowledged that there has been considerable debate in communities across fire-affected NSW in regard to whether the fuel load in certain areas was too high and whether various hazard reduction options could or should have been adopted. The NSW Bushfire Inquiry and the Royal Commission comprehensively addressed the issue with regards to land management, bushfire hazard reduction measures, traditional land management and cultural backburning.⁶ As a *general* proposition, it was said that fuel load does not have a significant influence on fire intensity and spread in relation to *extreme* fires.⁷
 - e. **Weather patterns – temperature:** NSW experienced frequent heatwave conditions across the 2019/2020 bushfire season, defined as consecutive days and nights with high maximum and minimum temperatures. As a result, fuel continued to dry, and fires continued to spread at night. This challenged firefighting efforts to 'catch-up' overnight and drained resources.⁸

¹ Exhibit 61, General Brief of Evidence – Stage 2, Tab 1, p. 5; Tab 3, p. 75.

² Exhibit 61, General Brief of Evidence – Stage 2, Tab 1, p. 6; Tab 3, p. 83.

³ Exhibit 61, General Brief of Evidence – Stage 2, Tab 1, p. 6; Tab 3, p. 107.

⁴ Exhibit 61, General Brief of Evidence – Stage 2, Tab 1, p. 6; Tab 3, p. 86.

⁵ Exhibit 61, General Brief of Evidence – Stage 2, Tab 1, p. 6; Tab 3, p. 90.

⁶ Exhibit 61, General Brief of Evidence – Stage 2, Tab 1, p. 7; Tab 3, 206-233; Tab 9, p. 1113-1126.

⁷ Exhibit 61, General Brief of Evidence – Stage 2, Tab 1, p. 8; Tab 3, p. 52; Tab 9, p. 1117. Here the Royal Commission recognised a need for further research into the role of fuel load in extreme fires.

⁸ Exhibit 61, General Brief of Evidence – Stage 2, Tab 1, p. 8; Tab 3, p. 111.

- f. **Fire-generated thunderstorms:** across NSW in the 2019/2020 bushfire season, there were a record number of fire-generated thunderstorms. These thunderstorms were observed to develop rapidly and unexpectedly, create plumes of smoke above fires, change the behaviour and force of fires, generate lightning and gusting, increase ember travel and spotting, and generate sudden and extreme ‘downbursts’ of wind in the vicinity of the thunderstorm.⁹
- g. **Lightning strikes:** most of the fires in the 2019/2020 bushfire season were observed to be started by lightning strikes.¹⁰ The likelihood of ignition on the ground from a lightning strike is determined by the fuel moisture content and nature of the point of ignition with lightning more likely to ignite a fire in very dry conditions.¹¹ Fires started by lightning strikes are also generally more likely to create larger fires because they may start in remote locations and often in clusters.¹²
- h. **Preparedness:** the NSW pre-season outlook and briefings indicated the 2019/2020 bushfire season was going to be severe. The RFS expressed pre-season concern that long-term rainfall deficiencies had severely impacted water resources; the preceding months had been some of the driest on record; and by the start of September 2019, much of eastern Australia was primed for high fire danger ratings.¹³ However, the NSW Bushfire Inquiry found that the scale of the actual fires took most – from firefighting and land management agencies, as well as local councils and members of local communities – by surprise. Consequently, there did not appear to be a general understanding and preparedness in the community, including in high bushfire risk areas, of what could be coming. The NSW Bushfire Inquiry identified areas for improvement in this regard, including, but not limited to, improvement in public land management relating to the identification and management of fire trails, risk assessments, cross-agency and jurisdictional collaboration, access to water supply, hazard reduction, and community education and engagement through nationally consistent high-quality information.¹⁴
- i. **Fire agencies:** NSW firefighters from the RFS, NPWS, FRNSW and the FCNSW completed 277,415 shifts throughout the 2019/2020 bushfire season.¹⁵ They also received significant assistance from emergency services personnel from interstate and internationally. Notwithstanding this, firefighting resources in NSW were considerably stretched during the 2019/2020 bushfire season.¹⁶
- j. **Use of backburning:** across the 2019/2020 bushfire season, fire agencies used backburning as a containment method for many fires. Backburning was characterised as either ‘strategic’ where it was used as a means to halt a fire, or ‘tactical’ where it was used to protect a particular asset or where there was a particular threat to containment lines.¹⁷ However, there were occasions where backburning was unsuccessful and broke containment lines, usually due to unforeseen wind changes and communication breakdowns.¹⁸
- k. **Communications infrastructure:** there was significant fire damage caused to power infrastructure (namely, poles, wires, and substations) during the 2019/2020 bushfire season. Electricity networks were extensively affected by bushfires,¹⁹ and in NSW there were 818 telecommunication facilities affected.²⁰ There was a high number of requests across the State for mobile generators and there was only a limited supply available. The main communications platform for emergency services organisations during the 2019/2020 bushfire season in NSW was the Public Safety Network. However, there were a number of limitations with this network. In some cases, fire agencies had challenges communicating with each other.²¹

⁹ Exhibit 61, General Brief of Evidence–Stage 2, Tab 1, p. 8; Tab 3, p. 116–117; Tab 9, p. 808–809.

¹⁰ Exhibit 61, General Brief of Evidence–Stage 2, Tab 1, p. 9; Tab 3, p. 120.

¹¹ Exhibit 61, General Brief of Evidence–Stage 2, Tab 1, p. 9; Tab 3, p. 120–121.

¹² Exhibit 61, General Brief of Evidence–Stage 2, Tab 1, p. 9; Tab 3, p. 121.

¹³ Exhibit 61, General Brief of Evidence–Stage 2, Tab 1, p. 9; Tab 3, p. 165–166.

¹⁴ Exhibit 61, General Brief of Evidence–Stage 2, Tab 1, p. 9; Tab 3, p. 165–166.

¹⁵ Exhibit 61, General Brief of Evidence–Stage 2, Tab 1, p. 9; Tab 3, p. 301.

¹⁶ Exhibit 61, General Brief of Evidence–Stage 2, Tab 1, p. 9–10; Tab 3, p. 302; Tab 9, p. 899, 903.

¹⁷ Exhibit 61, General Brief of Evidence–Stage 2, Tab 1, p. 10; Tab 3, p. 341.

¹⁸ Exhibit 61, General Brief of Evidence–Stage 2, Tab 1, p. 11; Tab 3, p. 338.

¹⁹ Exhibit 61, General Brief of Evidence–Stage 2, Tab 1, p. 11; Tab 3, p. 377.

²⁰ Exhibit 61, General Brief of Evidence–Stage 2, Tab 1, p. 11; Tab 3, p. 248.

²¹ Exhibit 61, General Brief of Evidence–Stage 2, Tab 1, p. 11–12; Tab 3, p. 386.

- l. **Public warning systems:** information about the bushfires was available throughout the 2019/2020 bushfire season through a range of platforms, including social media, mobile phone apps, websites, television, and radio. Fire agencies also engaged in doorknocking to alert residents to fire danger. The 'Emergency Alert' is a national telephone warning system used in NSW by emergency services where voice and text messages are sent to mobile phones within a defined area of emergency. However, the Emergency Alerts were not successful where there were power and telecommunication failures; location-based text messages were 81 per cent successful, address-based text message were 69 per cent successful, and voice messages were 70 per cent successful.²² Some people in remote or regional areas without mobile phone coverage could not call Triple Zero and could not receive emergency alerts.²³
4. Consideration of the above were one factor in decision making about whether a 2019/2020 bushfire proceeded to a coronial inquiry or was to be dispensed with. It was hoped that these proceedings would focus upon specifically targeted matters to allow the Court to understand the broader challenges faced by all individuals and communities impacted by fire during the 2019/2020 bushfire season, even those involved in matters that did not ultimately proceed to a hearing.

²² Exhibit 61, General Brief of Evidence–Stage 2, Tab 1, p. 12; Tab 3, p. 410.

²³ Exhibit 61, General Brief of Evidence–Stage 2, Tab 1, p. 13; Tab 3, p. 403.

3. Indigenous land and fire management practices

1. The importance of Indigenous land and fire management practices was also considered by the Earlier Inquiries including its role in land use planning and management and building standards and reducing bushfire risk, as well as improving Australia's resilience to natural disasters.²⁴
2. In particular, the NSW Bushfire Inquiry and the Royal Commission comprehensively examined traditional land management and cultural burning. As part of its inquiry, the NSW Bushfire Inquiry held expert roundtables on cultural land management, which included a range of Aboriginal land management practitioners and community members. The Royal Commission heard from Indigenous cultural burning practitioners, researchers, and organisations during the course of its inquiry and surveyed the literature on cultural burning practices.²⁵
3. It was against this background that the 'Summary of findings and recommendations concerning Indigenous Land and Fire Management Practices' dated 2 September 2021 was prepared, a copy of which is in Part 11, Appendix 10.
4. Indigenous land management, also referred to as 'caring for Country' aims to '*protect, maintain, heal and enhance health and ecologically diverse ecosystems, productive landscapes and other cultural values.*'²⁶ It allows landscapes to be managed in a way that empowers and reflects the cultural practices, voices, and aspirations of Indigenous Australians.²⁷
5. Indigenous land management is based on cultural understandings of Country, is tailored to specific places, and engages local people in development and implementation. Partly for these reasons, Indigenous land management differs widely across Australia.²⁸
6. Indigenous land management activities are diverse and include a range of environmental, natural resource and cultural heritage management activities, including water management, the harvesting of food and fibre and the conduct of controlled burns. They are undertaken by Indigenous individuals, groups, and organisations across Australia for a range of customary, community, conservation, and commercial reasons.²⁹
7. Indigenous Australians have used fire as one of many ways to shape and manage the land for over 60,000 years.³⁰ Cultural burning is the term used to describe burning practices developed by Indigenous Australians to enhance the health and land of its people.³¹ It is about maintaining healthy, ecologically diverse, and productive landscapes and also about practising cultural traditions. While it does not have fuel reduction as its primary objective, it can often produce that outcome.³² Modern cultural fire practices are developed using a blend of customary and western techniques to manage land and waters to the benefit of Country and communities across Australia.³³ These practices vary in application due to factors such as the type of vegetation, the presence of old growth forests and localised weather effects.³⁴

²⁴ Exhibit 61, General Brief of Evidence – Stage 2, Tab 2, p. 14–15; Tab 3, p. 51; Tab 9, p. 792; Tab 11, p. 1416.

²⁵ Exhibit 61, General Brief of Evidence – Stage 2, Tab 2, p. 15–16; Tab 3, p. 231–236; Tab 9, p. 1130–1141.

²⁶ Exhibit 61, General Brief of Evidence – Stage 2, Tab 2, p. 15; Tab 9, p. 1132.

²⁷ Exhibit 61, General Brief of Evidence – Stage 2, Tab 2, p. 15; Tab 9, p. 1140.

²⁸ Exhibit 61, General Brief of Evidence – Stage 2, Tab 2, p. 15; Tab 9, p. 765.

²⁹ Exhibit 61, General Brief of Evidence – Stage 2, Tab 2, p. 16, Tab 9, p. 1132.

³⁰ Exhibit 61, General Brief of Evidence – Stage 2, Tab 2, p. 16; The Office of the Royal Commission, *Background Paper: Cultural burning practices in Australia*, 15 June 2020, p. 4.

³¹ Exhibit 61, General Brief of Evidence – Stage 2, Tab 2, p. 16; The Office of the Royal Commission, *Background Paper: Cultural burning practices in Australia*, 15 June 2020, p. 6.

³² Exhibit 61, General Brief of Evidence – Stage 2, Tab 2, p. 17; Tab 3, p. 232–233; Tab 9, p. 1133–1134.

³³ Exhibit 61, General Brief of Evidence – Stage 2, Tab 2, p. 16; The Office of the Royal Commission, *Background Paper: Cultural burning practices in Australia*, 15 June 2020, p. 4.

³⁴ Exhibit 61, General Brief of Evidence – Stage 2, Tab 2, p. 16; The Office of the Royal Commission, *Background Paper: Cultural burning practices in Australia*, 15 June 2020, p. 4.

8. There is growing recognition of the value of Indigenous land and fire management practices as a way to mitigate the effects of bushfires and improve disaster resilience.³⁵ There is widespread support for Indigenous land management practices to be more widely implemented, including cultural burning, and for such opportunities to be explored.³⁶ However, barriers to the greater use of these practices were recognised and it was acknowledged that further work is required for their wider implementation.³⁷

Recommendations

9. Ultimately, it was recommended that Australia should engage further with Traditional Owners to explore the relationship between Indigenous land and fire management and natural disaster resilience and explore further opportunities to leverage Indigenous land and fire management insights, in the development, planning and execution of public land management activities. Further, it was recommended that the Government adopt the principle that cultural burning is one component of a broader practice of traditional Aboriginal land management and is an important practice culturally with a commitment to pursuing a greater application of such practices accompanied by a program of evaluation.³⁸
10. The response to the recommendations made by the Earlier Inquires included a commitment to increased funding by the Commonwealth and NSW Governments, supporting Traditional Owner-led activities and enhancing relationships with Indigenous land managers and Aboriginal communities to build a better understanding of Indigenous fire management practices and their implementation.³⁹
11. The summary in Part 11, Appendix 10 lists the recommendations made by the NSW Bushfire Inquiry and the Royal Commission in respect of Indigenous land and fire management in full and includes further information on the status of their implementation by the relevant agencies at the time of drafting.⁴⁰

³⁵ Exhibit 61, General Brief of Evidence – Stage 2, Tab 2, p. 17; Tab 3, p. 765.

³⁶ Exhibit 61, General Brief of Evidence – Stage 2, Tab 2, p. 17; Tab 3, p. 231, 238; Tab 9, p. 1133–1134.

³⁷ Exhibit 61, General Brief of Evidence – Stage 2, Tab 2, p. 17; Tab 3, p. 233–236.

³⁸ Exhibit 61, General Brief of Evidence – Stage 2, Tab 2, p. 17–20.

³⁹ Exhibit 61, General Brief of Evidence – Stage 2, Tab 2, p. 17–20.

⁴⁰ Exhibit 61, General Brief of Evidence – Stage 2, Tab 2, p. 17–20; Tabs 4–8, 10, 42, 67.

4. Climate change

1. The Earlier Inquiries considered the role of climate change in the 2019/2020 bushfire season with respect to the cause of the fires, its contribution to the severity of the fires and consequently, its contribution to the broader impacts of those fires. This resulted in the ‘Summary of findings and recommendations concerning Climate Change’ dated 5 August 2022 being prepared, a copy of which is in Part 11, Appendix 11.
2. The 2020 State of the Climate Report (**the 2020 Report**) prepared jointly by the Bureau and the CSIRO reported that Australia’s climate had warmed $1.44 \pm 0.24^{\circ}\text{C}$ since 1910, leading to changes to climate and weather, including:
 - a. increased frequency of extreme heat events;
 - b. decreased rainfall of approximately 12 per cent in the south-east of Australia since the late 1990s between April and October; and
 - c. a long-term increase in extreme fire weather, and in the length of the bushfire season, across large parts of Australia since the 1950s.⁴¹
3. The Earlier Inquiries examined the following themes which relate to the above changes in Australia’s climate and weather in the context of the 2019/2020 bushfire season:
 - a. dryness of the NSW landscape, including increased fuel load;
 - b. unusual/extreme weather and fire behaviour; and
 - c. longer and hotter bushfire seasons.

Dryness of NSW landscape and fuel loads

4. The Bureau advised the NSW Bushfire Inquiry that the drought leading up to the 2019/2020 bushfire season was exceptional in terms of severity as indicated by rainfall deficiencies, spatial extent (as it covered most of NSW), and its duration of multiple years.⁴² This period of drought also coincided with the warmest period on record for NSW. The combination of rainfall deficiency and maximum temperatures resulted in 2019 being the hottest and driest year on record for NSW.⁴³
5. The dryness of the landscape resulted in, among other impacts, greater sizes of fires in areas of continuous forests, fires occurring in areas that are usually too damp for a fire to burn, and lightning being able to ‘catch’ well to initiate fire.⁴⁴
6. Each of the Earlier Inquiries considered whether the extraordinary drought and extreme dryness of the NSW landscape during the period preceding the 2019/2020 bushfire season either was or may have been caused by climate change. Differing opinions were provided in this regard, including, but not limited to:
 - a. Professor Andy Pitman AO explained to the NSW Bushfire Inquiry that based on the available evidence, one cannot definitively say that climate change caused the extent and severity of the drought experienced in NSW preceding the 2019/2020 bushfire season, but it also cannot be ruled out as the cause.⁴⁵
 - b. the Royal Commission and the Senate Inquiry found that climate change is driving extreme weather and leading to worsening bushfire conditions, by creating amongst other things, drier vegetation, and fuel.⁴⁶ Similarly, the 2020 Climate Report stated that climate change affects dryness and the amount of fuel by influencing rainfall, air temperature and atmospheric moisture content, which exacerbates drying of the landscape.⁴⁷

⁴¹ Exhibit 61, General Brief of Evidence–Stage 2, Tab 13, p. 1577; Tab 19, p. 1674.

⁴² Exhibit 61, General Brief of Evidence–Stage 2, Tab 13, p. 1578; Tab 3, p. 86.

⁴³ Exhibit 61, General Brief of Evidence–Stage 2, Tab 13, p. 1578; Tab 3, p. 86–37.

⁴⁴ Exhibit 61, General Brief of Evidence–Stage 2, Tab 13, p. 1578; Tab 3, p. 78, 91.

⁴⁵ Exhibit 61, General Brief of Evidence–Stage 2, Tab 13, p. 1579; Tab 3, p. 71.

⁴⁶ Exhibit 61, General Brief of Evidence–Stage 2, Tab 13, p. 1579; Tab 9, p. 802; Tab 11, p. 1496.

⁴⁷ Exhibit 61, General Brief of Evidence–Stage 2, Tab 13, p. 1579; Tab 19, p. 1677.

- c. the Emergency Leaders for Climate Action (**ELCA**) submitted to the NSW Bushfire Inquiry that it is 'irrefutable that climate change was the main driver of the unprecedented 2019-20 bushfire season'.⁴⁸
7. However, there were also large-scale climate drivers prior to and during the 2019/2020 bushfire season which contributed to the dry conditions. These included:
 - a. a long-lived positive Indian Ocean Dipole, referring to changes in sea surface temperatures between the western and eastern Indian Ocean which influence temperatures and rainfall patterns in Australia. A positive Indian Ocean Dipole results in drier and warmer than average conditions.
 - b. a negative Southern Annular Mode associated with a sudden stratospheric warming event. Southern Annular Mode is a large-scale mode of weather and climate variability associated with a shift in the atmospheric pressure patterns across the southern hemisphere. A negative Southern Annular Mode generally leads to a decrease in rainfall and increase in westerly winds from inland Australia. Such conditions can greatly increase fire danger ratings in NSW and south-east Queensland. Further, a sudden stratospheric warming event is a more irregular phenomenon where temperatures in the stratosphere above the south pole heat rapidly. When these two phenomena combine, they can cause a prolonged northward shift in westerly winds and in late 2019, produced an intense period of low rainfall and above average temperatures with consecutive heatwaves over parts of eastern Australia.
 - c. neutral El Niño/Southern Oscillation meaning that NSW did not experience either El Niño (generally drier) or La Niña (generally wetter) conditions so in the lead-up to the 2019/2020 bushfire season, climatic drivers were experienced that increase the likelihood of dry conditions (i.e. the positive Indian Ocean Dipole and negative Southern Annular Mode) as well as a long period of time since a negative Indian Ocean Dipole or a La Niña which would be associated with wetter conditions.⁴⁹
 8. The CSIRO reported that since 1850, Australia's mean annual temperature has increased which is attributable to climate change associated with increased greenhouse gases in the atmosphere.⁵⁰

Extreme/unusual weather and fire behaviour

9. Fire-conducive weather conditions which exacerbated the fires included:
 - a. dryness of the landscape and fuel loads resulting in an increased ease of ignition (in most cases by lightning);⁵¹
 - b. repeated heatwave conditions with high temperatures overnight, high solar insolation, very low humidity, and hot westerly winds;⁵² and
 - c. an unprecedented number of fire-generated thunderstorms, also known as pyro-cumulonimbus.⁵³ Prior to the 2019/2020 bushfire season, there was 60 fire-generated thunderstorms recorded in NSW since 1978. However, there were 29 fire-generated thunderstorms in the 2019/2020 bushfire season alone.⁵⁴
10. The NSW Bushfire Inquiry also received evidence that the fires that occurred in the 2019/2020 bushfire season exhibited unusual or unexpected fire behaviour, including, but not limited to, quicker spread than expected during night-time, fires spreading in all directions simultaneously, fires spreading by the wind and embers spotting at great distances.⁵⁵
11. Based on evidence provided by the CSIRO, the Royal Commission attributed the increased frequency and intensity of extreme weather to climate change, noting that climate change influences Australia's natural climate variability, which causes changes in average and extreme weather.⁵⁶

⁴⁸ Exhibit 61, General Brief of Evidence – Stage 2, Tab 13, p. 1581; Tab 17, p. 1616.

⁴⁹ Exhibit 61, General Brief of Evidence – Stage 2, Tab 13, p. 1579; Tab 3, p. 92–94.

⁵⁰ Exhibit 61, General Brief of Evidence – Stage 2, Tab 13, p. 1579; Tab 3, p. 92–95.

⁵¹ Exhibit 61, General Brief of Evidence – Stage 2, Tab 13, p. 1580; Tab 3, p. 65.

⁵² Exhibit 61, General Brief of Evidence – Stage 2, Tab 13, p. 1580; Tab 3, p. 107.

⁵³ Exhibit 61, General Brief of Evidence – Stage 2, Tab 13, p. 1580; Tab 3, pp. 72, 118.

⁵⁴ Exhibit 61, General Brief of Evidence – Stage 2, Tab 13, p. 1580; Tab 3, p. 118.

⁵⁵ Exhibit 61, General Brief of Evidence – Stage 2, Tab 13, p. 1581; Tab 3, p. 84.

⁵⁶ Exhibit 61, General Brief of Evidence – Stage 2, Tab 13, p. 1581; Tab 3, p. 105, 107.

Longer and hotter bushfire seasons

12. Section 81 of the *Rural Fires Act 1997* (NSW) (**the RF Act**) sets the statutory bushfire danger period as commencing on 1 October and ending on 31 March of the following year. The 2019/2020 bushfire season started on 1 June 2019 with the last fires extinguished on 2 March 2020, spanning a total of 240 consecutive days of active fire.⁵⁷
13. The NSW Bushfire Risk Management Research Hub in part attributed the 2019/2020 bushfire season starting earlier to dead fuel being critically dry as compared to any other time since 1950.⁵⁸
14. The ELCA submitted to the Senate Inquiry that climate change is causing hotter temperatures which is resulting in a higher number of hot days and therefore, a longer bushfire season.⁵⁹
15. The 2020 Report reported a long-term increase in the length of the bushfire season across large areas in Australia since the 1950s. The 2020 Report stated that climate change is influencing long-term trends in some key risk factors for bushfires in Australia. While the influence of climate change in long-term trends is clear, the attribution of a single fire event to climate change is difficult and is the subject of current research. Further, the 2020 Report notes that there is considerable variability across years, particularly where La Niña occurs, as these years are associated with a lower number of days with high FFDI ratings.⁶⁰
16. The 2020 Report stated that *'climate change influences the frequency, magnitude and impacts of many types of extreme weather and climate events.'* When extreme weather and climate events occur consecutively within a short timeframe of each other, or when multiple types of extreme events coincide, the impacts can compound in severity. For example, heatwaves can have a larger impact when combined with the stress of long-term drought.⁶¹
17. Extreme events are more likely when natural climate variability acts to amplify the background influence of climate change. For example, record-breaking extreme heat and record-breaking fire weather are more likely when the El Niño–Southern Oscillation or the Indian Ocean Dipole favour warmer and drier conditions in Australia, since this reinforces warming and drying trends.⁶²
18. The spring and early summer of 2019 provides a good example of compounding extreme weather and climate conditions and illustrates the effect of background climate trends amplifying natural climate variability. In this period, record-breaking low rainfall coincided with extreme heat, and both continued into early 2020. An extreme positive Indian Ocean Dipole and rare Antarctic stratospheric warming in 2019 provided the naturally occurring climate variability that exacerbated long-term climate trends. These combined influences led to severe drought, record-breaking heatwaves, and fire weather.⁶³
19. Natural climate variability, which affects Australia's climate from one year to the next, means that not every year will see weather and climate that was as extreme as in 2019. However, the warming trend, primarily caused by climate change, increases the likelihood of extreme events that are beyond our historical experience. Multiple lines of evidence, including from observations and future climate change projections, point to a continuing trend of more frequent compound extreme events. This means Australia will experience, over the coming decades, continued warming including more extremely hot days and fewer cool days, a decrease in cool season rainfall across many regions of the south and east likely leading to more time spent in drought, and a longer fire season for the south and east and an increase in the number of dangerous fire weather days. Projecting the occurrence and severity of extreme events is therefore essential for current and future risk assessments, and for climate adaptation strategies and responses.⁶⁴

⁵⁷ Exhibit 61, General Brief of Evidence—Stage 2, Tab 13, p. 1581; Tab 3, p. 79, 155.

⁵⁸ Exhibit 61, General Brief of Evidence—Stage 2, Tab 13, p. 1582; Tab 3, p. 90.

⁵⁹ Exhibit 61, General Brief of Evidence—Stage 2, Tab 13, p. 1582; Tab 11, p. 1496.

⁶⁰ Exhibit 61, General Brief of Evidence—Stage 2, Tab 13, p. 1582; Tab 19, p. 1701.

⁶¹ Exhibit 61, General Brief of Evidence—Stage 2, Tab 13, p. 1587; Tab 19, p. 1704.

⁶² Exhibit 61, General Brief of Evidence—Stage 2, Tab 13, p. 1587; Tab 19, p. 1704.

⁶³ Exhibit 61, General Brief of Evidence—Stage 2, Tab 13, p. 1587; Tab 19, p. 1704.

⁶⁴ Exhibit 61, General Brief of Evidence—Stage 2, Tab 13, p. 1587; Tab 19, p. 1704.

Recommendations

20. Several recommendations were made by the Earlier Inquiries with respect to climate change. The recommendations largely focused on the need to invest in further modelling, forecasting, research, and evaluation and the creation of database/s to enable collaboration and the tracking of trends that contribute to severe bushfires. Further, the recommendations focused upon a commitment to a more strategic approach to planning for bushfires to accommodate changing climate conditions, including review of legislative frameworks and processes that consider the impact of climate change in relation to fuel loads and other bushfire hazards.⁶⁵
21. The response to the recommendations made by the Earlier Inquires included development of a national repository for bushfire history, development of a new bushfire planning framework, further commitment to funding with progress made in areas of research and project planning, and the commitment to establishing a new virtual climate and disaster risk information and services centre.⁶⁶
22. The summary in Part 11, Appendix 11 lists the recommendations made by the Earlier Inquiries concerning climate change in full and includes further information on the status of their implementation by the relevant agencies at the time of drafting.⁶⁷

“Climate Change 2022: Impacts, Adaptation and Vulnerability” – the Contribution of Working Group II to the IPCC Sixth Assessment Report Cycle (the IPCC Report)

23. The IPCC is the United Nations body for assessing the scientific literature related to climate change, including its impacts and options for responding to it. Its objective is to provide governments, at all levels, with scientific information they can use to develop climate policies.
24. The IPCC Report presents an assessment of the state of knowledge of the observed impacts and projected risks of climate change, including to the Australasian region, and outlines current and future adaptation interventions. It is based on scientific and technical literature published up to 1 September 2021.
25. Based on the key findings, the ‘Summary of Chapter 11 of the IPCC Climate Change 2022 Report’ dated 5 May 2023 was prepared, a copy of which is in Part 11, Appendix 12.
26. The IPCC Report presents a picture consistent, on the whole, with the findings of the Bureau and CSIRO in the 2020 Report in respect of air temperature increases of land, decreases in rainfall, and an increase in extreme fire weather days (such as thunderstorms and dry lightning).⁶⁸
27. The IPCC Report notes that some of the above observed trends and events can be partly attributed to anthropogenic climate change, resulting from, or produced by human activities (including regional warming trends, sea level rise, terrestrial and marine heatwaves, declining rainfall and increasing fire weather in southern Australia).⁶⁹

⁶⁵ Exhibit 61, General Brief of Evidence – Stage 2, Tab 13, p. 1582–1587.

⁶⁶ Exhibit 61, General Brief of Evidence – Stage 2, Tab 13, p. 1582–1587.

⁶⁷ Exhibit 61, General Brief of Evidence – Stage 2, Tab 13, p. 1582–1586; Tabs 4-8, 10, 12, 42, 67.

⁶⁸ Exhibit 61, General Brief of Evidence – Stage 2, Tab 65, p. 4709.

⁶⁹ Exhibit 61, General Brief of Evidence – Stage 2, Tab 65, pp. 4709–4710; Tab 64, p. 4655.

28. In relation to droughts, the IPCC Report indicates that anthropogenic climate change has contributed to drying in dry summer climates, including in south-western Australia.⁷⁰ There is high confidence⁷¹ in anthropogenic influence on increased meteorological drought in south-western Australia. Increased agricultural/ecological and/or meteorological and/or hydrological drought is also seen with either medium confidence or high confidence in the trend but with low confidence on attribution to anthropogenic climate change in eastern Australia.⁷² The IPCC Report notes that anthropogenic climate change has contributed to the increased likelihood or severity of drought events in many parts of the world, causing increased wildfire risk, amongst others with a medium confidence rating.⁷³
29. The IPCC Report outlines that in Australia, much of the south-eastern part of the continent has experienced extreme wildfire years, but analyses suggests that El Niño is more important than long-term climate change and can exert a stronger influence than climate change. While the effects of climate cycles on fire are superimposed on long-term climate change, the IPCC Report notes that the relative importance of anthropogenic climate change in explaining changes in burned areas in Australia remains unquantified.⁷⁴
30. While acknowledging that uncertainties exist in climate projections, the IPCC Report predicts with very high confidence that further climate change is inevitable, with the rate and magnitude dependent on emission pathway.⁷⁵
31. Australia's climate projections include (relative to average in 1986 – 2005):⁷⁶
 - a. further warming with more hot days and fewer cold days;
 - b. a decrease in winter and spring rainfall;
 - c. the intensity, frequency and duration of fire weather events are projected to increase throughout Australia, particularly for southern and eastern Australia; and
 - d. more time in drought over southern and eastern Australia is projected.
32. The IPCC Report summarises the observed and cascading impacts of the 2019/2020 bushfires on people, economic activity, built assets, ecosystems, and species.⁷⁷
33. The IPCC Report discusses the climate-related impacts on Aboriginal and Torres Strait Islander Peoples. Estimates of the loss from fire impacts on ecosystem services⁷⁸ that contribute to the wellbeing of remotely located Indigenous Australians were found to be higher than the financial impacts from the same fires on pastoral and conservation lands. The IPCC Report refers to examples of Aboriginal and Torres Strait Islander Peoples' practices of adaptation to a changing climate, including fire management using cultural practices that can achieve greenhouse gas emission targets while maintaining Indigenous cultural heritage and, Indigenous Ranger programmes which provide a means for Indigenous-guided land management including, amongst other things, fire management and carbon abatement.⁷⁹
34. Based on assessment of the literature and expert judgement, the IPCC Report addresses the projected impacts of climate change and identifies nine key risks from anthropogenic climate change. The key risks have potential to be severe but can be reduced substantially by rapid, large-scale, and effective mitigation and adaption.

⁷⁰ Exhibit 61, General Brief of Evidence – Stage 2, Tab 65, p. 4710; Intergovernmental Panel on Climate Change, *Climate Change 2022: Impacts, Adaptation and Vulnerability Report*, Chapter 4 (Water), February 2022, p. 563.

⁷¹ Noting that confidence ratings are based on the amount of evidence and agreement between lines of evidence.

⁷² Exhibit 61, General Brief of Evidence – Stage 2, Tab 65, p. 4710; Intergovernmental Panel on Climate Change, *Climate Change 2022: Impacts, Adaptation and Vulnerability Report*, Chapter 4 (Water), February 2022, p. 579.

⁷³ Exhibit 61, General Brief of Evidence – Stage 2, Tab 65, p. 4710; Intergovernmental Panel on Climate Change, *Climate Change 2022: Impacts, Adaptation and Vulnerability Report*, Chapter 4 (Water), February 2022, p. 579.

⁷⁴ Exhibit 61, General Brief of Evidence – Stage 2, Tab 65, p. 4710; Intergovernmental Panel on Climate Change, *Climate Change 2022: Impacts, Adaptation and Vulnerability Report*, Chapter 4 (Water), February 2022, p. 247.

⁷⁵ Exhibit 61, General Brief of Evidence – Stage 2, Tab 65, p. 4712; Tab 64, p. 4611.

⁷⁶ Exhibit 61, General Brief of Evidence – Stage 2, Tab 65, p. 4712; Tab 64, p. 4611.

⁷⁷ Exhibit 61, General Brief of Evidence – Stage 2, Tab 65, p. 4713; Tab 64, p. 4618.

⁷⁸ Exhibit 61, General Brief of Evidence – Stage 2; Tab 65, p. 4713; Tab 64, p. 4648–4649.

⁷⁹ Exhibit 61, General Brief of Evidence – Stage 2, Tab 65, p. 4713–4714; Tab 64, p. 4648–4649.

35. Of those nine key risks, three are considered relevant with regards to bushfires and each of which carry a high confidence rating:
- a. transition or collapse of alpine ash, snow gum woodland, pencil pine and northern jarrah forests in southern Australia due to hotter and drier conditions with more fires. The number of severe fire weather days is projected to increase by 5 to 35% (under low emissions) and by 10-70% (under high emissions) by 2050. The report notes a shift in landscape fire regimes to larger, more intense and frequent wildfires over extensive areas of forests and woodlands from longer fire seasons and more hazardous fire conditions and increasing human-sourced ignitions from urbanisation and projected increase in frequency of lightning strikes. Adaption options to reduce the risk include increased capacity to extinguish wildfires during extreme fire weather conditions and avoiding and reducing forest degradation from inappropriate forest management practices and land use;
 - b. increase in heat-related mortality and morbidity for people and wildlife in Australia due to an increased frequency, intensity, and duration of extreme heat events. Health risks are multiplied when other harmful exposures are experienced, for example, bushfire smoke. Adaption options include heatwave/fire early-warning systems; and
 - c. cascading, compounding and aggregate impacts on cities, settlements, infrastructure, supply chains and services due to extreme events. Risk drivers include the hazards of heatwaves, fires and include cascading and compounding events such as heatwaves with fires. Examples include, but are not limited to, failure of transport, energy and communication infrastructure and services, heat stress, injuries and death, air pollution, damage to agriculture and tourism, insurance loss from heatwaves and fires, damage to buildings, services and infrastructure, and the displacement of people.⁸⁰
36. The IPCC Report also provides examples of adaption options (and enablers) to reduce wildfire risk:
- a. in relation to land management, examples include prescribed burning to reduce fuel load close to assets and engagement with Aboriginal and Torres Strait Island Peoples to utilise and learning from their fire management knowledge and skill (to assist in landscape management and greenhouse gas mitigation), amongst others;
 - b. in respect of communications, examples include increased research to understand interactions between fire, fuel, weather, climate and human factors to enhance projections of fire occurrence and behaviour and the improvement of early-warning systems, more targeted messaging and increased emergency evacuation planning and sheltering options; and
 - c. in relation to infrastructure, examples include enhanced training and support for firefighters and aerial firefighting assets, including sharing of resources nationally and internationally to address the increasing overlap of fire seasons, which are lengthening across the world and the development of new systems to augment capability of fire services and technological advances to detect and respond to fires, amongst others.⁸¹
37. Ultimately, the IPCC Report notes that Australia's ability to adapt to climate change rests on better coordination and collaboration between government agencies, communities, Aboriginal and Torres Strait Islanders, not-for profit organisations and businesses to help prepare for climate impacts (such as wildfires, heatwaves, and droughts) in combination with future climate risks integrated into their decisions and planning. Work is already being undertaken but more adaptation is needed in light of the ongoing and intensifying climate risks. Australia's ability to adapt to climate change impacts also rests on every region in the world playing its part in reduction greenhouse gas emissions.⁸²

⁸⁰ Exhibit 61, General Brief of Evidence–Stage 2, Tab 65, p. 4715; Tab 64, p. 4610, 4655–4657.

⁸¹ Exhibit 61, General Brief of Evidence–Stage 2, Tab 65, p. 4716; Tab 64, p. 4659–4666.

⁸² Exhibit 61, General Brief of Evidence–Stage 2, Tab 65, p. 4716; Tab 64, p. 4659–4669.

5. Aerial resources

1. The role and effectiveness of aircraft in aiding fire responses during the 2019/2020 bushfire season was considered extensively by the Earlier Inquiries and the Audit and it was against this background that the ‘Summary of findings and recommendations concerning Aerial Resources’ dated 8 May 2023 was prepared, a copy of which is in Part 11, Appendix 13.
2. The scale of the 2019/2020 bushfire season in NSW meant that a large contingent of aerial resources was required, not just for firefighting purposes, but also for personnel and resource movement, and surveillance and reconnaissance missions. Aircraft are particularly valuable for fires in difficult terrain or fast-moving fires that are too dangerous for ground crews to confront and are an effective resource particularly when used in close coordination with ground-based firefighting crews.⁸³
3. The increasing duration of bushfire seasons in the northern and southern hemispheres and the increasing duration and severity of bushfire seasons in Australia, will make it increasingly difficult to share aircraft domestically, and to acquire aviation services when required, particularly at short notice. This increases Australia’s reliance on overseas providers. The Inquiries highlighted the importance of investing in Australian-based aerial resources and having less reliance on overseas resources.⁸⁴
4. The Earlier Inquiries and the Audit examined the following themes which relate to Australia’s aerial resources in the context of the 2019/2020 bushfire season:
 - a. aerial firefighting arrangements and systems;
 - b. strategies to control the spread of fires;
 - c. the use of difference aerial resources; and
 - d. training.

Aerial firefighting arrangements and systems

5. In Australia, the AFAC has four business units including the NRSC, which coordinates and facilitates international and interstate deployments, and the NAFC, which provides a cross-jurisdictional arrangement for aerial bushfire combat. Each State and Territory also has its own organisational arrangements for aerial firefighting with sharing of aviation services between States and Territories during bushfire seasons a feature of aerial firefighting in Australia. During the 2019/2020 bushfire season, aviation surge capacity usually available to NSW from other States and Territories was limited due to severe to extreme bushfire activity, or the risk of such activity, making fleet sharing difficult.⁸⁵
6. International support was crucial during the 2019/2020 bushfire season in ensuring continuity of supply of aerial firefighting capability. NSW and all other jurisdictions across Australia relied on international support through the AFAC and NAFC to meet fleet requirements. However, with a worldwide increase in demand and a lack of a commensurate increase in supply, there is an ongoing risk to these arrangements with the NAFC having difficulty in securing additional aircraft at short notice particularly with overlapping bushfire seasons in the northern and southern hemispheres. Other issues faced with respect to obtaining aircraft from overseas in a timely manner is the requirement to obtain the necessary approvals from the CASA and that Australian-licensed pilots are not licensed to operate foreign-registered aircraft used in Australia.⁸⁶

⁸³ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4859, Tab 3, p. 357.

⁸⁴ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4859, Tab 3, p. 362.

⁸⁵ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4822–4824; Tab 3, p. 182–184; Tab 9, p. 956–958, 962–964; Tab 11, p. 1429–1430, Tab 66, p. 4741.

⁸⁶ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4825–4826; Tab 3, p. 361–362; Tab 9, p. 963–966.

7. It was also found that the current terms of aircraft service contracts were a disincentive for some Australian-based service providers. Short contracts and minimal work during the off season made it unviable. However, long-term contracts may have the potential to encourage more overseas-based providers and lock out Australian-based providers.⁸⁷
8. Ultimately, the Earlier Inquiries stressed the need to increase Australia's national firefighting capacity.⁸⁸
9. In relation to supporting systems, the Earlier Inquiries examined the effectiveness of such systems including SAD and ARENA. States and Territories usually coordinate the use of aerial assets through a central mechanism, such as Air Desk. The NAFC also maintains the national shared information system, ARENA, which provides a common registry of aircraft, operators, and crew available for combat agencies to use during fire and emergency operations however, not all aircraft are recorded in the system. ARENA also has a dispatch capability which is used by some but not all authorities in Australia. It was found that a common national system such as ARENA for dispatch and monitoring would enhance the effective sharing of resources and post-incident analysis and reporting.⁸⁹
10. A national register for resources, both personnel and equipment, would also assist in decision making during natural disasters and improve resource sharing.⁹⁰
11. Communications between aircraft and ground crews was also considered. Because each State and Territory operates a different tactical radio communications system for ground crews, there are implications for communication with aircraft. It was found that incompatible communication impacts the coordination and use of aerial firefighting assets with the prioritisation of improvements to interoperable communications equipment encouraged.⁹¹

Strategies to control the spread of fires

12. NSW has large areas of bushland where rapid response by vehicle is not possible due to access, topography or the distances involved. It was found that initial and rapid aerial attack as an early suppression strategy for fires in remote areas is critical in preventing large fires developing and becoming a major threat.⁹²
13. RAFTs were used to a great effect during the 2019/2020 bushfire season however, at times they were deployed to high priority non-RAFT fire operations which reduced their availability to undertake remote firefighting. It was found that the deployment of RAFTs must be based on enhanced research and predictive modelling to ensure early suppression in prioritised.⁹³
14. RARTs were also critical in minimising the size of fires however, there were many days during the 2019/2020 bushfire season where the extreme weather and conditions on the ground meant it was unsafe to deploy RARTs.⁹⁴
15. Based on a review of initial aerial dispatch models used in South Australia and Victoria, it was considered that effective early suppression requires:
 - a. the right mix of aircraft that are able to respond within very tight timeframes;
 - b. pre-positioning of aircraft in strategic locations; and
 - c. logistical support on the ground.⁹⁵

⁸⁷ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4828; Tab 9, p. 958–959.

⁸⁸ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4827; Tab 3, p. 362; Tab 9, p. 966–967; Tab 11, p. 1430–1431.

⁸⁹ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4829–4830; Tab 9, p. 907, 961, Tab 66, p. 4741.

⁹⁰ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4830; Tab 9, p. 905–907.

⁹¹ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4832–4833; Tab 9, p. 912–914.

⁹² Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4833–4837; Tab 3, p. 333; Tab 66, p. 4741.

⁹³ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4833–4834; Tab 3, p. 333–339.

⁹⁴ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4834–4835; Tab 3, p. 333–339.

⁹⁵ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4836; Tab 3, p. 337–338; Tab 9, p. 955–956, 961.

16. Increased aerial firefighting at night was also identified as one of the important firefighting enhancements needed after the 2019/2020 bushfire season. It could enable taking advantage of more favourable conditions however, it was acknowledged that despite improvements such as night vision devices and infrared technology increasing the likelihood and effectiveness of aerial firefighting at night, overnight extreme weather conditions experienced during the 2019/2020 bushfire season sometimes prohibited aircraft from operating. It was nonetheless supported as a permanent fire suppression tool in future bushfire seasons subject to ongoing RFS trials.⁹⁶

The use of different aerial resources

17. A review of the use of different aerial resources during the 2019/2020 bushfire season found that helicopters were the most frequently used type of aircraft largely due to their multifunctionality and higher manoeuvrability. However, the RFS requires all winching activities to be carried out from a twin-engine helicopter over a single-engine helicopter for safety reasons. NPWS helicopters, all being single-engine, are unable to be tasked to operations by the SAD as they do not meet the minimum winching safety requirements set by the RFS.⁹⁷
18. Fixed-wing aircraft, including LATs, VLATs and SEAT were also considered with SEATs being an effective option in aerial firefighting as they can operate from regional and remote airfields and can be deployed quickly to drop suppressant, or perform coordination, fire detection and mapping roles.⁹⁸
19. LATs and VLATs used in firebombing have a greater operational flying range than other aircraft and can operate in worse conditions than smaller aircraft. However, LATs and VLATs are not without limitations, being relatively more expensive to operate than smaller aircraft, require significant supporting infrastructure with longer runways, have slower turnarounds, sometimes have less fire attack accuracy than smaller aircraft, and can be harder to integrate into firefighting operations as they often require an additional lead aircraft to help coordinate their bushfire attacks.⁹⁹
20. FRNSW and NPWS remote piloted aircraft systems (more commonly known as drones) were also a valuable part of the aerial response over the course of the 2019/2020 bushfire season. When flight conditions were unsuitable for manned aircraft, drones were deployed to ensure situational awareness was maintained by providing real time intelligence to incident command and were also used to identify hot spots to assist in the deployment of available and suitable resources. It was found that drones provide an enhanced perspective of a fire at a much smaller cost, can be flown at close range without placing the operator at risk and can be used effectively at night and in low-level visibility conditions. The limitations in their use ranged from the size of the drone available and extreme weather conditions making their use problematic. There is also a need to integrate the use of drones with aircraft to ensure a safe and coordinated approach is taken. Combat agencies were encouraged to take advantage of such emerging technologies and expand their use.¹⁰⁰
21. There is no 'silver bullet' when it comes to the right type of aircraft for firefighting and there are a range of factors to consider. A mix of aviation services is an essential element of Australia's ability to fight and control bushfires and the availability of some of these assets is limited. It was found that a review of the existing fleet should be undertaken to ensure NSW (and Australia) has fit-for-purpose aerial firefighting assets that support firefighting in a range of conditions. By the 2021/2022 bushfire season, the RFS had 28 firefighting contracted aircraft on exclusive use contracts in addition to RFS owned and call when needed aircraft. The RFS dedicated fleet includes 31 mixed aerial appliances.¹⁰¹

⁹⁶ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4837–4839; Tab 3, p. 25, 366–367.

⁹⁷ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4839–4841; Tab 3, p. 358–360; Tab 9, p. 953.

⁹⁸ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4841; Tab 9, p. 950.

⁹⁹ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4841–4842; Tab 3, p. 360; Tab 9, p. 950–952.

¹⁰⁰ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4843–4844; Tab 3, p. 363–366.

¹⁰¹ Exhibit 61, General Brief of Evidence–Stage 2, Tab 68, p. 4845–4846; Tab 3, p. 362–363, Tab 9, 966–967, Tab 66, p. 4741.

Training

22. The nature of the 2019/2020 bushfire season, with ongoing requirements for aerial support over extended periods of time, stretched the availability of qualified aviation personnel as fires occurred concurrently across multiple jurisdictions. In some instances, resource requests were unable to be fulfilled due to a lack of appropriately training and qualified personnel available.¹⁰²
23. Training gaps were identified including the need for more specialist aviation personnel such as AASs, Air Observers and Aerial Incendiary Operators. Such training is resource intensive and requires appropriate aircraft, conditions and trainers that are not always available. However, it was acknowledged that the RFS had commenced the implementation of simulator-based training into existing training and certification.¹⁰³

Recommendations

24. The NSW Bushfire Inquiry made several recommendations in relation to aerial resources including the expansion of specialist aviation personnel and training, ensuring long-term funding certainty to AFAC, prioritising early fire suppression, conducting a review of the current mix of aviation assets, expansion of drone capacity, and enhancing firefighting capacity through aerial firefighting at night.¹⁰⁴
25. In response, further funding was committed by the NSW Government to enhance aerial fleet and aviation training facilities and acquire additional drone capability as well as additional night operations equipment, long-term funding for AFAC was considered at a national level. The RFS reported that Athena was developed to predict fire behaviour and assist with rapid initial attack, pre-determined dispatch and night-time firebombing trials were conducted, and a review of aircraft requirements was undertaken.¹⁰⁵
26. The Royal Commission recommended that a national register that includes aerial assets be established, improvements be made to radio communications interoperability across jurisdictions, the development of an Australian-based and registered national aerial firefighting capability, as well as ongoing research and evaluation into aerial firefighting.¹⁰⁶
27. The Commonwealth Government supported the recommendations made by the Royal Commission however largely noted that they touched upon matters primarily the responsibility of States and Territories. The Commonwealth Government committed to continuing its annual contributions to the NAFC and announced further funding for critical research into bushfires, natural hazards, and aerial firefighting capabilities.¹⁰⁷
28. The Senate Inquiry recommended the establishment of a permanent, sovereign aerial firefighting fleet to which the Commonwealth Government responded by acknowledging the maturity, experience, and effectiveness of the operational response capabilities of the States and Territories, which it has no desire to replicate or replace.¹⁰⁸
29. The Audit resulted in a recommendation in respect of fleet planning and reporting, that the RFS develop performance measures to assess the performance and capabilities of fire response times and outcomes. With respect to its aerial firefighting fleet, the RFS responded noting its achievements in developing and managing the largest aerial firefighting fleet in Australia and had already committed to a target of limiting 80 per cent of bushfires to less than 10 hectares in area and a trial of pre-determined dispatch of aircraft in achieving such outcome.¹⁰⁹
30. The summary in Part 11, Appendix 13 lists the recommendations made by the Earlier Inquiries and the Audit concerning aerial resources in full and includes further information on the status of their implementation by the relevant agencies at the time of drafting.¹¹⁰

¹⁰² Exhibit 61, General Brief of Evidence – Stage 2, Tab 68, p. 4846–4847; Tab 3, p. 179–180, Tab 9, p. 898, 960–961.

¹⁰³ Exhibit 61, General Brief of Evidence – Stage 2, Tab 68, p. 4847–4848; Tab 3, p. 179–180.

¹⁰⁴ Exhibit 61, General Brief of Evidence – Stage 2, Tab 68, p. 4848–4854.

¹⁰⁵ Exhibit 61, General Brief of Evidence – Stage 2, Tab 68, p. 4848–4854.

¹⁰⁶ Exhibit 61, General Brief of Evidence – Stage 2, Tab 68, p. 4854–4856.

¹⁰⁷ Exhibit 61, General Brief of Evidence – Stage 2, Tab 68, p. 4854–4856.

¹⁰⁸ Exhibit 61, General Brief of Evidence – Stage 2, Tab 68, p. 4856–4858.

¹⁰⁹ Exhibit 61, General Brief of Evidence – Stage 2, Tab 68, p. 4858–4859.

¹¹⁰ Exhibit 61, General Brief of Evidence – Stage 2, Tab 68, p. 4848–4859, Tabs 4-8, 10, 12, 42, 66, 67.

31. Following the completion of the summary, updates were also obtained from the relevant agencies detailed below and tendered into evidence:¹¹¹
- a. the Department of Premier and Cabinet regarding the NSW Government's response to recommendations made by the Royal Commission in relation to aerial resources and radio interoperability. In its response, it was noted that NAFC's National Aerial Firefighting Strategy 2021-2026 was published in 2021 to guide the development of the sovereign aerial firefighting fleet, developed with substantial assistance from the RFS. Further, the NSW Government had invested \$5.4 million over five years (commencing 2020/2021) for the RFS to enhance its aerial fleet and aviation training facilities. The NSW Government also committed \$69.8 million over four years for the establishment of a Bushfire and Natural Hazards Research and Technology Program, and Bushfire Response R&D Mission, to accelerate bushfire research and development. Regarding radio interoperability, it was noted that cross-border communications and interoperability is a key tenet of the NSW Government Operational Communications Strategy 2020, a ten-year plan to enhance agency frontline telecommunications capabilities in NSW. The NSW Telco Authority had agreed on a deed to deliver interoperability with the Queensland Government by 30 June 2023 to enable seamless radio communications between NSW and Queensland emergency service organisations. The NSW Telco Authority is also continuing to progress an interoperable solution with Emergency Management Victoria and commenced discussions with the South Australian Attorney-General's Office on interoperability. The NSW Telco Authority is also facilitating reciprocal 'talkgroup' sharing arrangements between willing and compatible interstate agencies.
 - b. the RFS seeking further information on its response to recommendations made by the NSW Bushfire Inquiry concerning aerial resources. In response, the RFS confirmed that:
 - i. to prioritise early suppression and keep fires small and to assist with prioritising RART deployments for rapid initial attack in remote areas, the RART standby module sits within ICON and the module takes forecast weather information from the Bureau and using the various weather triggers / levels for RART standby identifies in a mapping layer the areas of the State that meet the standby requirements for a rolling 4-day period.
 - ii. to improve early fire suppression, the RFS completed the Bushfire Season Review of the Pre-Determined Dispatch Trial, which is the formal evaluation of the 2020/2021 dispatch trial and was completed in 2021. The trial was expanded, and the Evaluation of the Pre-Determined Dispatch Trial Extension was completed in 2022. Essentially, it was found that early intervention by aerial assets at the same time as ground crews simultaneously can dramatically reduce the spread of wildfire and achieve containment very quickly. The RFS advised the Court that given that each bushfire season since 2019/2020 has been subject to significant periods of above average rainfall and flooding the RFS would be continuing the trial program through the 2023/2024 bushfire season. The current El-Nino watch and longer term forecast of dryer than average conditions coupled with the continuing high grass fuel loads mean it is expected the 2023/2024 bushfire season will present the best opportunity to fully evaluate the program during a typical or above average period of fire potential. From this, the RFS will be able to develop a fully informed approach to what resourcing will be required in future years for the program to continue.
 - iii. to enhance NSW's firefighting capacity, the 2021/2022 Bushfire Season Night Time Aerial Fire Bombing Trial Evaluation was completed in 2022. It was ultimately found that the 2021/2022 trial was a success and allowed the RFS to further understand the capability and limitations of night-time firebombing and expand the program during the 2022/2023 bushfire season, which the RFS advised the Court remains ongoing.

¹¹¹ Exhibit 61, General Brief of Evidence – Stage 2, Tabs 72-74.

- c. the NPWS seeking further information on its response to a recommendation made by the NSW Bushfire Inquiry that, in order to prioritise early suppression and keep fires small, consideration be given to setting a Key Performance Indicator (**KPI**) target for NPWS that 70 per cent of fires that start on-park are contained within 10 hectares and prioritising the deployment of RARTs to enable rapid initial attack of new remote area ignitions. Following the NSW Bushfire Inquiry, the NPWS advised that it had reconsidered and readopted the proposed KPI. Further, the NPWS advised the Court that it continues to provide significant RART capability including three dedicated aircraft during the fire danger period and highly trained firefighters. Information was also sought from the NPWS concerning aviation business planning. In this regard, the NPWS had informed the NSW Bushfire Inquiry that it had commissioned two independent assessments to review the move from single-engine to twin-engine helicopters for winching activities. The NPWS advised the Court that:
- i. the first assessment examined the performance of various twin and single-engine rotary aircraft when undertaking winch operations during fires and was completed in 2021.
 - ii. the second assessment examined the performance of selected rotary aircraft across the whole range of aviation activities that NPWS undertakes. This was due to be completed by 30 June 2023.

The NPWS commissioned the development of a business case that relies on the outcomes of the two aforementioned assessments examining the cost and benefits of single-engine versus twin-engine aircraft across the entire NPWS aviation spectrum, which was due to be finalised by December 2023.

Part 9

Stage 2 Representative case study hearings: Introduction and context

9

1. The Court's jurisdiction

Jurisdiction to hold general inquiries

1. The Court has power under section 32(3) of the Act to hold a 'general' inquiry which, where directed, permits examination of the circumstances concerning a fire (including, but not limited to, a fire's cause and origin). Such an inquiry must take place where an authorised public official has made a request for a general inquiry to be held or I am of the opinion such an inquiry should be held.
2. In relation to the 2019/2020 bushfire season, there was no request made to the Court by an authorised official to hold a general inquiry.
3. Following completion of the 41 fire inquiries that proceeded to a Stage 1 hearing, an assessment was made about systemic issues of public importance requiring further analysis by the Court by way of representative case study. These were termed "Stage 2" hearings.
4. The intent of the Stage 2 hearings was not to traverse the extensive work of the Earlier Inquiries such as the NSW Bushfire Inquiry, the Royal Commission into National Natural Disaster Arrangements and the Senate Finance and Public Administration References Committee Inquiry. These inquiries each had a different scope, intended focus and level of resourcing.
5. The Court did consider responses to recommendations arising from the Earlier Inquiries and the need for any additional recommendations, under section 82 of the Act.

Assessment of issues

6. Evidence was heard during Stage 1 hearings about the catastrophic nature of the 2019/2020 bushfire season, competing demands for resources and the very significant impact on the State.
7. It is immediately apparent from a review of the circumstances of this fire season that many deaths occurred across the State on the same days. There were multiple fires and deaths that took place during 7 – 8 November 2019 and 30 – 31 December 2019. The evidence during Stage 1 hearings has demonstrated that these were days of particularly severe fire conditions.
8. I considered the evidence taken in the Stage 1 inquest and inquiry hearings, including detailed briefs of evidence and the oral evidence of 191 witnesses.
9. I also considered a general brief of evidence containing a number of documents, including the reports from the Earlier Inquiries and other material which focussed on broad themes including:
 - a. prevailing weather in the lead up to and across the bushfire season and the impact of extreme weather events;
 - b. the interpretation of lightning strike data;
 - c. hazard reduction efforts considering prevailing fuel loads and fuel dryness;
 - d. fire prediction modelling;
 - e. communication and emergency warning systems;
 - f. RFS use of aerial support and out of area crews to fight the fires; and
 - g. the conduct of cause and origin investigations into the fires.
10. I gave further consideration to the public submissions received in response to an open public invitation. Those submissions varied in length and detail and addressed a range of different fires and topics (as detailed earlier in Volume 1, Part 1). They provided valuable and unique perspectives and insights that have informed consideration of determining which matters proceeded to representative case study.
11. It is in this context that I determined there were identifiable and discrete systemic issues of public importance that required further consideration by the Court. While such issues might have arisen in very many fires during the 2019/2020 season, only those fires that best demonstrated each issue were identified as the selected representative case study for the purposes of further inquiry.

2. Systemic issues for further consideration

1. On 12 August 2022, pursuant to section 32(4) of the Act, I directed that a general inquiry should be held into the following matters:
 - a. Inquiry into the Kangawalla, Diehard Fire;
 - b. Inquiry into the Creewah Cluster of Fires (comprising the Creewah Road, Glen Allen Fire; the Big Jack Mountain Road, Cathcart Fire; and the Postmans Trail, Tantawangalo Fire);
 - c. Inquiry into the Mount Mackenzie Road, Tenterfield Fire;
 - d. Inquiry into the Grose Valley, Mount Wilson Fire;
 - e. Inquiry into the Failford Road, Darawank Fire
 - f. Inquiry into the Badja Forest, Forest Road and Deua National Park (Coondella) Fires;
 - g. Inquiry into the Green Valley, Talmalmo Fire;
 - h. Inquiry into the Green Wattle Creek (Lake Burragorang) Fire;
 - i. Inquiry into the Kian Road, South Arm Fire; and
 - j. Inquiry into the Currowan Cluster of Fires (comprising the Currowan Fire, the Tianjara Fire, the Morton Fire, the Clyde Mountain Fire and the Charley's Forest Fire).
2. The particular systemic issues identified for further consideration by the Court through the Stage 2 hearings are outlined below.

Investigation of fires by the NSW Police Force and NSW Rural Fire Service

3. The methodology for the investigation of fire cause and origin by the NSWPF was considered in the context of the Creewah Cluster of Fires. This included issues with respect to allocation, nature and scope of fire investigations, reporting requirements to the coroner and information sharing between the NSWPF and the RFS.
4. The approach of the RFS to the investigation of bushfires was also examined in the context of the Mount Mackenzie Road, Tenterfield and Grose Valley, Mount Wilson Fires. This included issues of investigation purpose, authority and process for conducting investigations, and training, qualification and allocation of investigators.
5. This case study hearing also considered whether any recommendations were desirable to ensure greater collaboration between the NSWPF and the RFS during these investigations.

Bushfire Risk Classification

6. This hearing focussed on Essential Energy's approach to BRC, having regard to the Failford Road, Darawank Fire. That fire was caused by at least one branch falling onto powerlines. This resulted in arcing which emitted embers onto dry foliage below, igniting a fire that went on to burn 3,000 hectares and destroy many homes in the surrounding area.
7. Essential Energy's classification of Bushfire Risk Severity Zones directly informs its vegetation management program, which seeks to reduce the risk of such events arising from the electrical infrastructure that it owns and operates across the State.
8. The Court specifically considered the appropriateness of Essential Energy's BRC approach (including underpinning modelling) in the lead up to preparing for the 2019/2020 bushfire season, and as currently applied. This included consideration of a new modelling approach being introduced by Essential Energy.

Communications and Warnings

9. This topic has previously been considered by the Earlier Inquiries, including the NSW Bushfire Inquiry and the Royal Commission. Evidence was heard of the difficulties fire authorities had communicating with each other, as well as the extensive damage to power lines, leading to power outages and associated impacts to communications systems. These communications failures also left communities feeling vulnerable and isolated. A number of recommendations were made following those Earlier Inquiries.
10. Further consideration of this topic was given by the Court in the context of the Kangawalla, Diehard Fire where, during extreme weather conditions on 8 November 2019, a fire previously thought to be contained, rapidly intensified and engulfed the Wyaliba commune causing the deaths of Vivien Chaplain and George Nole. Evidence within the brief suggests that the residents of Wyaliba received little to no warning that the Fire was rapidly bearing down upon them.
11. The issues considered by the Court included the process of issuing emergency alerts, the adequacy of RFS communications and emergency warnings on 8 November 2019, and the adequacy of RFS communications systems between ground crews in the field and/or FCCs.
12. This hearing took place in the context of changes to the Australian Fire Danger Rating System that had occurred since the conclusion of the Earlier Inquiries.

Fire Prediction Modelling

13. The topic of fire prediction modelling is an area of complex science and of enormous importance to the way in which future fire seasons will be approached. This issue was considered by the earlier NSW Bushfire Inquiry and recommendations were made.
14. The Court considered this topic in the context of:
 - a. the Kangawalla, Diehard Fire; in particular, the period between 7 and 8 November 2019, which resulted in the deaths of Ms Chaplain and Mr Nole;
 - b. the Badja Forest Fire, between 30 and 31 December 2019, which resulted in the deaths of six individuals – Colin Burns, Ross Rixon, Patrick Salway, Robert Salway, Richard Steele, and John Smith; and
 - c. the Currowan State Forest Fire, also between 30 and 31 December 2019, which saw the deaths of Laurance Andrew, John Butler and Michael Campbell.
15. The issues of specific focus for consideration by the Court included the adequacy of the RFS process for identifying when fire prediction is prepared, whether the RFS fire predictions performed were adequate and reasonable, whether the RFS process for communicating fire predictions was adequate to enable warnings to be communicated, and the adequacy of the process for communicating warnings.
16. The hearing also considered the adequacy of steps taken by the RFS to implement the earlier recommendations, together with important developments to fire prediction modelling that have occurred since the 2019/2020 bushfire season.

Vehicle Design and Safety

17. The safety of those who volunteer to risk their lives to protect their communities was the focus of several recommendations from the earlier NSW Bushfire Inquiry.
18. The Court considered the topic in the context of the following:
 - a. Geoffrey Keaton and Andrew O'Dwyer, who died responding to the Green Wattle Creek, Lake Burragorang Fire on 19 December 2019 after the RFS truck they were travelling in was struck by a burning tree at Wilson Drive, Buxton. Their colleagues, Carlos Quinteros, Benjamin Fraser, and Timothy Penning, were also seriously injured;
 - b. Samuel McPaul, who died responding to the Green Valley, Talmalmo Fire on 30 December 2019. His RFS truck was lifted from the ground by FGVs and overturned onto its roof. Andrew Godde and Rodney O'Keefe were also seriously injured; and
 - c. Darryl Aldridge and Irene Pachos, firefighters from FRNSW, who sustained serious injuries in a separate incident on 10 November 2019 after a tree fell onto their appliance whilst they were responding to the Kian Road, South Arm Fire.
19. In each of the three incidents, the vehicle's cabin was partially crushed. This raises the issue of the adequacy of the design of firefighting vehicles to protect those who dedicate themselves to the service of their community.
20. The issues of specific focus for the Court included compliance of fire appliance design during the 2019/2020 bushfire season, whether those designs were (and are) fit for purpose or otherwise adequate, whether the earlier NSW Inquiry Recommendation about vehicle design and safety is sufficient, and whether any other recommendations were warranted.
21. The hearing also considered the adequacy of steps taken by RFS to implement the earlier recommendations and ongoing research being undertaken into cabin protection.

Backburning Operations – Planning and Execution

22. The topic of backburning was considered during the NSW Bushfire Inquiry and recommendations were made to the RFS for enhancing firefighting strategies in severe conditions and that further research be undertaken on the risks and benefits of backburning to inform future protocols and training.
23. The Court considered the topic in the context of two strategic backburns implemented by firefighting authorities in 2019 under the control and direction of the RFS, namely:
 - a. the Grose Valley, Mount Wilson Fire which was the result of a backburn implemented on 14 December 2019 by firefighting authorities under the control and direction of the RFS and in response to the Gaspers Mountain (Wollemi National Park) Fire; and
 - b. the Currowan Fire and a backburn implemented on 30 – 31 December 2019 at Yatte Yattah in response by firefighting authorities under the control and direction of the RFS.
24. The specific issues that were considered by the Court included:
 - a. strategies to control the spread of fire during the 2019/2020 season;
 - b. containment strategies to control the spread of the southern edge of the Gaspers Mountain Fire and the state-wide context for responding at the time;
 - c. reasonableness of the strategy change and its implementation at Mount Wilson;
 - d. containment strategies to control the easterly spread of the Currowan Fire and the state-wide context for responding at the time; and
 - e. reasonableness of the strategy change, resources for its execution and its implementation at Yatte Yattah.
25. The hearing also considered the steps taken by the RFS to implement the earlier recommendations, together with the establishment of protocols for tactical and strategic backburning that draw on the lessons from the 2019/2020 fire season.

3. Hearing overview

1. The Stage 2 hearings took place during 19 – 21, 23 and 28 September 2022, 29 March 2023, 4 and 6 April 2023, and 15 – 19 and 22 – 25 May 2023. Closing submissions were heard during 7 – 10 August 2023.

4. Conclusion

1. Since the 2019/2020 bushfire season there have been many positive developments undertaken through the implementation of the Recommendations from the Earlier Inquiries, including, in particular by the RFS and the NSWPF. I now address each of the Stage 2 issues identified above.

Part 10

Stage 2 Representative
case study hearings

10

1. Investigation of fires by the NSW Police Force and NSW Rural Fire Service

Why was a general inquiry held?

1. A general inquiry was held under section 32(3) of the Act into the Creewah Cluster of Fires with respect to the investigation of fires by the NSWPF.
2. General inquiries were held under section 32(3) of the Act into the Mount Mackenzie Road, Tenterfield Fire and the Grose Valley, Mount Wilson Fire with respect to the investigation of fires by the RFS.

What issues did the inquiry examine?

3. Prior to the commencement of the inquiry a list of issues was circulated amongst the interested parties, identifying the scope of the inquest and the issues to be considered. That List identified the following issues:

Investigation of Fires (Police) – Creewah Cluster

1. *Guidance to the NSWPF statewide as to the nature and scope of investigations into fires to be undertaken across the 2019/2020 bushfire season.*
2. *The circumstances in which the NSWPF were required to report fires to the Coroner across the 2019/2020 bushfire season.*
3. *The process of allocating and pursuing police investigations into fires that crossed LGAs, Police Districts and/or Police Area Command boundaries.*
4. *Information sharing between the NSWPF and the RFS as to naming conventions for bushfires and access to ICON records once fires merge.*
5. *Are recommendations desirable to ensure greater collaboration between the NSWPF and the RFS in the course of the NSWPF undertaking bushfire cause and origin investigations?*

Other

6. *Whether it is otherwise necessary or desirable for the Coroner to make recommendations pursuant to section 82 of the Coroners Act 2009 (NSW) in relation to any matter connected with these fire inquiries.*

Investigation of Fires (RFS) – Mount Mackenzie Road, Tenterfield and Grose Valley, Mount Wilson

7. *The purpose behind RFS fire investigations and the authority to conduct such investigations including:*
 - a. *investigations into the cause and origin of a fire;*
 - b. *fire scene investigations of the point at which a fire is believed to have crossed from one LGA boundary into another LGA or from an area subject to a s.44 declaration to another area;*
 - c. *any fire investigation required when a fire is thought to be an extension of another fire, though annexed and managed as a separate incident in ICON; and*
 - d. *the process for determining which type of investigation will be carried out.*

8. *The process for conducting a cause and origin investigation requested by the NSWPF, including:*
 - a. *the process for determining when a fire investigation, instead of a cause and origin investigation, will be undertaken;*
 - b. *the process for communicating when a requested cause and origin investigation cannot be complied with (whether in whole or in part) and if reasons should be provided; and*
 - c. *the process that applies when it is agreed a joint investigation will be undertaken between RFS and the NSWPF.*
9. *The training and qualifications of RFS AFIs, including:*
 - a. *the qualifications and experience required to be an AFI;*
 - b. *the training (including refresher training) provided to AFI;*
 - c. *whether an AFI should set out in a cause and origin investigation report any reasonable hypothesis as to cause and origin, including evidence both for and against that hypothesis;*
 - d. *the communications that should occur between the AFI and the NSWPF (or other relevant party) about seizing physical exhibits and/or undertaking further investigations that the AFI reasonably believes are necessary in order to determine cause and origin;*
 - e. *whether a AFI should include in a cause and origin investigation report detail of relevant discussions with other people at a fire investigation scene, where such discussions might include information that supports or detracts from a hypothesis about cause and origin; and*
 - f. *the steps a AFI should take, after having prepared a cause and origin investigation report, if they receive information that causes them to change the views expressed in that report.*
10. *Allocation of AFIs to particular matters including:*
 - a. *the process for allocating an AFI to investigate a particular fire; and*
 - b. *whether an AFI has discretion to vary the scope of the investigation or request changes to the scope of the investigation if preliminary investigations suggest this is warranted.*
11. *Are recommendations desirable to ensure greater collaboration between the NSWPF and the RFS in the course of the NSWPF undertaking bushfire cause and origin investigations?*

Other

12. *Whether it is otherwise necessary or desirable for the Coroner to make recommendations pursuant to section 82 of the Coroners Act 2009 in relation to any matter connected with these fire inquiries.*

4. Each of these issues is discussed in further detail below.

Cause and Origin Investigations by the NSW Police Force

ISSUE 1

Guidance to the NSWPF state-wide as to the nature and scope of investigations into fires to be undertaken across the 2019/2020 bushfire season.

Investigations generally

5. The NSWPF Force Handbook requires that all bushfires are investigated, regardless of whether they are 'reportable' to the Coroner.¹¹²
6. Strike Force Tronto is the NSWPF's perennial, ongoing response to bushfire investigation.¹¹³ Officers that work within Tronto are particularly experienced in the investigation of fire-related crime, including arson and wildfires (or bushfires).¹¹⁴ The strike force is 'scalable' in that it can be expanded depending upon the demands of a particular bushfire season or having regard to other operational factors.
7. Strike Force Tronto do not conduct all fire investigations on behalf of the NSWPF. Local police districts retain an important role in conducting cause and origin fire investigations where Strike Force Tronto are not conducting a particular investigation. Cause and origin investigations are typically the responsibility of local police in the area or district where a fire originated.
8. Strike Force Tronto's role includes educating local PACs and Police Districts as to the respective roles of the officers from Tronto and local police officers in the course of any bushfire investigation.
9. In terms of support to local investigators, Strike Force Tronto aims to provide a 72-hour response to fires. This typically means Strike Force officers will attend a local command to assist local detectives in the early investigation and decide whether to lead the investigation themselves or provide other assistance.¹¹⁵
10. In the lead up to any bushfire season, the NSWPF and other government agencies participate in an annual briefing at RFS headquarters.¹¹⁶
11. DCI Richard Puffett, from the Arson Unit in the Financial Crime Squad at the NSWPF gave evidence that in an 'average' season, it was expected that every bushfire notified to the NSWPF would undergo some kind of investigation, ideally by the forensically-trained FETS, regardless of the size of the fire.¹¹⁷
12. DCI Puffett gave evidence that his expectation as to the minimum level of investigation to be conducted by local police should include:
 - a. a COPS event recording the fire;
 - b. attendance at scene; and
 - c. involvement of crime scene or fire scene forensic investigators to examine the scene unless it was clearly a case of an accidental fire.¹¹⁸

¹¹² Transcript for 19 September 2022 T 693-4; Exhibit 60A – Brief of Evidence at p. 18–133.

¹¹³ Transcript for 19 September 2022 T 689.

¹¹⁴ Transcript for 19 September 2022 T 689.

¹¹⁵ Transcript for 19 September 2022 T 691.

¹¹⁶ Transcript for 19 September 2022 T 690.

¹¹⁷ Transcript for 19 September 2022 T 697–698.

¹¹⁸ Transcript for 19 September 2022 T 698.

13. DCI Puffett also gave evidence that it was expected that local police officers would speak to the RFS to see if there was relevant information to obtain from first responders to the fire.¹¹⁹ and to seek assistance from Strike Force Tronto or the RFS to obtain lightning strike data where this was indicated as a potential cause.¹²⁰

The 2019/2020 season

14. In the lead up to the 2019/2020 bushfire season, the briefing between the RFS and the NSWPF suggested that the upcoming season as “*potentially above average*”.¹²¹ According to DCI Puffett, the scale of fires that occurred during the 2019/2020 bushfire season wasn’t “*strikingly apparent*” in advance.¹²²
15. Well in advance of the usual bushfire season, on 16 September 2019 Strike Force Tronto had to warn local police that the majority the state had entered a Bushfire Danger Period early.¹²³ In this email correspondence, police were reminded of resources such as the ‘Bushfire Hub’.¹²⁴ Included on the Bushfire Hub was a document titled ‘Bushfire Reporting and Investigation Guidelines’. That document included coronial bushfire reporting criteria that were developed in 2003 and remained in force at the commencement of the 2019/2020 bushfire season.¹²⁵
16. Other information distributed by Strike Force Tronto in advance of the season included an annual, general preparation email outlining individual command responsibilities and the availability of Strike Force Tronto to assist. Additionally, DCI Puffett sent or authorised state-wide emails as the season progressed, including emails reminding police of the coronial bushfire reporting criteria.¹²⁶
17. The unprecedented scale of the 2019/2020 season meant that not every bushfire notified to the NSWPF underwent investigation. According to police records, 2,367 bushfire incidents were reported to police on COPS, along with thousands of NSW RFS fire reports. Legal action was taken in relation to at least 470 bushfire related offences.¹²⁷
18. Strike Force Tronto investigators managed investigations into the fire-related deaths and the 14 of the largest fires in the southern region. A seconded group of 20 detectives were then put in place to review all the other fires in the state and provide local detectives and investigators support to ensure that local fires were adequately investigated.¹²⁸ This ‘Review and Support’ team also proactively identified fires that might not have been separately reported to local police and spoke directly to affected police commands to ensure that investigations were adequately undertaken.¹²⁹
19. The investigations into Postman’s Trail and Big Jack Mountain Fires reveal how the demands placed upon police impacted their ability to conduct fire investigations in the 2019/2020 season. DCI Puffett attributed such failures to the intensity of the bushfire season, lack of awareness, and the fact that many of the bushfires burnt for months and overlapped with each other, at times creating confusion about responsibilities.¹³⁰

CONCLUSION

The NSWPF have an established, systematic approach to investigating fires which utilises a specialist team as well as local area commands. Understandably, the unprecedented and unpredictable scale of the 2019/2020 season meant that effectiveness of fire investigations and the operation of these teams was impacted in some instances.

¹¹⁹ Transcript for 19 September 2022 T 698.

¹²⁰ Transcript for 19 September 2022 T 699.

¹²¹ Transcript for 19 September 2022 T 688.

¹²² Transcript for 19 September 2022 T 688.

¹²³ Transcript for 19 September 2022 T 669; Exhibit 60A - Brief of Evidence at p. 18-127.

¹²⁴ Transcript for 19 September 2022 T 697; Exhibit 60A - Brief of Evidence at p. 18-128.

¹²⁵ Transcript for 19 September 2022 T 695.

¹²⁶ Exhibit 60A, Brief of Evidence at p. 18-207-18-208; Transcript for 19 September 2022 T 691-2.

¹²⁷ Exhibit 60A, Brief of Evidence at p. 14.

¹²⁸ Transcript for 19 September 2022 T 690.

¹²⁹ Transcript for 19 September 2022 T 690.

¹³⁰ Transcript for 19 September 2022 T 697.

ISSUE 2

The circumstances in which the NSWPF were required to report fires to the Coroner across the 2019/2020 bushfire season.

Criteria for reporting fires

20. At the time of the 2019/2020 bushfire season, each of the following NSWPF documents provided criteria for the reporting of fires to the Coroner:
- the NSW Police Force coronial bushfire reporting criteria of 2003;¹³¹
 - the NSW Police Force Handbook, which included a chapter on ‘Coroner’s Matters’;¹³²
 - Strike Force Tronto’s 2019/2020 *Bushfire Reporting & Investigation SOP*;¹³³
 - the MOU on *Joint Agency Fire Investigation in New South Wales* (2018).¹³⁴
21. The coronial bushfire reporting criteria of 2003 were considered to be the guiding criteria for reporting of bushfires. Those criteria provided:¹³⁵
- Police will report Bushfires to the Coroner in the following circumstances:*
- *When there is death or injury to any person,*
 - *When the cause and origin of the bushfire are unclear,*
 - *Where criminality is suspected,*
 - *At the request of the Minister, Fire Commissioner or State Coroner.*
22. Somewhat unfortunately, the Police Handbook, Strike Force Tronto’s SOPs and the 2018 MOU each referred to different criteria for the reporting of fires to the Coroner. Some of the differences between the documents may be able to be understood by supposing that the criteria are intended to apply to different types of fires. For example, the Police Handbook refers to reporting criteria including the monetary value of property damage, and therefore potentially intends to apply to fires other than bushfires.¹³⁶ However, the Handbook uses the language of “*fires and explosions*” without specificity. Adding to the lack of clarity, the Handbook goes on to provide separate reporting criteria relevant to structural fires. The distinction of what fires fall within the categories of “*fires and explosions*”, when ‘structural fires’ and ‘bushfires’ are separately identified,¹³⁷ is not readily apparent.
23. Further, DCI Puffett acknowledged that within Strike Force Tronto’s 2019/2020 Bushfire Investigation SOP, another slightly different set of criteria for fires to be ‘disseminated’ to the Coroner was included.¹³⁸ This set of criteria was different to the coronial bushfire reporting criteria of 2003.¹³⁹
24. DCI Puffett raised concerns with the Court as to the effect of the coronial bushfire reporting criteria of 2003 across the 2019/2020 season.¹⁴⁰ In particular, DCI Puffett raised concern that “*most bushfires from the 2019/2020 season [had] not been reported to the Coroner, even where there [had] been significant and extensive property damage*”.¹⁴¹ Given that many fires were known to have been caused by lightning strike, the 2003 criteria did not require these fires to be reported even in circumstances where they had led to extensive property damage.

¹³¹ Exhibit 60A, Brief of Evidence at p. 14.

¹³² Exhibit 60A, Brief of Evidence at p. 18-132.

¹³³ Exhibit 60A, Brief of Evidence at p. 18-115.

¹³⁴ Exhibit 60A, Brief of Evidence at p. 18-152.

¹³⁵ Exhibit 60A, Brief of Evidence at p. 14.

¹³⁶ Exhibit 60A, Brief of Evidence at p. 18-132.

¹³⁷ Exhibit 60A, Brief of Evidence at p. 18-133.

¹³⁸ Transcript for 19 September 2022 T 700.

¹³⁹ Exhibit 60A, Brief of Evidence at p. 18-115.

¹⁴⁰ Exhibit 60A, Brief of Evidence at p. 18-1.

¹⁴¹ Exhibit 60A, Brief of Evidence at p. 18-1.

Updates since the 2019/2020 bushfire season

25. The coronial bushfire reporting criteria applicable to the 2019/2020 season were updated twice in 2022 in response to the State Coroner's Bulletin No. 22.¹⁴² The updates to the criteria now provide that a fire must be reported to the Coroner:

Where there is a fire or explosion that has damaged or destroyed property, including bushland, within NSW and:

- *A person dies or is seriously injured as a result of the fire or explosion;*
- *The fire or explosion has a significant impact upon the local community or relates to a systemic health or safety issue that is of public interest; or*
- *The Attorney General, NSWPF Commissioner or delegate, Commissioner of Fire and Rescue NSW, Commissioner of NSW Rural Fire Service or the NSW State Coroner requests the report of the fire or explosion.*

26. At the time of this inquiry, the NSWPF advised that a revised version of the Police Handbook would likely be published at the end of February 2023, which would incorporate the new coronial reporting criteria.¹⁴³ Strike Force Tronto's 2022/2023 SOP were updated in November 2022 to incorporate the reporting criteria in Bulletin No. 22.¹⁴⁴ Police had also received communications about the new reporting criteria prior to the 2022 fire season.¹⁴⁵

CONCLUSION

It is clearly desirable that there is consistency and clarity within NSWPF documents for the criteria for reporting fires to the Coroner. There is also a need for the criteria to adequately capture the fire events that most significantly impact the community and therefore warrant coronial investigation, and the updates to the coronial bushfire reporting criteria are helpful in this respect. I note the steps undertaken by the NSWPF to update their procedures since the 2019/2020 season, and due to these updates, I do not consider that any recommendations are necessary.

ISSUE 3

The process of allocating and pursuing police investigations into fires that crossed LGAs, Police Districts and/or PAC boundaries.

27. As noted, the responsibility for police investigations into fires lies with the local area command where that fire originated. Difficulties arise in this process where there is confusion as to the origin of a fire, the cause of their ignition (for example, spotting from an established fire) or where fires cross command boundaries. Confusion can be increased due to the naming conventions used to describe fires.
28. The Creewah and Postmans Trail Fires are an example where spotting from a fire in one district (the Creewah Fire) travelled to ignite a fire in another police district (the Postmans Trail Fire).
29. Establishing that a fire is in fact a spot over requires investigation. Spot overs are traditionally considered to be part of the originating fire and therefore the police command where the fire initially ignited would have ownership.¹⁴⁶ However this does not remove the need for the 'spot over' police command to cooperate with the originating command and investigate, in particular map, the area of the fire that falls within their command.¹⁴⁷

¹⁴² Exhibit 62, State Coroner's Bulletin No 21 signed 1 September 2022 – Stage 2 Investigations of Fires (Police); Exhibit 65, NSW State Coroner's Bulletin 22 signed 11 October 2022 – Stage 2 Investigations of Fires (Police).

¹⁴³ Submissions of the Commissioner of Police, NSW Police Force (17 February 2023) at [14].

¹⁴⁴ Submissions of the Commissioner of Police, NSW Police Force (17 February 2023) at [15].

¹⁴⁵ Submissions of the Commissioner of Police, NSW Police Force (17 February 2023) at [16]-[17].

¹⁴⁶ Transcript for 19 September 2022 T 703-4.

¹⁴⁷ Transcript for 19 September 2022 T 703-4.

30. DCI Puffett referred to this process as the PAC or Police District in which the fire originated ‘owning’ that investigation. Where fires cross area boundaries, it is expected that the commands cooperate to ensure adequate resources are made available for investigation of both cause and origin and impact on persons and properties.¹⁴⁸
31. Unfortunately, the investigation into the Postmans Trail Fire was so delayed (for understandable reasons) that no investigation of the suspected scene of ignition was undertaken. Therefore there was no determination as to whether it was the result of a spot over from the Creewah Fire which commenced in the neighbouring Police District. It follows that there was no coordination between investigating police in neighbouring districts.

CONCLUSION

The NSWPF process for allocating investigations into fires is clear, however confusion can arise due to circumstances of the fire itself. Such confusion can potentially be alleviated through cooperation between PACs and ensuring at least preliminary investigations are undertaken into fires suspected of being spot overs, to establish that fact ahead of the investigation reverting to the originating police area command.

ISSUE 4

Information sharing between the NSWPF and the RFS as to naming conventions for bushfires and access to ICON records once fires merge.

Naming conventions and the use of ICON

32. The Court heard that names for fires are automatically generated by ICON once a 000 call is logged. The name generated is derived from the address identified by the caller as the likely scene of the fire. The generated name can be manually overridden by an operator when further information is received providing a different location or more precise details.¹⁴⁹
33. RFS Assistant Commissioner Ben Millington gave evidence that the general practice within the RFS to name a fire based upon a geographical area is important in generating community awareness of the fire.¹⁵⁰
34. The Court heard that some officers from Strike Force Tronto faced difficulties when accessing information in ICON, which then delayed their investigations.¹⁵¹ Officers expressed some frustration that they spent time and effort investigating what they understood to be separate fires, only to belatedly discover the fires had been renamed by the RFS as they crossed LGA boundaries or were otherwise split and renamed in order to be managed via separate IMTs. Conversely, when two or more fires merged and were being managed as one fire, police reported that it was difficult to access information specific to the time prior to the fires having merged. Such information, covering things like the identification, reporting and early responses to individual fires whilst still in their infancy, is of obvious importance to any cause and origin investigation.
35. More broadly, having clarity regarding naming conventions is important for the prioritisation of resources. The NSWPF may determine it is appropriate to prioritise investigations of new ignitions ahead of fires that have merely been renamed as they have spread across LGA boundaries.

¹⁴⁸ Exhibit 60A, Brief of Evidence at p. 16–17.

¹⁴⁹ Transcript for 20 September 2022 T 756.

¹⁵⁰ Transcript for 20 September 2022 T 756-7.

¹⁵¹ Transcript for 20 September 2022 T 758.

36. Assistant Commissioner Millington gave evidence that ICON retains data from all fires from the period prior to any merge into a larger fire, however this information is accessed through a different part of ICON.¹⁵² Assistant Commissioner Millington agreed that in the 2019/2020 season, ICON became unwieldy because the system was having to manage many fires which burned for extended periods. He nonetheless said that overall the ICON system held up well and collated a substantial number of records.¹⁵³
37. Assistant Commissioner Millington gave evidence that the RFS regularly conducts ICON training and awareness sessions for the NSWPF and other agencies. During this inquiry, he welcomed a further opportunity to provide more comprehensive training to the NSWPF arson officers and others.¹⁵⁴ I consider this proposal has merit.
38. The NSWPF have advised that ICON refresher training courses took place in February 2023 with the RFS.¹⁵⁵

Automated information sharing

39. The Court also heard evidence about a potential for improved information sharing between the NSWPF and the RFS in relation to RFS call outs to bushfires, via the RFS Comms Centre and the Police CAD system.
40. This type of automated information sharing exists between the NSWPF and FRNSW, whereby the FRNSW CAD system automatically activates a notification to the NSWPF CAD system when an appliance is dispatched to a fire. In this way, “*police will be called to a house fire at the same time that the Fire and Rescue crew is called*”.¹⁵⁶
41. I consider that a similar initiative with respect to RFS appliances being dispatched has merit.
42. This is not to suggest that should similarly be dispatched in response to every RFS call out. As DCI Puffett stated:¹⁵⁷

‘It is challenging because, as you can imagine with bushfires, you may get multiple calls to one – and there’s much more volume involved. So we’ve got to look into the mechanics of that to make sure that our Police aren’t overloaded in the regions with attending fires where they might not be a need.’
43. Assistant Commissioner Millington gave evidence confirming there is scope to automate information sharing between the RFS and the NSWPF CAD systems.¹⁵⁸ The RFS have indicated that they will investigate this process.¹⁵⁹
44. The NSWPF advised that procedures for improved information sharing are underway between the two agencies.¹⁶⁰ Personnel from the NSWPF and the RFS were collaborating to enable the RFS to provide the NSWPF with significant fire data and information through a new digital mapping system developed by Strike Force Tronto.¹⁶¹ This system, which will be available for the 2023/2024 bushfire season, will allow police investigators to map fires in ‘real time’ and to visually overlay data including fire footprints, fire polygons, trend analysis, identification of ignition ‘hotspots’ and identification of LGAs, NSWPF Districts and Area Commands and RFS command boundaries.¹⁶²

¹⁵² Transcript for 20 September 2022 T 758.

¹⁵³ Transcript for 20 September 2022 T 758-9.

¹⁵⁴ Transcript for 20 September 2022 T 759, and see Submissions of the NSW RFS, NPWS and FCNSW (17 March 2023) at [14].

¹⁵⁵ Submissions of the Commissioner of Police, NSW Police Force (17 February 2023) at [22].

¹⁵⁶ Transcript for 19 September 2022 T 711.

¹⁵⁷ Transcript for 19 September 2022 T 711.

¹⁵⁸ Transcript for 20 September 2022 T 762-3.

¹⁵⁹ Submissions of the NSW RFS, NPWS and FCNSW (17 March 2023) at [15], [26].

¹⁶⁰ Submissions of the Commissioner of Police, NSW Police Force (17 February 2023) at [7].

¹⁶¹ Submissions of the Commissioner of Police, NSW Police Force (17 February 2023) at [23].

¹⁶² Submissions of the Commissioner of Police, NSW Police Force (17 February 2023) at [24].

CONCLUSION

I consider it necessary and desirable to make the following Recommendation:

To the Commissioner of the NSW Rural Fire Service and the Commissioner of the NSW Police Force

Recommendation 26:

That the NSW Rural Fire Service develop, and the NSW Police Force participate in, an additional ICON training and awareness session to assist officers from Strike Force Tronto navigate ICON in order to:

- a. locate information earlier recorded for individual fires that later merge and are managed on ICON as one larger fire or fire complex; and*
- b. understand NSW Rural Fire Service naming conventions used when a fire spreads across a Local Government Area or other boundary and is accordingly renamed and managed as a new fire.*

ISSUES 5 & 6

Are recommendations desirable to ensure greater collaboration between the NSWPF and the RFS in the course of the NSWPF undertaking bushfire cause and origin investigations?

Whether it is otherwise necessary or desirable for the Coroner to make recommendations pursuant to section 82 of the Coroners Act 2009 (NSW) in relation to any matter connected with these fire inquiries.

45. This topic is addressed throughout this section.

Investigation of Fires (RFS) – Mount Mackenzie Road, Tenterfield and Grose Valley, Mount Wilson

ISSUE 7(a)

The purpose behind RFS fire investigations and the authority to conduct such investigations including:

- a. investigations into the cause and origin of a fire;*

46. The 2018 MOU on Joint Agency Fire Investigation in New South Wales remains in force but a five yearly review is due in 2023.¹⁶³
47. The MOU acknowledges the jurisdiction of the RFS to operationally manage all fires and related incidents within Rural Fire Districts (other than hazardous materials incidents) within NSW. This includes investigations into the origin and cause of fires within its jurisdiction.
48. Additionally, the MOU recognises the additional responsibilities of the RFS for bushfire fighting operations and fire prevention measures citing sections 44 and 33 (likely intended as a reference to section 33A) of the RF Act. In this regard the RFS Commissioner also has statutory authority to enter land to investigate the cause or origin of a fire in order to assist in the prevention of fires.
49. The RFS Fire Investigation Manual version 4 (released in 2022) relevantly states the following in its overview: *‘The role of the fire investigator is more important than ever before. There is an increasing emphasis and legislated responsibility on fire agencies to accurately identify the origin and cause of fires they attend.’*¹⁶⁴
50. While perhaps self-evident, RFS Fire Investigation Coordinator Mark Fullagar confirmed in his evidence (and Assistant Commissioner Millington agreed) that from the RFS perspective the purpose of an investigation by an RFS Accredited Fire Investigator is to determine cause and origin, and this purpose exists independently of the obligation upon the NSWPF to investigate fires and report certain fires to the Coroner.¹⁶⁵

¹⁶³ Exhibit 61, Brief of Evidence at p. 2619.

¹⁶⁴ Exhibit 61, Brief of Evidence at p. 3085-40.

¹⁶⁵ Transcript for 20 September 2022 T 732:20-30.

51. Division 3A of the Act contemplates that RFS investigations into cause or origin of a fire will yield information that *may* assist in preventing similar fires in the future, particularly as the accumulation of information across many fires may allow the RFS and other agencies to identify particular patterns around the cause and origin of fires.
52. It follows an RFS fire investigation into the cause and/or origin of a fire has a focus that is both similar to, and distinct from, the focus that the NSWPF bring to a cause and origin investigation.
53. Each investigation shares a focus on fact finding: where did the fire start and what caused it?
54. The NSWPF are then concerned with determining whether any criminal activity relating to the fire might require further investigation and whether the fire needs to be reported to the Coroner.
55. The RFS is concerned with determining whether anything can be learned about the cause of the fire in order to assist in the prevention of fires.

CONCLUSION

Division 3A of the RF Act contemplates that RFS investigations into cause or origin of a fire will yield information that may assist in the prevention of fires.

I accept the evidence of Mr Fullagar and Assistant Commissioner Millington that the purpose of an investigation by an RFS Accredited Fire Investigator is to determine cause and origin, and this purpose exists independently of the obligation upon the NSWPF to investigate fires and report certain fires to the Coroner.

ISSUES 7(b) & (c)

The purpose behind RFS fire investigations and the authority to conduct such investigations including:

- b. fire scene investigations of the point at which a fire is believed to have crossed from one LGA boundary into another LGA or from an area subject to a s.44 declaration to another area and;*
- c. any fire investigation required when a fire is thought to be an extension of another fire, though annexed and managed as a separate incident in ICON;*

56. In his evidence, Assistant Commissioner Millington explained that from an incident management perspective, a section 44 declaration is made so that the response to the fire can be co-ordinated loosely based on Rural Fire Districts or LGA boundaries.
57. Across the 2019/2020 bushfire season, the RFS would frequently conduct cause and origin investigations at the point where a fire was believed to have crossed from one LGA into another, or from one area subject to a section 44 declaration into another area.
58. For example, with the Grose Valley, Mount Wilson Fire, the cause and origin investigation examined the scene where the Fire, suspected to have commenced as a result of a spot over from a strategic backburn along Mount Wilson Road, crossed the Grose River and spread into a new LGA and thereafter took on the name of the Grose Valley Fire.

59. Assistant Commissioner Millington was asked:

Q: If the RFS already has intel suggesting that the fire has moved from one boundary into another boundary, why do you need a cause and origin investigation to assist an Incident Management Team to coordinate the response to the fire?

A: Look, it's also to determine the cause and origin. You know there may be other reasons why that fire either crossed or ignited in an adjoining boundary. So it gives us certainly around the cause. Whilst there's an assumption that could be made that the fire has crossed, I guess in some instances there's a need for that certainty to be undertaken.¹⁶⁶

60. It was put that the same logic must apply when, as with the Fire that commenced to the east of Mount Wilson Road, a new fire is believed to have commenced as the unintended consequence of a strategic backburn.

61. Assistant Commissioner Millington and Mr Fullagar agreed at least '*in principle*'.¹⁶⁷

62. Counsel Assisting submitted that:

- a. using the Grose Valley Fire example, Assistant Commissioner Millington and Mr Fullagar each agreed that a scene examination of the point to the east of Mount Wilson Road, where the Fire commenced, would have been important as a means to exclude other possible causes, such as arson conducted under cover of wildfire. This was so even if such an investigation was unlikely to have shed light on which sector of the strategic backburn actually caused the spot over.¹⁶⁸
- b. this is not to suggest that every fire suspected to be the result of a spot over should receive a cause and origin investigation. There are likely a huge number of spot overs in the course of any large fire and there might be little to be gained from investigating instances where fire predictably behaves as anticipated in response to prevailing weather conditions.
- c. but some fires suspected to be caused by spot over from a strategic backburn introduce fire into areas long before (many hours or days before) an approaching bushfire directly threatens the area. So it was with the Fire that ignited to the east of Mount Wilson Road, arising from a strategic backburn implemented to strengthen a southern containment line in advance of the Gospers Mountain (Wollemi National Park) Fire burning to the north.
- d. as at 5:30pm on 13 December 2019, the southern perimeter of the Gospers Mountain Fire was recorded as 12 kilometres north of Bell, Mount Wilson and Mount Irvine, with an estimated forward rate of spread of 10.6 kilometres over the following three days. If the estimate eventuated, it would have left the Fire's location approximately 1.4 kilometres north of these communities by the late afternoon of 16 December 2019.¹⁶⁹
- e. thus, when the strategic backburn was lit on the morning of 14 December 2019 the southern perimeter of the (enormous) Gospers Mountain (Wollemi National Park) Fire was still likely over ten kilometres away from the communities that were ultimately heavily impacted by the strategic backburn that spotted over to the eastern side of Mount Wilson Road.

63. In answer to questions from Senior Counsel for the RFS, Mr Fullagar stated that if a backburning operation conducted in association with attempts to contain an existing fire itself causes spotting and a further fire, that would not necessarily generate a cause and origin investigation because it's a '*known spot-over*', but if there was suspicion that it may not have been a spot over, a cause and origin investigation may be sought.¹⁷⁰

64. Assistant Commissioner Millington stated '*there may be the opportunity to provide formal advice or criteria around that setting*'.¹⁷¹

¹⁶⁶ Transcript for 20 September 2022 T 749:11-26.

¹⁶⁷ Transcript for 20 September 2022 T 749:37 – 750:5.

¹⁶⁸ Transcript for 20 September 2022 T 749:44 – 750:34.

¹⁶⁹ Exhibit 56A, Brief of Evidence at p. 151.

¹⁷⁰ Transcript for 20 September 2022 T 764:16-19.

¹⁷¹ Transcript for 20 September 2022 T 764:16-19.

65. Counsel Assisting further submitted that some formal advice or criteria guiding investigations into the cause and origin of such fires should be adopted with the Grose Valley Fire illustrative of this point.
66. In the RFS Fire Investigation Report for the Grose Valley Fire, the cause and origin of the Fire was described in these terms: *'It was determined that the Grose Valley fire was a continuation of the Gospers fire, and the cause and origin of the fire would be in the Gospers fire report'*.¹⁷² Mr Fullagar and Assistant Commissioner Millington accepted that it was important for the Fire Investigation Report to provide the reader with an accurate understanding of what actually occurred at the scene.¹⁷³
67. Counsel Assisting submitted that the Grose Valley Fire occurred as the unintended consequence of a strategic backburn lit in response to the Gospers Mountain Fire and not merely as a result of the inexorable march of the Gospers Mountain Fire.
68. Counsel Assisting additionally submitted that at the very least, this should be explicitly included in the conclusion within the Fire Investigation Report detailing the cause and origin of the Grose Valley Fire. On their view, this seemed particularly important given the statutory focus within the Act upon the investigation of the cause and origin of a fire in order to assist in the prevention of fires.
69. Senior Counsel for the RFS submitted that it is important to note:
 - a. on the morning of 14 December 2019, when the backburn commenced at the junction of the Bells Line of Road and Mount Wilson Road, the SITREP for the Gospers Mountain Fire at 9:08am described the backburn as being the Bell Division of the Gospers Mountain Fire.¹⁷⁴
 - b. from the afternoon of 14 December 2019 and throughout 15 December 2019, while the Fire burnt in the Hawkesbury Rural Fire District under the control of the Hawkesbury IMT, it was known as the Gospers Mountain Fire, irrespective of whether it was part of the main fire, the backburn, or as a result of the escape of a backburn. In the Hawkesbury Rural Fire District IMT SITREPs for that period, the Fire that had spotted from the south-east of Mount Wilson Road was considered part of the Gospers Mountain Fire, within the Bell Division.¹⁷⁵
 - c. it was only on 19 December 2019 that the RFS gave the Fire burning to the south of the Grose River a new name, namely *"the Grose Valley fire"*. That new name arose because the Fire to the south of the Grose River had passed from the control of the Hawkesbury RFS and was burning within the Blue Mountains RFS District and being managed by a separate IMT under the Blue Mountains section 44 declaration.¹⁷⁶ To the extent that the escaped backburn fire was burning north of the Grose River, it continued to be managed by the Hawkesbury IMT and known as the Gospers Mountain Fire.
70. Finally, some section 44 fires underwent a desktop investigation rather than a physical scene investigation during the 2019/2020 bushfire season. Assistant Commissioner Millington explained that this might have been because there were no fatalities or significant property losses recorded, and within the context of the season, more damaging bushfires were prioritised for a scene investigation. Additionally, the declaration of a section 44 fire might have been made more for the purposes of co-ordination.¹⁷⁷
71. Assistant Commissioner Millington said that in a *'normal'* fire season, each section 44 fire would be subject to a cause and origin investigation (at the scene).¹⁷⁸

¹⁷² Exhibit 56A, Brief of Evidence at p. 24.

¹⁷³ Transcript for 20 September 2022 T 765:3-37.

¹⁷⁴ Exhibit 55A, Brief of Evidence at p. 400.

¹⁷⁵ Exhibit 55A, Brief of Evidence at p. 310-385.

¹⁷⁶ Exhibit 56A, Brief of Evidence at p. 33, 106.

¹⁷⁷ Transcript for 20 September 2022 T 731:28-45.

¹⁷⁸ Transcript for 20 September 2022 T 731:47-732:30.

CONCLUSION

Across the 2019/2020 season, the RFS would frequently conduct cause and origin investigations at the point where a fire was believed to have crossed from one LGA into another, or from one area subject to a section 44 declaration into another area.

By way of example, the cause and origin investigation into the Grose Valley, Mount Wilson Fire, examined the scene where the Fire, suspected to have commenced as a result of a spot over from a strategic backburn along Mount Wilson Road, crossed the Grose River and spread into a new LGA and thereafter took on the name of the Grose Valley Fire.

In the RFS Fire Investigation Report for this Fire, the cause and origin of the Fire was described in these terms: *'It was determined that the Grose Valley fire was a continuation of the Gospers fire, and the cause and origin of the fire would be in the Gospers fire report'*. Mr Fullagar and Assistant Commissioner Millington accepted that it was important for the Fire Investigation Report to provide the reader with an accurate understanding of what actually occurred at the scene.

I note the submissions of the RFS, however, accept the submission of Counsel Assisting that the Fire Investigation Report for the Grose Valley Fire ought to have reflected what actually occurred at the scene; that is the Grose Valley Fire occurred as the unintended consequence of a strategic backburn lit in response to the Gospers Mountain Fire.

Assistant Commissioner Millington and Mr Fullagar each agreed that a scene examination of the point to the east of Mount Wilson Road, where the Fire commenced, would have been important as a means to exclude other possible causes, such as arson conducted under cover of wildfire. This was so even if such an investigation was unlikely to have shed light on which sector of the strategic backburn actually caused the spot over.

Mr Fullagar further stated, if a backburning operation conducted in association with attempts to contain an existing fire itself causes spotting and a further fire, that would not necessarily generate a cause and origin investigation because it's a 'known spot-over', but if there was suspicion that it may not have been a spot over, a cause and origin investigation may be sought. In this context, Assistant Commissioner Millington stated *'there may be the opportunity to provide formal advice or criteria around that setting.'*

I will address the matter of recommendations separately.

ISSUE 7(d)

The purpose behind RFS fire investigations and the authority to conduct such investigations including:

d. the process for determining which type of investigation will be carried out.

72. During the 2019/2020 bushfire season, Fire Investigation Service Standard 3.1.9 version 2 was in force, having been released in 2009.¹⁷⁹ Mr Fullagar confirmed the effect of the standard was that where the senior officer of the first responding crew to a fire formed an opinion as to the likely cause of the Fire, no further fire investigation was required by the RFS.¹⁸⁰
73. If the cause was not apparent, or the Fire met other criteria set out within the standard, Mr Fullagar said the Fire would be flagged for investigation on ICON.¹⁸¹ The criteria requiring an investigation relevantly included death, serious injury, significant media or public interest, significant property damage including over \$100,000, deliberately lit or suspicious fires and section 44 fires.¹⁸²
74. Not all fires the subject of the Court's inquiries received an RFS scene investigation, notwithstanding the criteria under Service Standard 3.1.9 version 2. Mr Fullagar agreed that AFI availability during the 2019/2020 season was insufficient to allow all fires meeting the criteria to be the subject of a scene investigation by an AFI, with the result that the RFS had to prioritise which fires received an AFI review.¹⁸³

¹⁷⁹ Exhibit 61, Brief of Evidence at p. 2967; Transcript for 20 September 2022 T 728:40 – 729:43.

¹⁸⁰ Transcript for 20 September 2022 T 729; Exhibit 61, Brief of Evidence at p. 3971.

¹⁸¹ Transcript for 20 September 2022 T 729:43:47.

¹⁸² Exhibit 61, Brief of Evidence at p. 3971.

¹⁸³ Transcript for 20 September 2022 T 730:49 – 731:45.

75. Priority was given to incidents involving fatalities, significant property loss and those fires resulting in section 44 declarations.¹⁸⁴ As noted above, some section 44 fires in fact received a desktop investigation.

CONCLUSION

Not all fires the subject of the Court's inquiries received an RFS scene investigation, notwithstanding the criteria under RFS Service Standard 3.1.9 version 2.

I accept the evidence of Mr Fullagar that AFI availability during the 2019/2020 season was insufficient to allow all fires meeting the criteria to be the subject of a scene investigation by an AFI, with the result that the RFS had to prioritise which fires received an AFI review.

Priority was given to incidents involving fatalities, significant property loss and those fires resulting in section 44 declarations, and some section 44 fire received a desktop investigation.

ISSUES 8(a) & (b)

The process for conducting a cause and origin investigation requested by the NSWPF, including:

- a. the process for determining when a fire investigation, instead of a cause and origin investigation, will be undertaken; and*
- b. the process for communicating when a requested cause and origin investigation cannot be complied with (whether in whole or in part) and if reasons should be provided; and*

76. In addition to using an AFI to physically attend the scene to conduct a cause and origin investigation or undertaking a desktop cause and origin investigation, Matthew O'Donnell, Capability Manager with the RFS undertook a "factual investigation". The following excerpts detail the scope of his investigation:

Investigation

On Saturday 14 December 2019, on the Gaspers Mountain Fire (ICON No. 19102652934) within the Hawkesbury Local Government Area, a breach of the southern containment line occurred resulting in the Mt Wilson and Bilpin communities being impacted by fire. It was alleged that this breach of containment occurred as a result of back burning operations undertaken along Bells Line of Road and Mount Wilson Road, between Mount Wilson and Flag Staff Hill on Saturday 14 December 2019. The back burning operations formed part of the broader strategy to build a continuous southern containment line from Bell to Mount Irvine.

On 16th April 2020, the NSW Rural Fire Service (RFS) appointed Officers from the RFS to undertake an investigation into the incident to determine the sequence of events which led to the impact on the communities of Mount Wilson and Bilpin on 14 and 15 December 2019 and the circumstances surrounding the event.

Objective

This investigation was undertaken to establish a factual sequence of events, inclusive of relevant circumstances prior to and during the incident. The investigation did not seek to apportion responsibility for the incident but focused on key facts and issues.

...

¹⁸⁴ Exhibit 61, Brief of Evidence at p. 2595.

Spot Fires

It was not within the scope of this investigation to determine cause and origin based on a physical fire investigation. However, following a review of the evidence at hand, the impact on the communities of Mount Wilson, Mount Irvine, Mount Tomah, Berambing, Warawalong and Bilpin is understood to have originated from the spot overs from the back burning operation in the Bell Division on 14 December 2019 and their subsequent spread. The spot fires were a significant distance from the main fire front and the investigation was not aware of any other potential ignition sources.

The investigation encountered conflicting theories on whether the spot overs originated from the back burning in the October Sector along Mount Wilson Road or the Dalpura Sector along Bells Line of Road...¹⁸⁵

77. The Factual Investigation Report that followed has been very useful in understanding RFS decision making around the strategic backburn. It was not however within the scope of the Factual Investigation to undertake a cause and origin investigation.
78. Counsel Assisting submitted that the later provision of a detailed Factual Investigation Report from Mr O'Donnell did not obviate the need to attempt a timely investigation of the scene where the Grose Valley Fire originated to the east of Mount Wilson Road, as requested by the OIC of the Investigation, DS Laura Harvey.
79. Senior Counsel for the RFS submitted that there was never any real doubt that the spot fire was caused by spotting from the backburn:
 - a. it was witnessed by the Divisional Commander in charge of implementing the backburn, James Carter, who at 2:40pm on 14 December 2019 immediately reported to the IC, Karen Hodges that there were multiple spot overs that they had been unable to control.¹⁸⁶
 - b. Ms Hodges expressly acknowledges in her section 44 report for the Gospers Mountain Fire that the *'backburn on 14 December in the Mt Wilson area broke containment under worse than forecast weather conditions and eventually crossed Bells Line of Road and the Grose River.'*¹⁸⁷
 - c. in those circumstances, as Mr Fullagar stated, it was not something that would ordinarily generate an origin and cause investigation because it was a *'known spot-over'*.¹⁸⁸
80. Before addressing the circumstances in which the cause and origin investigation transpired, it is useful to consider the provisions of the MOU as it applied to joint agency fire investigation.
81. The MOU supports a co-operative approach between fire investigation agencies.¹⁸⁹ It states that the NSWPF and FETS investigators should work in conjunction with RFS and FRNSW AFIs to determine the cause and origin of a fire.¹⁹⁰ It also states that joint investigations are encouraged, and on some occasions, agencies will require assistance from each other, which should be provided where practicable.¹⁹¹
82. The MOU also promotes interagency information sharing as follows:

*To the extent permitted by law, and to assist the execution of a timely and quality overall investigations, the sharing of information privy to NSW RFS and FRNSW is to be provided to NSWPF Senior Investigating Officer to progress coronial or criminal investigations ... It is agreed that the exchange of information between respective agencies will be completed in a timely manner to ensure the fire scene and ongoing investigation(s) to progress towards a successful outcome.*¹⁹²

¹⁸⁵ Exhibit 56A, Brief of Evidence at p. 147, 220.

¹⁸⁶ Exhibit 55A, Brief of Evidence at Tab 16, [26].

¹⁸⁷ Exhibit 55A, Brief of Evidence at p. 189.

¹⁸⁸ Transcript for 20 September 2022 T 764.1

¹⁸⁹ Exhibit 61, Brief of Evidence at p. 2621.

¹⁹⁰ Exhibit 61, Brief of Evidence at p. 2623.

¹⁹¹ Exhibit 61, Brief of Evidence at p. 2624.

¹⁹² Exhibit 61, Brief of Evidence at p. 2626.

83. Turning to the circumstances of the Grose Valley Fire investigation, on 23 December 2019, the OIC, emailed the fire investigation team at RFS requesting someone speak with her about the *'out of control backburn fire, either stated (sic) in Mt Wilson or Bilpin 14/15 Dec'*.¹⁹³
84. On 14 January 2020, DS Harvey emailed Officer Andrew Brady, then of the FETS,¹⁹⁴ identifying a list of locations, stating the following 'ignition point' was still outstanding: *'Grose Valley Fire – (RFS BACKBURN) – Corner of Mt Wilson Road and Bells Line of Road, Mt Tomah'*.¹⁹⁵
85. By email dated 15 January 2020, DSS Susan Guillaumier emailed Cheryl Cook, then Supervisor at RFS FICU, identifying the Grose Valley Fire, with the same location supplied in DS Harvey's email, as an *'outstanding wildfire to be examined'*.¹⁹⁶
86. Despite this, and for reasons unknown, no fire scene examination at the point of interest identified by DS Harvey has ever been undertaken.¹⁹⁷
87. Nor was DS Harvey advised, by FETS or by RFS, that the scene examination that she was waiting for was of a different scene to that which she requested. Counsel Assisting submitted that at the very least, DS Harvey should have been advised of the change in plan so that she could advocate for an investigation at the corner of Mount Wilson Road and Bells Line of Road. This need not have replaced an investigation of the scene where the Fire was thought to have crossed the Grose River and entered into another LGA. It could have been in addition to the investigation at that site.
88. Assistant Commissioner Millington and Mr Fullagar agreed that DS Harvey should have been notified of an intention to vary the planned investigation scene that she had originally nominated.¹⁹⁸ They agreed that this would have been consistent with the MOU and the focus on shared decision making between the fire investigation agencies.¹⁹⁹
89. Assistant Commissioner Millington offered that there were a number of conversations occurring between the RFS and the NSWPF that led to this advice not being communicated to DS Harvey.²⁰⁰ As the emails annexed to DS Harvey's supplementary statement demonstrated, often she was not included in email chains between FETS of the NSWPF and the RFS FICU.²⁰¹
90. Additionally, it appears the preference during 2019/2020 was for the NSWPF to communicate with FICU via Strike Force Tronto's review team to streamline communication between the agencies.²⁰²
91. Counsel Assisting submitted that the Grose Valley Fire, Mount Wilson, highlights systemic issues impacting upon cause and origin investigations where a fire commences as an unintended result of an RFS strategic backburn. In such circumstances there is merit in the decision making around the use of the strategic backburn and its implementation being independently reviewed.
92. Counsel Assisting noted that a factual investigation was later undertaken by a senior RFS member unconnected to the IMT responsible for managing the Gospers Mountain or Grose Valley Fires. Nonetheless, at least from a community perspective, this still looks like the RFS investigating the actions of the RFS. In such circumstances, an independent investigation by the NSWPF, including consideration of whether a report to the Coroner is warranted, is important.
93. Counsel Assisting submitted it would thus be worthwhile to emphasise (within the MOU, the NSWPF Handbook, and Strike Force Tronto SOP for Bushfire Reporting & Investigations) that fires thought to have commenced as the unintended consequence of a strategic backburn by the RFS (or any other agency or person), may raise a systemic safety issue that is of public interest and which should therefore be referred to the Coroner pursuant to criteria B of the State Coroner's Bulletin No 22. In this way the community can be assured that someone independent of the RFS will be at least considering the circumstances in which the strategic backburn was planned and executed.

¹⁹³ Exhibit 56A, Brief of Evidence at p. 3485.

¹⁹⁴ Transcript for 20 September 2022 T 718:47-48.

¹⁹⁵ Exhibit 56A, Brief of Evidence at p. 3489.

¹⁹⁶ Exhibit 56A, Brief of Evidence at p. 3492.

¹⁹⁷ Transcript for 20 September 2022 T 747:14-33.

¹⁹⁸ Transcript for 20 September 2022 T 747:49–748:32; 751:28-40.

¹⁹⁹ Transcript for 20 September 2022 T 748:24-32.

²⁰⁰ Transcript for 20 September 2022 T 748:41-43.

²⁰¹ Exhibit 56A, Brief of Evidence at Tab 72.

²⁰² Exhibit 56A, Brief of Evidence at p. 3501.

94. Senior Counsel for the RFS submitted it is not clear that DS Harvey's request for an origin and cause investigation of the spot over was ever understood as being understood in that way by anyone at the RFS. In relation to the evidence of the request:
- a. on 14 January 2020, DS Harvey emailed Mr Brady of NSWPF FETS saying that the *'ignition point' '1 Grose Valley Fire-(RFS BACKBURN) Corner of Mt Wilson Road and Bells Line of Road, Mt Tomah'* was still to be done.
 - b. on the same day, Mr Brady emailed various police officers, including DSS Guillaumier and DS Harvey, identifying *'Outstanding Wildfires to be examined'*, including *'1 Grose Valley Fire-(RFS BACKBURN) Corner of Mt Wilson Road and Bells Line of Road, Mt Tomah'*.²⁰³
 - c. on 15 January 2020, DSS Guillaumier emailed Ms Cook (then supervisor at the RFS FICU) also identifying the Grose Valley Fire as an *'outstanding wildfire to be examined'* however, in her description of the Fire she removed the brackets *'(RFS BACKBURN)'* so that it read *'1 Grose Valley Fire-Corner of Mt Wilson Road and Bells Line of Rd, Mt Tomah'*.²⁰⁴
95. Senior Counsel for the RFS further submitted:
- a. the request identified an address *'Corner of Mt Wilson Road and Bells Line of Rd, Mt Tomah'* that was not in fact the location of the Grose Valley Fire. That fire administratively commenced as a separate fire on 19 December 2019, when fire crossed the Grose River and the RFS named fire burning to the south of the Grose River, the Grose Valley Fire.
 - b. while the evidence was silent as to why there was no origin and cause investigation in relation to the spot over, a likely explanation is that it was as a result of a misunderstanding, rather than a deliberate decision to ignore a request. From the RFS' perspective an investigation into the cause and origin of the Grose Valley Fire was an investigation into where the Fire crossed the Grose River on 19 December 2019, which is what occurred. However, the RFS accepts as a general proposition that where a deliberate decision is made not to undertake an investigation following a request from the NSWPF, the Police officer making the request should be informed.

CONCLUSION

Mr O'Donnell undertook a factual investigation to *'determine the sequence of events which led to the impact on the communities of Mount Wilson and Mount Bilpin on 14 and 15 December 2019 and the circumstance surrounding the event'*.

Mr O'Donnell commented in his report that *'It was not within the scope of this investigation to determine cause and origin based on a physical fire investigation. However, following a review of the evidence at hand, the impact on the communities of Mount Wilson, Mount Irvine, Mount Tomah, Berambing, Warawalong and Bilpin is understood to have originated from the spot overs from the back burning operation in the Bell Division on 14 December 2019 and their subsequent spread. The spot fires were a significant distance from the main fire front and the investigation was not aware of any other potential ignition sources.'*

On 14 January 2020, a request was made by the OIC, DS Harvey to Police FETS for a cause and origin investigation to be undertaken at the *'ignition point' '1 Grose Valley Fire -(RFS BACKBURN) Corner of Mt Wilson Road and Bells Line of Road, Mt Tomah'*.

On 15 January 2020, DSS Guillaumier emailed Ms Cook (then supervisor at the RFS FICU) also identifying the Grose Valley Fire as an *'outstanding wildfire to be examined'* however, in her description of the Fire she removed the brackets *'(RFS BACKBURN)'* so that it read *'1 Grose Valley Fire-Corner of Mt Wilson Road and Bells Line of Rd, Mt Tomah'*.

The evidence is silent as to why there was no cause and origin investigation in relation to the spot over. To theorise would result in impermissible speculation or conjecture.

²⁰³ Exhibit 55A, Brief of Evidence at p. 3488.

²⁰⁴ Exhibit 55A, Brief of Evidence at p. 3491.

I accept the following propositions:

- a. where a decision by the RFS is made not to undertake a cause and origin investigation following a request from the NSWPF, the Police officer making the request should be informed; and
- b. there is utility in emphasising within the MOU, the NSWPF Handbook, and Strike Force Tronto SOP for Bushfire Reporting & Investigations that fires thought to have commenced as the unintended consequence of a strategic backburn by the RFS (or any other agency or person), may raise a systemic safety issue that is of public interest, and which should therefore be referred to the Coroner pursuant to criteria B of the State Coroner's Bulletin No 22.

The NSWPF indicated that they would consider amending their procedures and the MOU to include the above issues, should recommendations be made.

The first recommendation above put forward by Counsel Assisting was agreed by RFS save for a further matter, namely to include proposition (b) which will assist the NSWPF in understanding whether the backburn led to a significant escalation of the fire, which is a matter addressed below in relation to Recommendation 12(b).

I am persuaded that the proposed Recommendation is necessary and desirable. I make that Recommendation in slightly amended terms to account for the further matter raised by the RFS.

To the Commissioner of the NSW Rural Fire Service and the Commissioner of the NSW Police Force

Recommendation 25:

That in the course of undertaking the five yearly review of the Memorandum of Understanding, Joint Agency Fire Investigation in New South Wales consideration be given to:

- a. *directly incorporating the provisions of State Coroner's Bulletin No 22–October 2022;*
- b. *expressly recording that a bushfire suspected of having started as an unintended result of a strategic backburn may meet criteria requiring a report to the Coroner as relating to a safety issue that is of public interest;*
- c. *providing that in such cases where there is suspicion of a bushfire having started as an unintended result of a strategic backburn, the NSW Police Force may request modelling from the Rural Fire Service to consider what might have occurred if the backburn had not occurred; and*
- d. *noting that the Officer-in-Charge of any Police Investigation into a bushfire must be notified (whether by Forensic Evidence and Technical Services Command or by NSW Rural Fire Service or both) in the event that a cause and origin examination of a particular scene requested by the Officer-in-Charge is not going to occur as contemplated by the request.*

The below Recommendation 12(a) put forward by Counsel Assisting was agreed by the RFS.

In respect of Recommendation 12(b), the RFS proposed alternative wording. Senior Counsel for the RFS submitted that in respect of Counsel Assisting's proposed recommendation there is a link suggested between escaping backburns and investigations into fires crossing LGA boundaries, which is what occurred in the case of the Gospers Mountain/Mount Wilson backburn/Grose Valley Fires. However, other than the fact that it occurred in that fire, there is no necessary logical link between the two.

In principle, the RFS agreed that there will be cases where a separate investigation into how a fire came to burn outside of control lines is justified, provided it is kept within sensible limits. As Counsel Assisting noted, during any large fire there are likely to be a huge number of spot fires and there would be little to gain from investigating the vast majority of those spot fires.

The RFS submitted as Counsel Assisting acknowledged, the difficulty is determining what the sensible limits are, given fires spread by spotting all the time, and in many instances it will be difficult to know whether the spotting occurred from a backburn or from the main fire. Further, even where a spot fire has eventuated from a strategic backburn, that would not justify an origin and cause investigation where it is clear what has occurred and there was no question of the spot fire significantly escalating the Fire.

I am persuaded that the proposed Recommendation is necessary and desirable. I make that Recommendation in the slightly amended terms proposed by the RFS.

To the Commissioner of the NSW Rural Fire Service

Recommendation 12:

That the NSW Rural Fire Service review Standard Operating Procedures 3.1.9 to:

- a. incorporate matters referred to in Recommendations 11 and 25(d); and
- b. provide that, where it is suspected that a wildfire has breached containment lines or proposed containment lines, leading to a significant escalation of a fire, the Fire Investigation and Compliance Unit should consider:
 - i. asking an Authorised Fire Investigator to examine the scene of the containment line breach to determine the cause of the breach; and
 - ii. asking the NSW Rural Fire Service Predictive Services Unit to undertake modelling to consider what would have occurred if the backburn in question had not been done.

It follows from Recommendation 25 that the NSWPF should update their SOP to incorporate the new matters proposed not already encompassed in the SOP. Accordingly, I make the following Recommendation:

To the Commissioner of the NSW Police Force

Recommendation 24:

That the NSW Police Force review any related Standard Operating Procedures to incorporate matters referred to in Recommendation 25(b) to (d).

ISSUE 8(c)

The process for conducting a cause and origin investigation requested by the NSWPF, including:

- c. the process that applies when it is agreed a joint investigation will be undertaken between RFS and the NSWPF.

96. While the MOU uses the language of ‘joint investigations’,²⁰⁵ I note that police investigators and the RFS run separate, though ideally cooperative, investigations.²⁰⁶ The NSWPF have sole jurisdiction to investigate fires that may be reportable to the Coroner.²⁰⁷ The Court heard that ‘joint investigations’ more aptly describes endorsed cooperation between scene investigators and joint attendances of NSWPF FETS and RFS AFIs,²⁰⁸ which are the Police OIC’s responsibility to coordinate.²⁰⁹
97. Using the Grose Valley Fire example, an OIC will usually make a request for a joint fire investigation between FETS and the RFS. The offices of those investigators will then agree on a time and place to progress the investigation and will usually attend the relevant RFS FCC to speak with the IC and obtain maps, coordinates and other necessary information. They will often be accompanied to the scene by a firefighter who had early involvement in the Fire.
98. Counsel Assisting submitted that the Grose Valley Fire demonstrates however, how such arrangements can unfortunately go awry.

²⁰⁵ Exhibit 61, Brief of Evidence at p. 2624.

²⁰⁶ See, for example, division 3A of the *Rural Fires Act* which provides for the Commissioner of the RFS to investigate cause and origin of fires.

²⁰⁷ Transcript for 19 September 2022 T 707.

²⁰⁸ Transcript for 20 September 2022 T 707-8.

²⁰⁹ Transcript for 20 September 2022 T 707-8.

CONCLUSION

Using the Grose Valley Fire example, an OIC will usually make a request for a joint fire investigation between FETS and the RFS. The offices of those investigators will then agree on a time and place to progress the investigation and will usually attend the relevant RFS FCC to speak with the IC and obtain maps, coordinates, and other necessary information. They will often be accompanied to the scene by a firefighter who had early involvement in the Fire.

In the context of the Grose Valley Fire, it appears to me that there is opportunity to clarify such arrangements.

ISSUE 9(a)

The training and qualifications of RFS AFIs, including:

a. the qualifications and experience required to be an AFI; and

99. Mr Fullagar gave evidence that a person applying to be an AFI must be an RFS member (staff or volunteer) of Crew Leader qualification with a minimum five years' experience in fighting wildfires and wildfire behaviour, and the competency in protecting and preserving an incident scene.²¹⁰
100. An applicant applies by submitting an expression of interest through their District Office to their Area Command for approval. The EOI is then supplied to the FICU.²¹¹
101. Once accepted into the AFI course, the applicant participates in a blended learning course. The first part is an online component with two online theory assessments.²¹² The second is a three-day, face-to-face fire scene examination exercise. At the time of the hearing, these courses were being offered in Dubbo, the Central Coast and near Cooma. The locations are properties in which the course facilitators can arrange for the land to be burnt in advance of the course. Students are then instructed on how to read macro and micro indicators in the landscape in order to ultimately determine an area of origin and likely cause for the Fire.²¹³
102. Applicants are ultimately later examined on their ability to examine two separate fire scenes, write a fire investigation report, write a statement, and give evidence in a mock court setting.²¹⁴
103. Once the applicant is deemed competent, the FICU puts a submission to the Deputy Commissioner of Field Operations for the applicant's approval as an AFI.²¹⁵
104. Ongoing development is encouraged once an AFI is appointed. Mr Fullagar explained that new AFIs are encouraged to get out to as many fire scenes as possible. FICU aims to initially pair new AFIs with a more experienced AFI on the early jobs to further develop their skills.²¹⁶ These aims might not, however, always be met.
105. Mr Fullagar said all fire investigation reports are '*technically and administratively*' reviewed by FICU to meet the unit's service requirements. The chain of reasoning leading to a hypothesis or conclusion is reviewed, as well as the coherence of photographs and their descriptions, as well as matters such as correct grammar.²¹⁷
106. Assistant Commissioner Millington added that the AFI course underwent a comprehensive review in the prior 18 months, in line with the National Competency and Training Standards.²¹⁸

²¹⁰ Transcript for 20 September 2022 T 733:50 – 734:3.

²¹¹ Transcript for 20 September 2022 T 734:14-25.

²¹² Transcript for 20 September 2022 T 734:29 – 735:3.

²¹³ Transcript for 20 September 2022 T 735:5 – 736:24.

²¹⁴ Transcript for 20 September 2022 T 736:23-50.

²¹⁵ Transcript for 20 September 2022 T 735:49 – 736:2.

²¹⁶ Transcript for 20 September 2022 T 737:5-36.

²¹⁷ Transcript for 20 September 2022 T 738:11-35.

²¹⁸ Transcript for 20 September 2022 T 738:1-34.

CONCLUSION

I accept Mr Fullagar's evidence that a person applying to be an AFI must be an RFS member (staff or volunteer) of Crew Leader qualification with a minimum five years' experience in fighting wildfires and wildfire behaviour, and the competency in protecting and preserving an incident scene.

To attain this qualification, the applicant participates in a blended learning course. The first part is an online component with two online theory assessments. The second is a three-day, face-to-face fire scene examination exercise. Applicants are ultimately later examined on their ability to examine two separate fire scenes, write a fire investigation report, write a statement, and give evidence in a mock court setting.

Ongoing development is encouraged once an AFI is appointed.

All fire investigation reports are technically and administratively reviewed by FICU to meet the unit's service requirements.

The AFI course has undergone a comprehensive review in line with the National Competency and Training Standards.

ISSUE 9(b)

The training and qualifications of RFS AFIs, including:

b. the training (including refresher training) provided to AFIs;

107. At a minimum, AFIs are required to undertake at least one fire investigation per year. If this is not possible, they are encouraged to get on 'burnt ground' and practise their skills in the identification of indicators and document what they have done on scene. FICU has been monitoring this since 2018 and is in the process of 'fine tuning' this monitoring process, Mr Fullagar explained.²¹⁹
108. Assistant Commissioner Millington gave evidence that AFIs engage in professional development opportunities including at the State Fire Investigation Forum held in Dubbo earlier in 2022. That forum included sessions addressing skills maintenance and awareness and had opportunities for professional development sessions with the NSWPF and other agencies.²²⁰
109. Such forums are hosted annually across the state by the RFS.²²¹

CONCLUSION

At a minimum, AFIs are required to undertake at least one fire investigation per year. If this is not possible, they are encouraged to get on 'burnt ground' and practise their skills in the identification of indicators and document what they have done on scene. The FICU has been monitoring this since 2018 and is currently 'fine tuning' this process.

AFIs also engage in professional development opportunities. The RFS hosts a State Fire Investigation Forum annually.

²¹⁹ Transcript for 20 September 2022 T 737:33 – 739:34.

²²⁰ Transcript for 20 September 2022 T 739:6-22.

²²¹ Transcript for 20 September 2022 T 740:3.

ISSUE 9(c)

The training and qualifications of RFS AFIs, including:

- c. *whether an AFI should set out in a cause and origin investigation report any reasonable hypothesis as to cause and origin, including evidence both for and against that hypothesis; and*

110. As already outlined above, Mr Fullagar agreed in his evidence that it is important that the AFI include within their report relevant evidence that may support or detract from their hypothesis as to fire causation, in addition to setting out the chain of reasoning that the AFI has employed in order to reach their conclusion. This is so that the rigour of their conclusion can be understood by someone reading the report.²²²
111. This is an obvious minimum requirement if the report is to be independently ‘*technically and administratively*’ reviewed to determine that the chain of reasoning leading to the ultimate conclusion is adequately explained.
112. For example, in relation to the Mount Mackenzie Road, Tenterfield Fire, Mr Fullagar agreed that if the AFI had formed the opinion that the most probable cause of the Fire was accidental transmission as a result of powerline arcing and it transpires that the AFI had a conversation with energy workers present at the scene at the time the investigation suggesting that no network fault had occurred, ideally that is intelligence that should be included within the AFI’s fire investigation report as being one factor that might support or detract from the hypotheses as to fire causation.²²³

CONCLUSION

I accept the evidence of Mr Fullagar that it is important that AFIs include within their report relevant evidence that may support or detract from their hypothesis as to fire causation, in addition to setting out the chain of reasoning that the AFI has employed in order to reach their conclusion.

ISSUE 9(d)

The training and qualifications of RFS AFIs, including:

- d. *the communications that should occur between the AFI and the NSWPF (or other relevant party) about seizing physical exhibits and/or undertaking further investigations that the AFI reasonably believes are necessary in order to determine cause and origin; and*

113. RFS AFIs do not have a formal evidence-collection role like the NSWPF and therefore are necessarily limited in what they can seize from a scene. The 2009 RFS SOP 3.1.9-6 *Handling of Exhibits relevantly provided:*

It is not the role of the AFI to take custody of Exhibits or suspect items relating to the cause of the fire found in or near the area of origin. Should an AFI find an item suspected of being associated with the cause of a fire, NSW Police should be immediately notified and requested to take the item into their custody. If the evidence is at risk of being damaged or destroyed, the AFI may take the item to the nearest Police station after consulting with Police, and they must follow appropriate evidence handling procedures, including completing a chain of custody form.²²⁴

²²² Transcript for 20 September 2022 T 743:46-50.

²²³ Transcript for 20 September 2022 T 743:34-50 – 744:1-11.

²²⁴ Exhibit 61 – Brief of Evidence at p. 3977.

114. This is particularly important in circumstances where the NSWPF OIC of the Investigation might lack experience in bushfire cause and origin investigations and is therefore assisted by the RFS AFI advising which exhibits should be seized, particularly in the absence of a FETS officer.
115. For example, in relation to the Mount Mackenzie Road, Tenterfield Fire, the RFS AFI at the scene used a magnet to collect metal fragments from different points of interest, which were then provided to the NSWPF. In his evidence, Mr Fullagar agreed that if those fragments were thought to be significant enough that the NSWPF should be asked to secure them as an exhibit, the fire investigation report should ideally explain the potential relevance.²²⁵
116. Similarly, it is useful for the NSWPF to share with the RFS AFI information of potential relevance to a cause and origin investigation (although noting that police cannot be compelled to share confidential information subject to an ongoing criminal investigation). The MOU supports information-sharing between the NSWPF and the RFS as follows:²²⁶
- It is agreed that (notwithstanding the sensitive nature of any ongoing criminal or coronial investigations) the NSWPF may also supply relevant information to the FRNSW and/or NSW RFS Fire investigators to assist them in their origin and cause determination ... It is agreed that the exchange of information between respective agencies will be completed in a timely manner to ensure the fire scene and ongoing investigation(s) to progress towards a successful outcome.*
117. In acknowledging that the NSWPF OIC may be relatively inexperienced in fire investigation and may not understand the significance of evidence they are taking from witnesses at the scene, Mr Fullagar agreed that it can be part of the AFI's contact with the NSWPF to inquire about what information has been obtained in the course of their investigation that the NSWPF may not know enough about to volunteer to the AFI in the first place.²²⁷
118. For example, witnesses at the scene of the Mount Mackenzie Road, Tenterfield Fire saw the Fire in its early stages and made attempts to extinguish it. None of those witnesses reported seeing any flash of light or hearing any noise that may have been associated with arcing (noting that the AFI had formed the opinion that the most probable cause of the Fire was accidental transmission as a result of powerline arcing). If that evidence had been communicated to the AFI, that information would be of potential relevance as to the cause of the Fire being recorded as powerline arcing and is the type of information that should ideally be shared between the NSWPF and the AFI, with which Mr Fullagar agreed.²²⁸
119. Further, a number of witnesses to the Mount Mackenzie Road, Tenterfield Fire had travelled to the scene in an older style car which they had pulled over somewhere along the verge at the side of Mount Mackenzie Road near where the Fire had started. Their presence at the scene was something that ideally should have been shared with the AFI if considering the possibility of exhaust or mechanical cause for the Fire, with which Mr Fullagar agreed.²²⁹
120. Additionally, if at the scene of any fire the AFI believes there would be benefit in soil samples being taken, as was the case in relation to the Mount Mackenzie Road, Tenterfield Fire, that is something that the AFI should be discussing with the NSWPF OIC or the FETS officer, if present, with which Mr Fullagar also agreed.²³⁰

²²⁵ Transcript for 20 September 2022 T 744:49-50 – 745:1-6.

²²⁶ Exhibit 61, Brief of Evidence – General at p. 2626.

²²⁷ Transcript for 20 September 2022 T 745:27-43.

²²⁸ Transcript for 20 September 2022 T 745:8-25.

²²⁹ Transcript for 20 September 2022 T 746:32-39.

²³⁰ Transcript for 20 September 2022 T 746:41-46.

121. In response to a question from Counsel Assisting as to how the RFS would inculcate the need for AFIs to be proactive and themselves ask the NSWPF OIC what sort of information they have obtained, Mr Fullagar said this would come from the AFI's experience working with the NSWPF. Ultimately, Mr Fullagar agreed that it would be useful, and certainly could be included, within RFS AFI training if AFIs are encouraged to be in contact with the NSWPF OIC and ask what sort of information might have been collected to date and it would be up to the NSWPF as to what information they would volunteer in reply. In relation to this, Mr Fullagar agreed that it would be important to encourage AFIs to be exploring with the NSWPF what sort of evidence they might have to assist the AFI in their investigation.²³¹

ISSUE 9(e)

The training and qualifications of RFS AFIs, including:

- e. whether an AFI should include in a cause and origin investigation report detail of relevant discussions with other people at a fire investigation scene, where such discussions might include information that supports or detracts from a hypothesis about cause and origin; and ...*

122. The 2021 Service Standard 3.1.9 (which came into force after the 2019/2020 bushfire season) includes provision, by way of a template form, for canvassing reports of persons who have provided relevant information at the scene. Mr Fullagar explained that the obligation to canvass reports existed in the prior standard applicable in 2019/2020, and this information would have been recorded as a contemporaneous note. Mr Fullagar added that the requirement has been made more explicit in the current standard.²³²
123. The updated RFS Fire Investigation Manual draws a distinction between canvassing witnesses, which involves screening of witnesses, as opposed to interviewing witnesses, which is the role of the NSWPF.²³³ Mr Fullagar agreed that this is not to suggest that the AFI has any particular role in canvassing witnesses themselves at the scene, although, Mr Fullagar acknowledged that such interactions between AFIs and witnesses may occur in limited circumstances if, for instance, investigating police have not arrived at the scene but a witness is volunteering information to the AFI. Mr Fullagar said any witnesses or first responders to a fire should be canvassed by the AFI to ascertain what they saw, what they observed and what they may have heard.²³⁴
124. The RFS Fire Investigation Manual version 4 (released 2022) contains detailed advice about the importance of canvassing witnesses as part of a cause and origin investigation.²³⁵ The previous version of this manual in use during the 2019/2020 bushfire season, namely, Version 1 of the Basic Wildfire Investigation Course Manual (dated 2016) also had a chapter on this topic.²³⁶

²³¹ Transcript for 20 September 2022 T 745:46-50 – 746:1-23.

²³² Transcript for 20 September 2022 T 744:20-47.

²³³ Exhibit 61, Brief of Evidence at p. 3085-91.

²³⁴ Transcript for 20 September 2022 T 744:28-35.

²³⁵ Exhibit 61, Brief of Evidence at p. 3085-90; 3085-96.

²³⁶ Exhibit 61, Brief of Evidence at p. 3776.

ISSUE 9(f)

The training and qualifications of RFS AFIs, including:

- f. the steps an AFI should take, after having prepared a cause and origin investigation report, if they receive information that causes them to change the views expressed in that report.*

125. It does not appear that a final report can be amended by an AFI after being submitted. Administratively, an RFS fire investigation report is either 'draft' or 'final' on the ICON system.²³⁷
126. Yet if later evidence causes the AFI to change their opinion on such fundamental matters as cause or origin of the Fire, it is important that the records within ICON are amended to reflect this.

CONCLUSION

Based on the evidence received, I consider the following Recommendation is appropriate:

To the Commissioner of the NSW Rural Fire Service

Recommendation 11:

That the NSW Rural Fire Service review its Authorised Fire Investigator training and consider providing refresher training to specifically incorporate the following matters:

- a. that an Authorised Fire Investigator is encouraged, as part of their canvassing, to contact the Police Officer-in-Charge of a bushfire investigation to request any information relating to origin and cause of the fire, obtained by the Officer-in-Charge up that point, that the Officer-in-Charge is prepared to release;*
- b. that an Authorised Fire Investigator may advise the Police Officer-in-Charge of a bushfire investigation of the desirability to seize exhibits if they have not already done so;*
- c. that an Authorised Fire Investigator is encouraged as part of their canvassing to contact private landowners or land tenure managers (such as the National Parks and Wildlife Service, the Forestry Corporation of NSW, or Crown Lands NSW) at the area where a bushfire is believed to have originated, to inquire about any information which may be relevant to determining the cause and origin of the bushfire;*
- d. that an Authorised Fire Investigator should include within their report any information obtained at the scene which might bear upon their conclusion as to cause and origin, even if that information is contrary to the final conclusion reached; and*
- e. the appropriate procedure to be followed when an Authorised Fire Investigator becomes aware of information, after their fire investigation report has been finalised, which causes them to change their opinion as to the cause and origin of the fire.*

²³⁷ Exhibit 61 – Brief of Evidence at p. 2597–2598.

ISSUE 10

Allocation of fire investigators to particular matters including:

- a. the process for allocating a fire investigator to investigate a particular fire; and*
- b. whether a fire investigator has discretion to vary the scope of the investigation or request changes to the scope of the investigation if preliminary investigations suggest this is warranted.*

127. The RFS does not have full-time AFIs employed solely in that capacity. Instead, salaried staff or volunteers are authorised to undertake this important work, with specific investigations allocated as the need arises. That is, once an investigation becomes necessary a call out is made seeking an AFI who might be available to travel to the scene, complete the investigation and prepare the report arising from it. This might involve the AFI in days of work away from their other employment and away from their own families and communities at times when fires might be threatening their own local area.
128. In his evidence, Mr Fullagar estimated that there were approximately 130 AFIs with the RFS during the 2019/2020 bushfire season.²³⁸ Only around ten AFIs were typically available to perform fire investigations when the call went out at any one time.²³⁹ There were six to ten AFIs who regularly made themselves available in that capacity across the season.²⁴⁰
129. Mr Fullagar said the current AFI contingent had decreased somewhat in size since then and now comprised 60 volunteers and 46 salaried staff. Again though, none worked full-time as an AFI.²⁴¹
130. The available AFIs in the 2019/2020 fire season were located around the state. While Mr Fullagar said the aim is to have an AFI in each district, this had not been achieved as at the time of the hearing²⁴² necessitating AFIs sometimes having to travel to other districts to perform investigations.
131. During 2019/2020, FICU prioritised more experienced AFIs for the bigger fire investigation jobs.²⁴³
132. Additionally, as a general practice, FICU aims to deploy two AFIs to perform a scene investigation where possible, to allow each AFI to test their hypotheses and ideas with their colleague.²⁴⁴
133. Assistant Commissioner Millington accepted, given fire seasons are becoming longer and more intense, that it was the '*natural progression*' to go down the path of considering the employment of full-time AFIs.²⁴⁵
134. That is, one can anticipate an increasing need for AFIs to undertake their important work across the state in coming years at a time when the number of AFIs available to be dispatched to a job is falling.
135. It seems clear that an AFI does not have discretion to vary the scope of the investigation they are tasked to perform by FICU.

²³⁸ Transcript for 20 September 2022 T 726:40-49.

²³⁹ Transcript for 20 September 2022 T 733:22-24.

²⁴⁰ Transcript for 20 September 2022 T 733:29-30.

²⁴¹ Transcript for 20 September 2022 T 726:40-49.

²⁴² Transcript for 20 September 2022 T 732:41-44.

²⁴³ Transcript for 20 September 2022 T 733:38:48.

²⁴⁴ Transcript for 20 September 2022 T 743:24-32.

²⁴⁵ Transcript for 20 September 2022 T, 727:24-27.

CONCLUSION

The RFS does not have full-time AFIs employed solely in that capacity. Instead, salaried staff or volunteers are authorised to undertake this important work, with specific investigations allocated as the need arises. That is, once an investigation becomes necessary a call out is made seeking an AFI who might be available to travel to the scene, complete the investigation and prepare the report arising from it.

In his evidence, Mr Fullagar estimated that there were approximately 130 AFIs with the RFS during the 2019/2020 bushfire season. Only around ten AFIs were typically available to perform fire investigations when the call went out at any one time. There were six to ten AFIs who regularly made themselves available in that capacity across the season.

Mr Fullagar said the current AFI contingent had decreased somewhat in size since then and now comprised 60 volunteers and 46 salaried staff. Again though, none worked full-time as an AFI.

Assistant Commissioner Millington accepted, given fire seasons are becoming longer and more intense, that it was the *'natural progression'* to go down the path of considering the employment of full-time AFIs.

That is, one can anticipate an increasing need for AFIs to undertake their important work across the state in coming years at a time when the number of AFIs available to be dispatched to a job is falling.

An AFI does not have discretion to vary the scope of the investigation they are tasked to perform by FICU.

Recommendations

ISSUES 11 & 12

Are recommendations desirable to ensure greater collaboration between the NSWPF and the Rural Fire Service in the course of the NSWPF undertaking bushfire cause and origin investigations?

Whether it is otherwise necessary or desirable for the Coroner to make recommendations pursuant to section 82 of the Coroners Act 2009 in relation to any matter connected with these fire inquiries.

136. Counsel Assisting submitted that although there is already effective collaboration between the NSWPF and the RFS, the 2019/2020 season highlighted some areas in which that collaboration could be further strengthened.
137. The Court heard that in respect to collaboration between the NPWS and the RFS, collaboration could be improved by encouraging routine contact by the RFS to the NPWS when investigating fires which ignited on NPWS managed land. The purpose of this contact was suggested to be for the RFS to ascertain whether the NPWS have information bearing upon the investigations. It was said that this practice already occurs in some cases where, for example, NPWS might be the first responders to a fire and remain on site when the RFS AFI attends. It was suggested that the NPWS may be in a position to assist with information of relevance arising from their specialised knowledge of the terrain or previous fire history. Both Assistant Commissioner Millington and Mr Fullagar thought this a sensible initiative which could be expanded *"more broadly to land tenure managers rather than just National Parks itself"*.²⁴⁶
138. I agree with Counsel Assisting's submission that in all the circumstances highlighted in the course of these Stage 2 hearings, recommendations are necessary and appropriate to improve the efficiency of fire investigations. Some recommendations are jointly directed to the Commissioner of the RFS and the Commissioner of the NSW Police Force, some directed separately.

²⁴⁶ Transcript for 20 September 2022 T, 752-753.

139. These Recommendations are set out above and included again here for ease of reference:

To the Commissioner of the NSW Rural Fire Service and the Commissioner of the NSW Police Force

Recommendation 25:

That in the course of undertaking the five yearly review of the Memorandum of Understanding, Joint Agency Fire Investigation in New South Wales consideration be given to:

- a. directly incorporating the provisions of State Coroner's Bulletin No 22–October 2022;*
- b. expressly recording that a bushfire suspected of having started as an unintended result of a strategic backburn may meet criteria requiring a report to the Coroner as relating to a safety issue that is of public interest;*
- c. providing that in such cases where there is suspicion of a bushfire having started as an unintended result of a strategic backburn, the NSW Police Force may request modelling from the Rural Fire Service to consider what might have occurred if the backburn had not occurred; and*
- d. noting that the Officer-in-Charge of any Police Investigation into a bushfire must be notified (whether by Forensic Evidence and Technical Services Command or by NSW Rural Fire Service or both) in the event that a cause and origin examination of a particular scene requested by the Officer-in-Charge is not going to occur as contemplated by the request.*

Recommendation 26:

That the NSW Rural Fire Service develop, and the NSW Police Force participate in, an additional ICON training and awareness session to assist officers from Strike Force Tronto navigate ICON in order to:

- a. locate information earlier recorded for individual fires that later merge and are managed on ICON as one larger fire or fire complex; and*
- b. understand NSW Rural Fire Service naming conventions used when a fire spreads across a Local Government Area or other boundary and is accordingly renamed and managed as a new fire.*

To the Commissioner of the NSW Rural Fire Service

Recommendation 11:

That the NSW Rural Fire Service review its Authorised Fire Investigator training and consider providing refresher training to specifically incorporate the following matters:

- a. that an Authorised Fire Investigator is encouraged, as part of their canvassing, to contact the NSW Police Force Officer-in-Charge of a bushfire investigation to request any information relating to origin and cause of the fire, obtained by the Officer-in-Charge up that point, that the Officer-in-Charge is prepared to release;*
- b. that an Authorised Fire Investigator may advise the NSW Police Force Officer-in-Charge of a bushfire investigation of the desirability to seize exhibits if they have not already done so;*
- c. that an Authorised Fire Investigator is encouraged as part of their canvassing to contact private landowners or land tenure managers (such as the National Parks and Wildlife Service, the Forestry Corporation of NSW, or Crown Lands NSW) at the area where a bushfire is believed to have originated, to inquire about any information which may be relevant to determining the cause and origin of the bushfire;*

- d. *that an Authorised Fire Investigator should include within their report any information obtained at the scene which might bear upon their conclusion as to cause and origin, even if that information is contrary to the final conclusion reached; and*
- e. *the appropriate procedure to be followed when an Authorised Fire Investigator becomes aware of information, after their fire investigation report has been finalised, which causes them to change their opinion as to the cause and origin of the fire.*

Recommendation 12:

That the NSW Rural Fire Service review Standard Operating Procedures 3.1.9 to:

- a. *incorporate matters referred to in Recommendation 11 and 25(d); and*
- b. *provide that, where it is suspected that a wildfire has breached containment lines or proposed containment lines, leading to a significant escalation of a fire, the Fire Investigation and Compliance Unit should consider:*
 - i. *asking an Authorised Fire Investigator to examine the scene of the containment line breach to determine the cause of the breach; and*
 - ii. *asking the NSW Rural Fire Service Predictive Services Unit to undertake modelling to consider what would have occurred if the backburn in question had not been done.*

To the Commissioner of the NSW Police Force

Recommendation 24:

That the NSW Police Force review any related Standard Operating Procedures to incorporate matters referred to in Recommendation 25(b) to (d).

140. I wish to express my sincere gratitude to those who have aided and provided information to the Court to assist with the general inquiry that considered the topic of the Investigation of Fires by the NSW Police Force and the NSW Rural Fire Service.

2. Bushfire Risk Classification

Why was a general inquiry held?

1. A general inquiry was held under section 32(3) of the Act *into the Failford Road, Darawank Fire in respect to the adequacy of Essential Energy's BRC system, including the modelling which underpins that system.*
2. Over almost three weeks from 26 October 2019, the Failford Road, Darawank Fire burnt approximately 3,000 hectares in the MidCoast LGA encompassed within the lands of the Worimi People. At least 16 structures were destroyed or damaged, including homes in Failford, Darawank and Hallidays Point and surrounds.
3. The weight of the evidence during the Failford Road, Darawank Fire Inquiry indicated that the Fire was caused by at least one but possibly two tree branches falling onto powerlines alongside Failford Road. This resulted in arcing which emitted embers onto dry foliage below the powerlines, igniting the Fire. A combination of high temperatures and gusting winds quickly pushed the Fire to the east, and the Fire took hold.
4. The powerlines (conductors) formed part of Essential Energy's electricity distribution network. Since May 2018, and potentially as early as 2014, branches overhung the powerlines at the very location of the point of ignition of the Failford Road, Darawank Fire. Under Essential Energy's vegetation management program, there was no requirement that the overhanging branches be removed or cut back. The branches were outside minimum clearance zones, but still close enough to hit the conductors when they fell.
5. Essential Energy's BRC system informs the application of Essential Energy's vegetation management program, by which it seeks to minimise the bushfire risk posed by its electrical infrastructure. As well as considering cause and origin, the Court examined this issue as part of a general inquiry into the Failford Road, Darawank Fire during the Stage 2 representative case study hearings.

What issues did the inquiry examine?

6. Prior to the commence of the General Inquiry, a list of issues was circulated amongst the interested parties, identifying the scope of the inquiry and the issues to be considered. That Issues List identified the following issues:

Bushfire Risk Classification – Failford Road, Darawank

1. *The appropriateness of Essential Energy's BRC approach (including underpinning modelling) in the lead up to preparing for the 2019/2020 bushfire season, and as currently applied; and*

Other matters

2. *Whether it is otherwise necessary or desirable for the Coroner to make recommendations pursuant to section 82 of the Coroners Act 2009 in relation to any matter connected with these fire inquiries.*

7. Each of these issues is discussed in further detail below.
8. The following witnesses gave oral evidence on 28 September 2022:
 - a. Mr Paul de Mar, Court-appointed expert, Bushfire Risk and Vegetation Management Consultant;
 - b. Mr Jason Sharples, Court-appointed expert in dynamic bushfire behaviour and extreme bushfire development, and Professor of Bushfire Dynamics at the University of New South Wales, Canberra; and
 - c. Mr Ian Fitzpatrick, Manager of Network Risk Strategy at Essential Energy.

ISSUE 1

The appropriateness of Essential Energy's BRC approach (including underpinning modelling) in the lead up to preparing for the 2019/2020 bushfire season, and as currently applied.

9. Evidence adduced during the case and origin hearing into the Failford Road, Darawank Fire, suggested that the branch or branches which caused the Fire, had been overhanging the powerlines for some time. There was no requirement in Essential Energy's own policies that it remove or cut back those branches due to the branches being outside minimum clearance zones.
10. Those policies included a vegetation management program which stipulates the different levels of vegetation management (such as clearance distances around Essential Energy infrastructure) required depending on a BRC for specific area. Essential Energy's BRC procedure classifies its network into four categories of bushfire risk as follows:
 - a. P1: high risk severity;
 - b. P2: moderate risk severity;
 - c. P3: low risk severity; and
 - d. P4: non-bushfire prone.²⁴⁷
11. The level of vegetation maintenance taken by Essential Energy varies depending upon the classified risk level. For example, a 'clear to sky' approach is adopted for all sub-transmission bare conductors (33kV to 132kV) within an area classified as P1 high risk (see image below).²⁴⁸

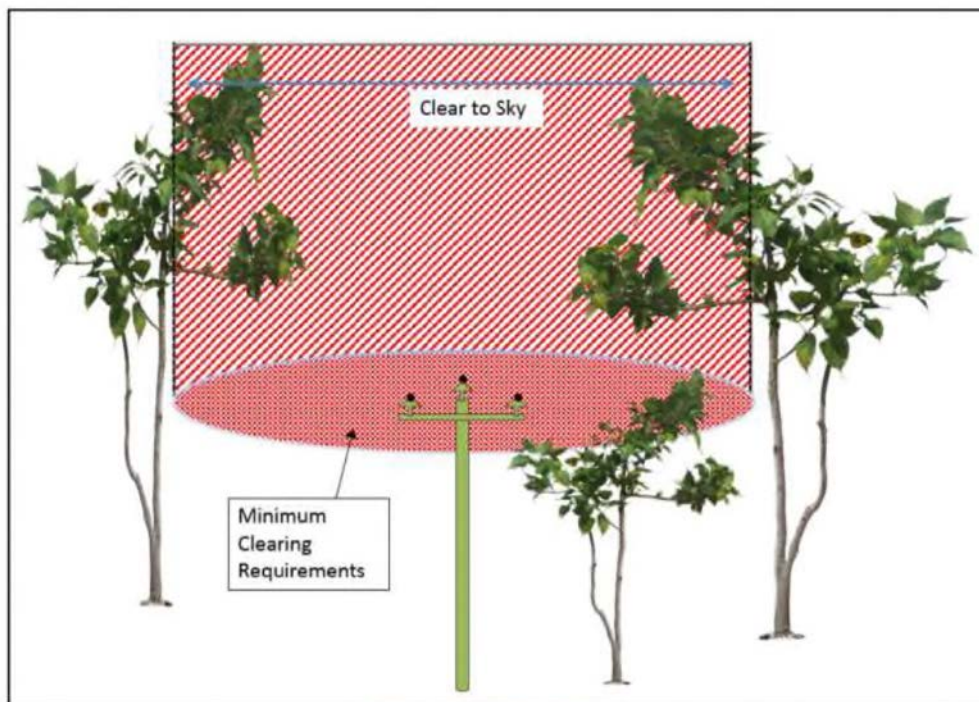


Figure 1: Clear to Sky

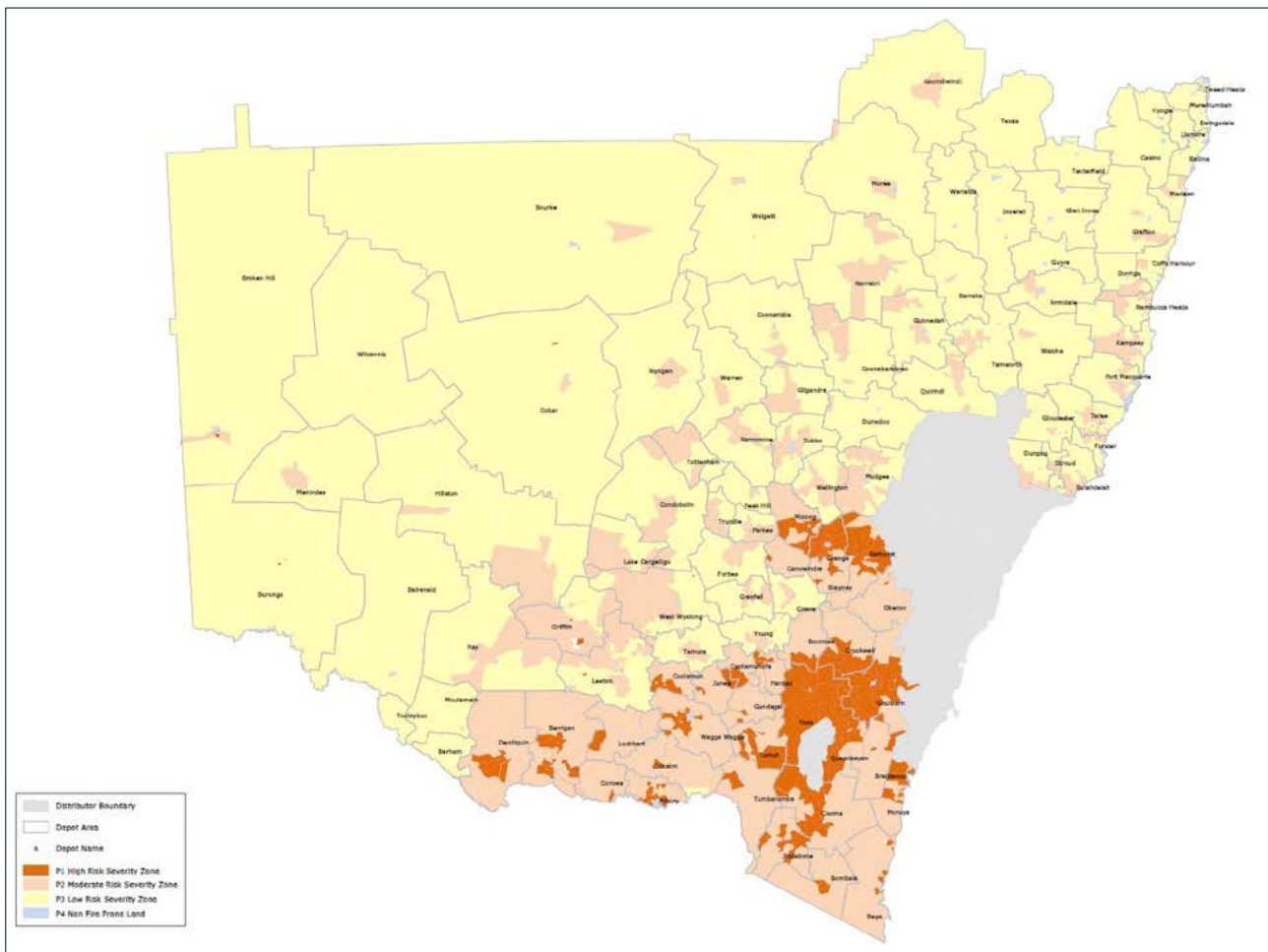
12. P1 high risk areas tend to be concentrated around the south-eastern part of the state as highlighted in the map contained in the *Essential Energy Operational Procedure – Bushfire Risk Management Plan* (CEOP8022)²⁴⁹ (and depicted in the image below):

²⁴⁷ Exhibit 49A, Brief of Evidence at p. 222.

²⁴⁸ Exhibit 49A, Brief of Evidence at p. 21-162, 21-168.

²⁴⁹ Exhibit 49A, Brief of Evidence at p. 21-72.

Map of Risk Prioritisation Zones



13. In the lead up to the 2019/2020 bushfire season, Essential Energy also conducted a PSBI Program which provided an additional layer of risk management in areas with a P1 (high risk severity) BRC.
14. There is no suggestion in the evidence that Essential Energy failed to comply with its vegetation management policy in relation to the tree that sparked the Darawank Fire. The power lines identified as the likely cause of the Fire, were located within an area classified by Essential Energy as P2, being moderate risk severity. Under that classification, there was no requirement to keep the area above conductors ‘clear to sky’, nor was there a requirement for a PSBI.
15. This raised the issue of whether the Essential Energy’s system for BRC (and the modelling which underpinned it) was appropriate and fit for purpose in the lead up to the 2019/2020 bushfire season and whether it is currently fit for purpose.
16. In determining the classifications for its network, Essential Energy draws upon a consequence-based model developed by the University of Melbourne (in consultation with RFS) using software known as Phoenix RapidFire Software. This is complemented by Essential Energy’s own Fire Risk Model.
17. The Phoenix RapidFire Software produces, amongst other things, a Phoenix HLI.
18. The Fire Risk Model is a likelihood-based system informed by historical network fire starts and TOBAN declarations. It produces, amongst other things, an Internal Fire Risk Profile Regional Map.
19. A combination of the results from each model produces the priority rating (P1 to P4) for particular areas of the state and the infrastructure contained therein.
20. There is evidence that neither were, nor are, fit for purpose.

Phoenix House Loss Index

21. The Phoenix HLI is in general terms based on:
 - a. NSW data taken from five dates in January and October 2013; and
 - b. models of fire behaviour and spread using the Phoenix RapidFire Software, developed from house surveys undertaken in the aftermath of the 2009 Victorian Black Saturday Fires.
22. Professor Sharples, court-appointed expert, opined that the Phoenix HLI is not and was not appropriate and fit for purpose in the lead up to preparing for the 2019/2020 bushfire season. He identified two primary issues.
23. First, instead of the Phoenix HLI's generalised risk assessment based on five bad fire days across the State, there should be a more focussed climatological analysis of regional fire conditions. This is because there is no guarantee that the five days that the Phoenix HLI relies upon are going to be representative of the worst fire conditions across every part of the state.²⁵⁰ Professor Sharples said that *'what would normally be done is you would look at all the data available across the whole State, and try and make some ... inferences about what's the worst fire conditions for particular regions based on all the available data'*.²⁵¹ That data includes temperature, humidity, wind speed, and drought factor over a climatologically meaningful period (which could be in the order of 30 years).
24. Second, the model used was dependent upon probabilistic models developed by Tolhurst and Chong in 2011²⁵² and assumes that embers are a lesser factor in causing house loss than current research suggests. In the view of Professor Sharples, more recent studies, particularly after the Canberra fires in 2003, provide a *'strong picture that a lot of house loss or the majority of house loss, is actually resulting from ember attack'*.²⁵³
25. This evidence as to the limitations of the Phoenix HLI was largely unchallenged. In response, Ian Fitzpatrick, Manager of Network Risk Strategy at Essential Energy, identified how the classifications were developed, particularly Essential Energy's understandable reliance upon expert advice.²⁵⁴
26. Essential Energy did not specifically address the two direct criticisms identified above.
27. It may be that the criticisms will become redundant with the development of a new approach to BRC adopted and sponsored by the ENA in 2019/2020, known as the IGNIS Project.
28. It is important to note that even if the limitations in the modelling identified above had been addressed prior to the 2019/2020 season, Professor Sharples opined it is unlikely that it would have led to a different BRC for Essential's Energy's electrical infrastructure along Failford Road. Two of the bad fire days relied upon in the model, were days with extremely High FFDI indicators (99.3 and 99.5 percentile) which were comparable to those experienced during the initial stages of the Darawank Fire.²⁵⁵

²⁵⁰ Transcript for 28 September 2022 T 906:24-26.

²⁵¹ Transcript for 28 September 2022 T 906:8-11.

²⁵² Tolhurst KG, Chong DM (2011) Assessing potential house losses using PHOENIX RapidFire. In 'Proceedings of Bushfire CRC & AFAC 2011 Conference Science Day', 1 September 2011, Sydney, NSW, Australia (Bushfire Cooperative Research Centre: Sydney, NSW, Australia).

²⁵³ Transcript for 28 September 2022 T 906:48 - 907:1.

²⁵⁴ Exhibit 49A, Brief of Evidence at p. 1188.

²⁵⁵ Exhibit 49A, Brief of Evidence at p. 1140.

29. With specific reference to the geographic area of Taree (and encompassing where the Darawank Fire burnt), Professor Sharples considered that the simulated scenarios appeared appropriate. This, outcome, however, in Professor Sharples' view was purely a '*matter of happenstance rather than one assured by the analytical methodology employed*'.²⁵⁶ It would not be true for other areas of the state. Accordingly, there is still a need to update the modelling.
30. Mr de Mar, court-appointed expert, expressed a similar view to Professor Sharples, but on a different basis. In his view, Essential Energy's fire risk likelihood methodology and mapping does not adequately account for regional differences across the State. This is based on the view that it substantially under-classifies bushfire risk when compared to planning documents such as statutory bushfire risk management plans.
31. There are clearly limitations to the extent to which risk classifications for electrical infrastructure can be compared to strategic planning documents developed by local authorities. Mr Fitzpatrick correctly observed that the two systems have different objectives. The statutory planning documents are typically focussed on the management of fuel loads and hazards across the local area, and not specifically the management of the risk arising from electrical infrastructure.²⁵⁷
32. Mr de Mar's other primary concern in relation to the Phoenix HLI was that the higher classifications appeared to be based on a modelled level of house loss that is excessively high and out of step with bushfire history in NSW. The Phoenix Level 1 classification, modelling a fire resulting in house loss exceeding 2,000 houses, and Level 2 classification, modelling a fire resulting in house loss between 500 to 2,000 houses, were both excessively high in circumstances where no single fire in NSW has ever destroyed more than 500 houses. Further, no single fire in Australia's history has ever destroyed 2,000 houses.
33. In response to this, Mr Fitzpatrick emphasised that Essential Energy is focussed on the relative difference in risk, using worst case scenario modelling. Irrespective of any overstatement, the model would still identify those parts of the network which might be multiple times the risk of another part of the network elsewhere in the state, in terms of potential community damage and loss.²⁵⁸

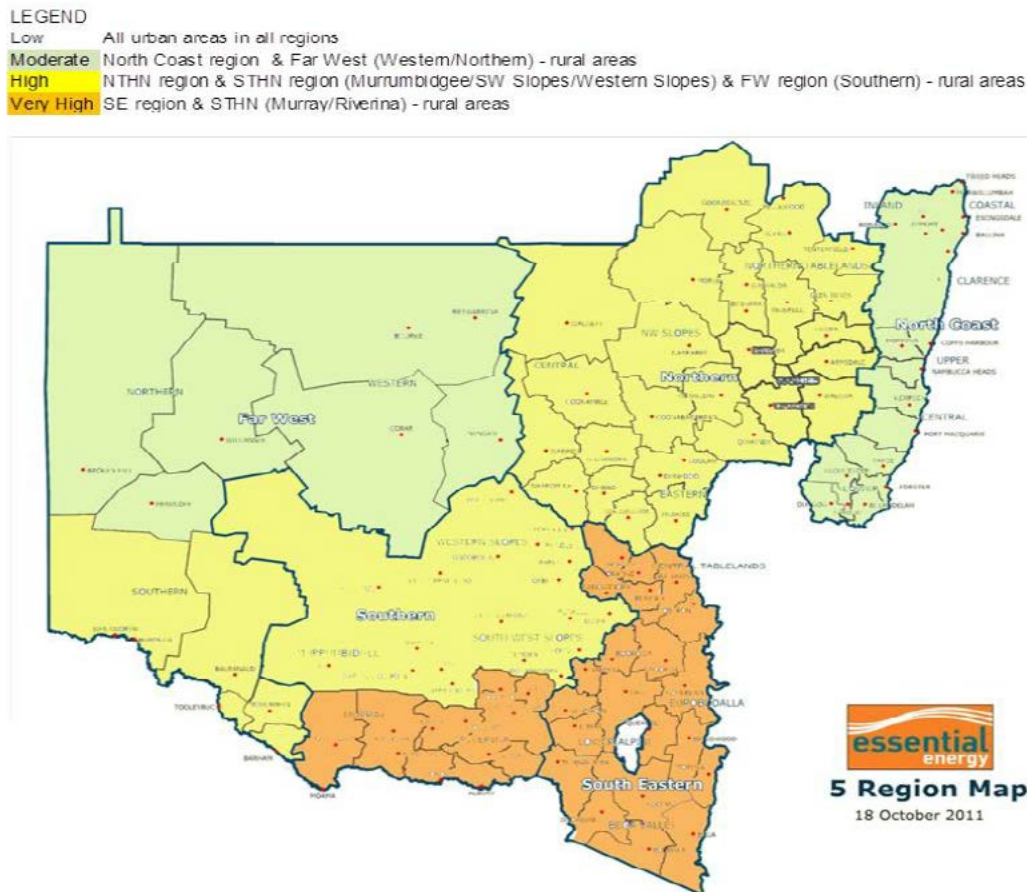
²⁵⁶ Exhibit 49A, Brief of Evidence at p. 1141.

²⁵⁷ Exhibit 49A, Brief of Evidence at p. 21-195.

²⁵⁸ Transcript for 28 September 2022 T 920:40-44.

Essential Energy’s “Internal Fire Risk Profile” Regional Map

34. The second component of Essential Energy’s BRC, its Risk Profile Map (see image below), uses four input layers:
- Australian bushfire potential zones based on a 1995 study;
 - fire start history for the Essential Energy regional network;
 - the average regional frequency of TOBAN declarations; and
 - a spatial pattern of historical fire damage and house loss.²⁵⁹



35. Professor Sharples expressed the view that these input layers do not incorporate the best information available. The first three layers were, in his view, outdated, being data respectively from 1995 (for a), and 2004 to 2011 (for (b) and (c)).²⁶⁰ The input layers did not account for more recent, and projected, increases in the annual average cumulative FFDI. In his view, there was a particular need to update the data to ensure decisions are based on ‘climatologically relevant’ information ‘given that we’ve now moved to another epoch’.²⁶¹
36. Whilst this criticism is pertinent, Essential Energy has indicated it expects to retire the Profile Map once it starts implementing the IGNIS Project.²⁶² It is expected that the IGNIS Project will be operational for the 2023/2024 fire season.²⁶³

²⁵⁹ Exhibit 49A, Brief of Evidence at p. 21-226, 21-253.

²⁶⁰ Transcript for 28 September 2022 T 908:27 –909:7; Exhibit 49A, Brief of Evidence at p. 1143-1144.

²⁶¹ Transcript for 28 September 2022 T 908:33:36.

²⁶² Exhibit 49A, Brief of Evidence at p. 1193.

²⁶³ Transcript for 28 September 2022 T 917.

Ignis Project

37. The IGNIS Project seeks to understand fire risk by combining fire simulation, economic analyses, and Bayesian analysis. The Bayesian component seeks to utilise a graphical probability model to account for uncertainties within the fire modelling. Notably, the underlying fire simulation and modelling utilised in the IGNIS Project is the Phoenix RapidFire Software.
38. Professor Sharples opined that the latest bushfire simulator officially endorsed for national use by the AFAC is CSIRO Spark, rather than Phoenix RapidFire.
39. Notwithstanding this, it is understood that the IGNIS Project modelling methodology can be used with any fire simulation software.²⁶⁴
40. Professor Sharples opined that the IGNIS Project appeared to extend the notion of BRCs to include more recent developments in bushfire simulator (Phoenix RapidFire) capability and more sophisticated incorporation of probabilistic information through Bayesian modelling. On his view, compared to the risk assessment methodologies which underpin Essential Energy's current BRC system, the IGNIS Project methodology is much more consistent with 'the state of the science'. Further, the manner in which weather inputs were chosen is far more appropriate and fit for intended purpose and the methodology considers a wide range of bushfire impacts, not just house loss.²⁶⁵
41. Mr Fitzpatrick advised that Essential Energy is presently analysing output from their preliminary application of the 'proof of concept' methodology endorsed by the IGNIS Project with a view to 'refreshing' its BRC system.²⁶⁶ To this end, Essential Energy is collaborating with the University of Melbourne to have the new BRC system operational by the 2023/2024 bushfire season.
42. When asked whether the modelling would take into account the 2019/2020 bushfire season in NSW, Mr Fitzpatrick gave evidence that:
- 'It would take into account the weather that was consistent with that particular season. I'm not the expert in the technical working of the model. We engage relevant experts that do that and they could probably best talk to how it might consider what happened in 2019 and 2020. My understanding is that it takes into account the weather that might have been the cause of the 2019/2020 fires across the State.'*²⁶⁷ [emphasis added]
43. This raises a question of whether the modelling for the IGNIS Project actually takes into account data from the most recent catastrophic fires experienced in NSW (or merely that which is consistent with it). This may be particularly important given Professor Sharples' criticism of the limitations of the data used in the current modelling (for the HLI). In his view, the Bayesian component cannot fully compensate for such limitations. In this regard, he said that:
- 'I think Bayesian Decision Networks are the right tool to use at that final stage. As I said before though, it comes back to sort of making sure that the models you're using to inform the input to that Bayesian Decision Network are actually as, you know, the best information you have, and that they are faithfully representing the, you know, the actualities of fire behaviour.'*²⁶⁸
44. Essentially, if any of the first three stages of the IGNIS Project are flawed (for example, because the data inputs into the model are deficient), then the final component may not account for the full range of potential uncertainties tied to the assessment of bushfire risk and potential house loss.
45. Mr Fitzpatrick raised with the University of Melbourne (which is carrying out the modelling) the issues raised by Professor Sharples and Mr de Mar with the existing HLI.²⁶⁹ It is not completely clear whether those concerns have been, or will be, addressed in the modelling for the IGNIS Project. It would be surprising if they were simply ignored by the experts relied upon by Essential Energy.

²⁶⁴ Exhibit 49A, Brief of Evidence at p. 1147.

²⁶⁵ Exhibit 49A, Brief of Evidence at p. 1147.

²⁶⁶ Transcript for 28 September 2022 T 916:25–917:38.

²⁶⁷ Transcript for 28 September 2022 T 917:2-7.

²⁶⁸ Transcript for 28 September 2022 T 911:8-12.

²⁶⁹ Transcript for 28 September 2022 T 918.

46. Essential Energy submitted that:
- a. when it first commenced development of its Bushfire Modelling after 2010, as an energy network service provider it, had no internal expertise in relation to such modelling. For this reason, it understandably sought out, and relied upon, external expert advice through its collaboration with the University of Melbourne from 2014.
 - b. it continues to engage with external experts in relation to Bushfire Modelling. Plainly, the Bushfire Modelling used by Essential Energy to assess bushfire risk and inform its BRC is not static. In his evidence, Mr Fitzpatrick explained: *'These models are an evolutionary thing and the input data is also evolving with time and improving.'*²⁷⁰
 - c. it has committed and will continue to commit *'significant sums of money'*,²⁷¹ to the development of its Bushfire Modelling with the aim of refining and improving its approach to BRC. It has and will continue to engage with experts in this area to improve its BRC system.²⁷²
 - d. its focus and responsibility as a network operator is to assess and manage risks associated with the network, which Mr de Mar agreed can be described as *'focussed on ignition that might be associated with power lines'*. This is a different focus from that of Bushfire Management Committees, which are concerned with all ignition sources.²⁷³
 - e. it agreed regarding the evidence of Professor Sharples that even if *'limitations'* in the modelling used been addressed prior to 2019/2020, it was unlikely that it would have led to a different BRC for Essential Energy's infrastructure along Failford Road.
 - f. the relevant high voltage distribution lines were in an area classified as P2: under this classification, there is no requirement to keep the area above the conductors *'clear to sky'* for 22kV lines, unless such clearance has previously been established.²⁷⁴ There is, however, a *'clear to sky'* requirement for higher voltage lines (33kV to 132kV) in all areas, unless precluded by local environmental considerations.
 - g. in the circumstances, criticisms directed at Essential Energy's BRC and Bushfire Modelling as at 2019/2020 do not sufficiently take account the challenges and practical context, including:
 - i. the need to develop and apply the modelling in the context of managing an electricity network comprising *737,000 square kilometres of landmass and ... 183,612km of powerlines, almost 90 per cent of which (163,417 kms) are located in designated bushfire zones;*
 - ii. evolving data and modelling techniques; and
 - iii. the fact that 2019/2020 was a season of unusually high fire risk.
 - h. the criticisms identified in the course of the Inquiry may become redundant as Essential Energy implements a new system of Bushfire Modelling for the 2023/2024 fire season.

²⁷⁰ Transcript for 28 September 2022 T 919:48-50.

²⁷¹ Transcript for 28 September 2022 T 918:31-38.

²⁷² Transcript for 28 September 2022 T 917:4-5, 918:37-38.

²⁷³ Transcript for 28 September 2022 T 903:15-16.

²⁷⁴ Exhibit 49A, Brief of Evidence at p. 2-34; Transcript for 23 March 2022 T 12:34-46.

CONCLUSION

There is no suggestion in the evidence that Essential Energy did not comply with its vegetation management policy in relation to the tree that sparked the Failford Road, Darawank Fire.

Notwithstanding this, there is evidence that Essential Energy's BRC system (and the modelling which underpins it) was not appropriate and fit for purpose in the lead up to the 2019/2020 bushfire season, nor at the time this Inquiry was heard. I acknowledge the challenges and practical context referred to by Essential Energy in their submissions.

Essential Energy submitted that it was analysing output from their preliminary application of the proof of concept methodology endorsed by the IGNIS Project with a view to refreshing its BRC System. To this end, Essential Energy is collaborating with the University of Melbourne to have the new system operational by the 2023/2024 bushfire season.

This action is indicative of positive progress.

Recommendations

ISSUE 2

Whether it is otherwise necessary or desirable for the Coroner to make recommendations pursuant to section 82 of the Coroners Act 2009 in relation to any matter connected with these fire inquiries.

47. Counsel Assisting submitted that in circumstances where Essential Energy is moving towards abandoning the current approach to BRC in favour of the IGNIS Project by the 2023/24 fire season, and is understandably reliant upon experts in the development of the latest model, any recommendations are best targeted at ensuring that the new modelling addresses the shortfalls identified. This is particularly the case in circumstances where there is largely uncontested evidence (from Professor Sharples) of deficiencies in the existing modelling. Those deficiencies, to the extent that they may result in an understatement of fire risk, could produce a less comprehensive approach to vegetation management around electrical infrastructure in areas of high bushfire risk across the State.
48. Essential Energy advised it welcomed the insights offered by Professor Sharples and Mr de Mar in assisting it to improve its approach to Bushfire Modelling and BRC. To this end, it has already undertaken in part, one of the proposed recommendations put forward by Counsel Assisting; to provide the following information to those undertaking the re-model of Essential Energy's BRC System, namely relevant experts at the University of Melbourne for consideration in their development of the new Bushfire Modelling:
 - a. Expert Report of Mr Paul de Mar dated 11 February 2022;
 - b. Supplementary Expert Report of Mr Paul de Mar dated 4 August 2022;
 - c. Expert Report of Professor Jason Sharples dated 22 August 2022; and
 - d. Transcript of the oral evidence of Mr de Mar and Mr Sharples given on 28 September 2022.
49. Finally, Essential Energy submitted that it noted and supported the making of the remaining recommendations put forward by Counsel Assisting.

CONCLUSION

The Recommendations put forward by Counsel Assisting are supported by Essential Energy, with progress already underway. I am persuaded that the proposed Recommendations are necessary and desirable. I make those Recommendations in slightly amended terms to account for the actions already undertaken by Essentially Energy to date.

50. These Recommendations are set out below:

To the Chief Executive Officer of Essential Energy

Recommendation 27:

That those undertaking the re-model of Essential Energy's Bushfire Risk Classification System be:

- a. provided with a copy of any findings relevant to this Inquiry, in addition to the following documents which Essential Energy has submitted it has already provided to the relevant individuals:*
 - i. Expert Report of Mr Paul de Mar dated 11 February 2022;*
 - ii. Supplementary Expert Report of Mr Paul de Mar dated 4 August 2022;*
 - iii. Expert Report of Professor Jason Sharples dated 22 August 2022; and*
 - iv. Transcript of the oral evidence of Mr de Mar and Mr Sharples given on 28 September 2022.*
- b. tasked to take into account the limitations identified by Mr de Mar and Professor Sharples in the documents referred to in (a) above (as applicable), in developing, and carrying out, the re-model.*

Recommendation 28:

That a copy of the documents referred to in Recommendation 27(a) above also be provided to the Chief Executive Officer of Energy Networks Australia to inform the IGNIS Project Team in its ongoing work, as they see fit.

51. I wish to express my sincere gratitude to those who have aided and provided information to the Court to assist with the general inquiry that considered the topic of Bushfire Risk Classification.

3. Fire Prediction Modelling & Communications and Warnings

Why was a general inquiry held?

1. General inquiries were held under section 32(3) of the Act into the Kangawalla, Diehard Fire, the Badja Forest Fire and the Currowan State Forest Fire in respect of RFS fire prediction modelling.
2. A general inquiry was also held into the Kangawalla Fire in respect of RFS communications and warnings.
3. In late 2019, the Kangawalla Fire, Badja Forest Fire, and Currowan State Forest Fire tragically claimed the lives of 11 people:
 - a. On 8 November 2019, the Kangawalla Fire spread rapidly and unexpectedly into the community of Wyaliba. Many of the residences in that community were destroyed, including the primary school which burned to the ground. Tragically, George Nole and Vivien Chaplain lost their lives.²⁷⁵
 - b. Almost two months later, on 30 and 31 December 2019, days of severe fire danger:
 - i. the Badja Forest Fire spread far beyond what was anticipated, and ultimately claimed the lives of Colin Burns, Ross Rixon, Patrick Salway, Robert Salway, Richard Steele, and John Smith;²⁷⁶ and
 - ii. the Currowan State Forest Fire saw the deaths of Laurence Andrew, John Butler, and Michael Campbell.²⁷⁷
4. The sheer spread of each fire, each of which was considered extreme and anomalous, gave rise to the issue of the adequacy of systems and methods of fire prediction used by the RFS in the 2019/2020 bushfire season.
5. Further, the failure to warn the community of Wyaliba of the unexpected spread of the Kangawalla Fire on 8 November 2019 before it was impacted, raised a concern about the adequacy of communications and emergency warning systems used by the RFS.
6. Given accurate fire prediction can affect the determination of whether and when a warning needs to be issued, I will deal with fire prediction modelling and communications and warnings, together.

What issues did the inquiry examine?

7. Prior to the commencement of each general inquiry, a list of issues was circulated amongst the interested parties, identifying the scope of each inquiry and the issues to be considered. Those lists identified the following issues:

Fire prediction modelling

1. *Whether the process for identifying when a fire prediction should be prepared to assist the RFS with its operational planning is adequate.*
2. *Whether the fire predictions performed by the RFS were:*
 - a. *carried out to an expected standard, having regard to available technology and information; and*
 - b. *reasonable, having regard to the broader operational context at the time.*

²⁷⁵ Exhibit 32A, Brief of Evidence – Kangawalla Fire, Tab 1, p. 1-2.

²⁷⁶ Exhibit 2A, Brief of Evidence – Badja Forest and Deua National Park Fire, Tab 1 and Tab 2, p. 1-4. Additionally, Michael Clark also lost his life as a result of the Badja Forest Fire, however as his death occurred later in January 2020, and was not connected with events on 30 and 31 December 2019, it has not been included as part of these findings.

²⁷⁷ Exhibit 19A, Brief of Evidence – Currowan Cluster of Fires, Tab 1, p. 1-5.

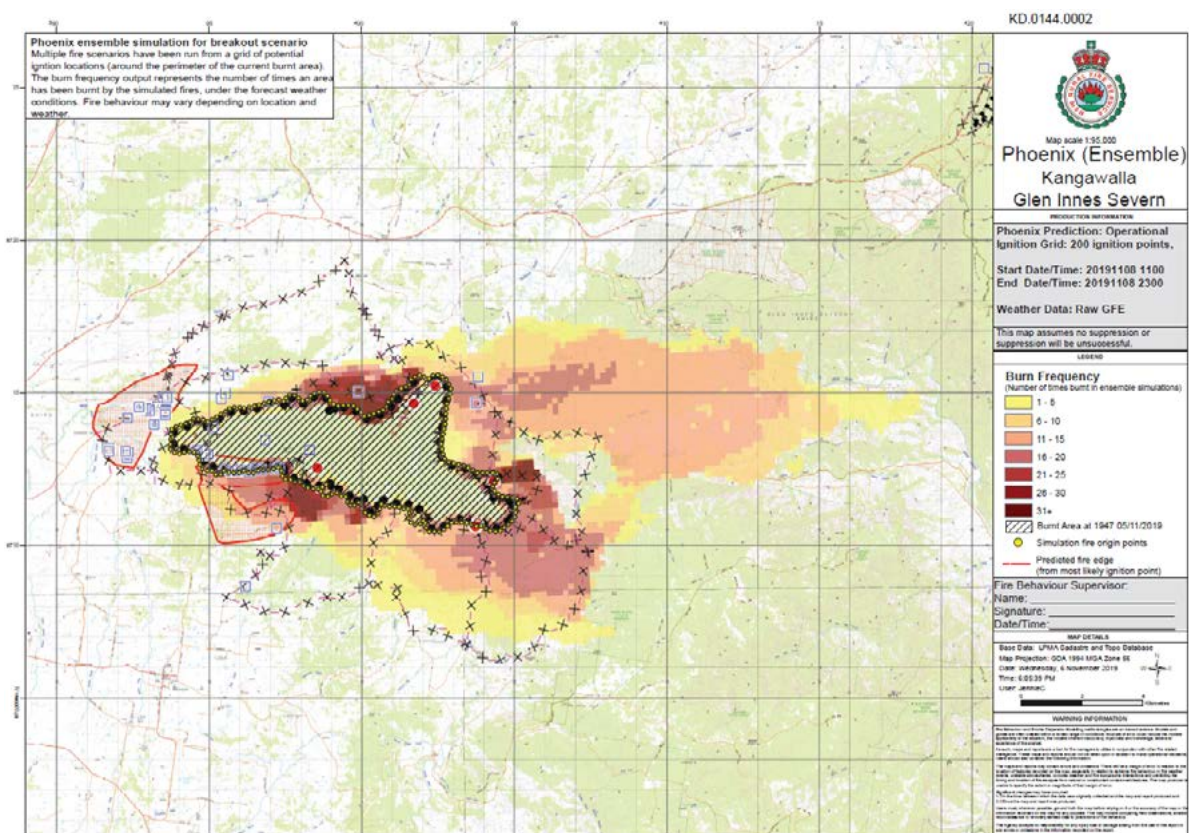
3. *Whether the process for the communication of predictions within the RFS is adequate to enable warnings to be communicated with sufficient notice to landowners, the community and/or other stakeholders.*
4. *Whether the RFS process for communicating predictions to landowners, the community and/or other stakeholders is adequate.*
5. *Whether it is otherwise necessary or desirable for the Coroner to make recommendations pursuant to section 82 of the Coroners Act 2009 (NSW) in relation to any matter connected with these fire inquiries.*

Communications and emergency warnings

1. *The process for issuing emergency alerts, including:*
 - a. *the process for deciding when a telephone-based emergency alert is issued;*
 - b. *the process for defining the geographic reach of an emergency alert; and*
 - c. *the additional steps required for areas with poor mobile reception, black spots and/or where there is no telecommunication coverage.*
 2. *The adequacy of RFS communications and emergency warning systems on 8 November 2019 in respect of the Kangawalla Fire and its likely impact on the community of Wyaliba.*
 3. *The adequacy of RFS communications systems between ground crews in the field, including with respect to black spot areas and/or network failures, and contingency planning for operational continuity.*
 4. *The adequacy of RFS communications systems between ground crews and FCCs (or other operational command areas), including with respect to black spot areas and/or network failures, and contingency planning for operational continuity.*
 5. *Whether it is otherwise necessary or desirable for the Coroner to make recommendations pursuant to section 82 of the Coroners Act 2009 (NSW) in relation to any matter connected with these fire inquiries.*
8. These findings will address these issues together by reference to four broad themes:
- a. *processes for predictions and emergency alerts;*
 - b. *communication of predictions and emergency alerts;*
 - c. *operational communications; and*
 - d. *technical issues concerning fire prediction.*

Kangawalla, Diehard Fire

9. Wyaliba is a remote tight-knit community on the Mann River east of Glen Innes. It is the kind of place ‘...where people describe you have to stand on one leg with your tongue hanging out and hope the wind is blowing the right way to get [mobile phone] reception’.²⁷⁸
10. On 2 November 2019 at 3:00pm, a fire spread prediction map was prepared by David Philp, RFS FBA, with an extended outlook valid from 12:00pm that day until 9:00am on 8 November 2019. It showed no impact on Wyaliba.²⁷⁹
11. Between 2 and 7 November 2019, the Kangawalla Fire was west of Wyaliba, and it was contained. During that period, it was mapped as progressing only short distances of less than 1 kilometre per day in various directions or not at all.²⁸⁰
12. On 6 November 2019, two Phoenix RapidFire fire spread prediction maps were carried out by State Command that modelled potential breakout scenarios for the Kangawalla Fire:
 - a. at 5:48pm, covering the period of 11:00am until 11:00pm on 7 November 2019;²⁸¹ and
 - b. at 6:05pm, covering the period of 11:00am until 11:00pm on 8 November 2019, a copy of which is reproduced below.²⁸²



²⁷⁸ Transcript for 21 September 2022 T 774:5-7.

²⁷⁹ Exhibit 32A, Brief of Evidence at p. 586.

²⁸⁰ Exhibit 32A, Brief of Evidence at p. 365–387.

²⁸¹ Exhibit 32A, Brief of Evidence at p. 871-3.

²⁸² Exhibit 32A, Brief of Evidence at p. 871-4.

13. In the Phoenix RapidFire fire spread prediction map prepared at 6:05pm, Wyaliba was shown as being impacted by the Kangawalla Fire on 8 November 2019 in 11 to 15 simulations. These maps were not provided to the IMT.²⁸³
14. In the afternoon of 7 November 2019, the Bureau released an Incident Weather Forecast for the Glen Innes Eastern Complex of Fires, which included the Kangawalla Fire. For the afternoon of 8 November 2019, that forecast predicted:
 - a. temperatures of up to 30 degrees;
 - b. a negative dew point;
 - c. RH into the single digits;
 - d. west/north-westerly winds of 40-45 kilometres per hour, with wind gusts of up to 60 kilometres per hour; and
 - e. a CHI of 12 to 13.²⁸⁴
15. At 10:00am on the morning of 8 November 2019, the Kangawalla Fire was at 'Patrol' status.²⁸⁵ The Fire had been contained for a number of days and the RFS anticipated 'no control issues.'²⁸⁶ However, the safety briefing notes contained in the IAP prepared by the IMT on 7 November 2019 recorded 8 November 2019 as a 'blow up day'.²⁸⁷
16. Despite this, there were no updated manual predictions carried out by the RFS on 7 November 2019, or in the morning of 8 November 2019. At the time, the RFS was dealing with an extensive number of 'Going' fires.²⁸⁸
17. At 10:15am on 8 November 2021, Mr Philp within the IMT emailed a list of 9 fires to Simon Heemstra, Supervising FBA within State Command, on which he required prediction assistance. The Fires were listed in order of priority with the Kangawalla Fire sixth on the list.²⁸⁹
18. At 3:15pm, Grant Donnelly, Captain of the Bald Nob RFS Brigade, telephoned the Glen Innes FCC. Mr Donnelly informed the IMT that the Kangawalla Fire had broken out:

*'Heading east. More than likely in the Mann River Nature reserve by now... and heading towards Old Grafton Road ... Wyaliba might have to look at some strategies there off the Old Grafton Road, but the wind's got to drop. It's potentially threatening Wyaliba.'*²⁹⁰
19. At 3:18pm, an entry recorded in Mr Philp's operational log referenced a call with Derek Gibb, another FBA within State Command: *'Doing some work on Kangawalla'*.²⁹¹
20. At 3:20pm, Mr Gibb also included an entry in his operational log. It recorded contact with Dr Heemstra, and the words simply: *'Kangawalla'*.²⁹²
21. At 3:25pm, Mr Gibb subsequently recorded in his operational log that he informed another person within State Command that he was *'looking at Kangawalla'*.²⁹³

²⁸³ Transcript for 4 April 2023 T 1308:2-7; Transcript for 4 April 2023 T 1335:3-13.

²⁸⁴ Exhibit 32A, Brief of Evidence at p. 279.

²⁸⁵ Exhibit 32A, Brief of Evidence at p. 225.

²⁸⁶ Exhibit 32A, Brief of Evidence, Tab 48 (entry at 9:30:10 on 8 November 2019).

²⁸⁷ Exhibit 32A, Brief of Evidence at p. 213.

²⁸⁸ Exhibit 2A, Brief of Evidence at p. 957; Transcript for 4 April 2023 T 1292:3-14.

²⁸⁹ Exhibit 2A, Brief of Evidence at p. 957.

²⁹⁰ Exhibit 32A, Brief of Evidence, Tab 60 (recording 15:15).

²⁹¹ Exhibit 32A, Brief of Evidence at p. 819.

²⁹² Exhibit 32A, Brief of Evidence at p. 889.

²⁹³ Exhibit 32A, Brief of Evidence at p. 889.

22. A further two calls were received about the Kangawalla Fire:
- a. at 3:26pm from RFS member James Gresham;²⁹⁴ and
 - b. at 3:39pm in which the content of an earlier call appears to be relayed to the IMT indicating the Kangawalla Fire was near Tommy's Rock, a short distance west of Wyaliba.²⁹⁵
23. At about 3:50pm, Angela Burford, PLO at the Glen Innes FCC on 8 November 2019, stated that she started preparing for the issue of an emergency alert.²⁹⁶ That emergency alert was not issued until 4:48pm.²⁹⁷
24. At 3:53pm, Kym Jerney, Captain of the Wyaliba RFS Brigade, made a telephone call to the Glen Innes FCC. During the call, Mr Jerney informed the IMT, '*... we've got a big problem down here. We've got a fire below Tommy's Rock on the west end paddock heading to Wyaliba. We need all the help we can get...*'²⁹⁸
25. In that same call, Andre Cook, a fellow NSW RFS member, stated in part:
- "[At the camping ground] from the southern side of the river a k and half up the hill I can see the flames. It's spotting in front of itself by about 500m every couple of minutes ... "It's going to hit the western road of Wyaliba within the hour or two..."*²⁹⁹
26. At 4:15pm, Mr Donnelly, unable to reach the IMT on the radio, made a further call to the Glen Innes FCC, in which he said in part:
- 'The fire is at least a kilometre east of us [at Brown's Road] in the nature reserve. So you'll need to probably evacuate Wyaliba and maybe talk about the prison farm... I just don't know what way it's going to go once it hits Old Grafton Road.'*³⁰⁰
27. At 4:25pm, in a call with State Command, Mark Williams, RFS IC, requested an emergency message be sent to the Wyaliba community for 'ember attack warning'.³⁰¹

²⁹⁴ Exhibit 32A, Brief of Evidence, Tab 60 (recording 15:26).

²⁹⁵ Exhibit 32A, Brief of Evidence, Tab 60 (recording 15:39).

²⁹⁶ Exhibit 32A, Brief of Evidence at p. 708.

²⁹⁷ Exhibit 32A, Brief of Evidence at p. 295-1 – 295-2.

²⁹⁸ Exhibit 32A, Brief of Evidence, Tab 60 (recording 15:53).

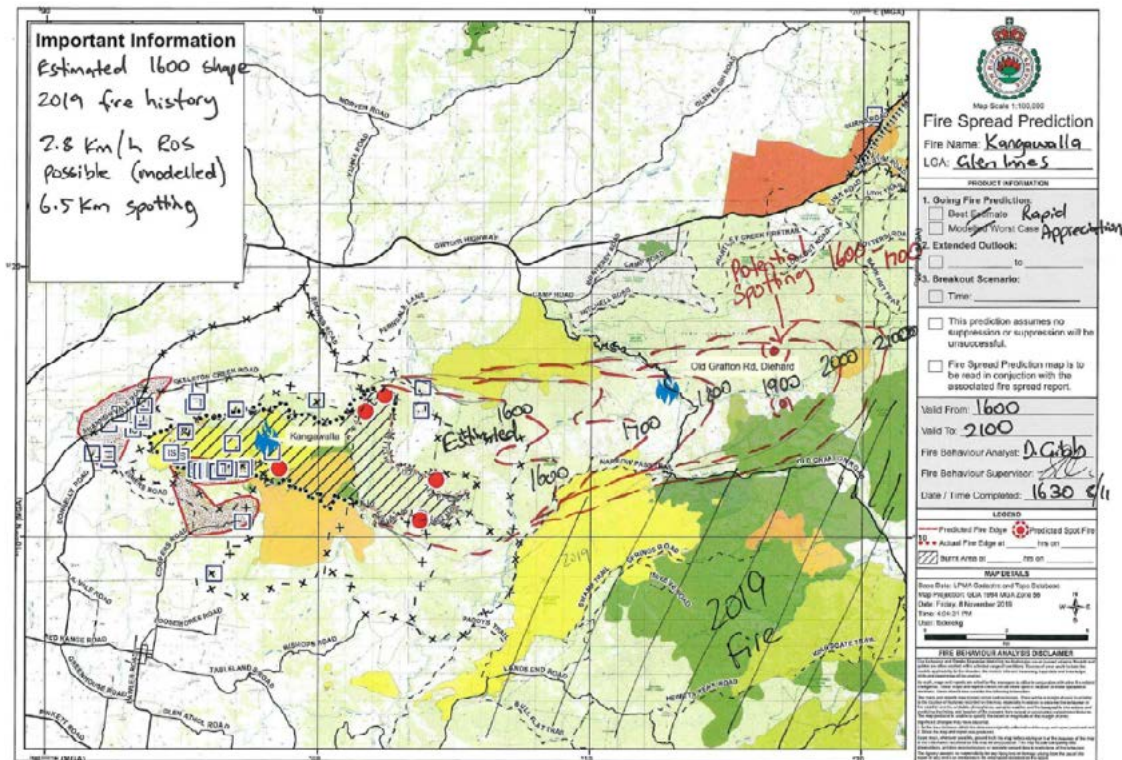
²⁹⁹ Exhibit 32A, Brief of Evidence, Tab 60 (recording 15:53).

³⁰⁰ Exhibit 32A, Brief of Evidence, Tab 60 (recording 16:15).

³⁰¹ Exhibit 32A, Brief of Evidence, Tab 60 (recording 16:25).

28. At 4:30pm, Mr Gibb completed a fire spread prediction map valid from 4:00pm until 9:00pm, a copy of which is reproduced below.³⁰² This prediction was completed as a ‘rapid appreciation’ which Mr Gibbs stated is a prediction that is:

“... completed as quickly as possible and without taking the time to consider all of the terrain, weather and fuel details and making minimal refinements to the model inputs ... to provide the IMT with some idea of the potential spread, with a more detailed best estimate to follow soon after”.³⁰³



29. The fire spread prediction showed potential spotting beyond Wyalaliba between 4:00pm and 5:00pm, with the main fire front impacting the township at about 6:00pm.³⁰⁴ By the time the rapid prediction had been completed, that is 4:30pm, the situation in Wyalaliba had deteriorated significantly:

- a. RFS members Michael Borgia and Jesse Kirkman were surrounded by fire and unable to leave a property on the western side of Wyalaliba.³⁰⁵ Mr Kirkman told police that they had difficulties contacting the other RFS appliance in Wyalaliba at the time, as ‘fireground and UHF radios do not transmit when crews are located on opposite sides of Wyalaliba’.³⁰⁶
- b. Mr Jermey witnessed ‘an explosion of spot fires everywhere’ as he drove from the RFS shed in Wyalaliba back to his property to direct the fire effort;³⁰⁷
- c. Newcastle Fire Command had received a call from a Mr Tonks at 11450 Old Grafton Road, Diehard that a grass fire was about to impact his house near the Wyalaliba School;³⁰⁸ and

³⁰² Exhibit 32A, Brief of Evidence at p. 203.
³⁰³ Exhibit 32A, Brief of Evidence at p. 884.
³⁰⁴ Exhibit 32A, Brief of Evidence at p. 203.
³⁰⁵ Exhibit 33, Brief of Evidence at p. 132.
³⁰⁶ Exhibit 33, Brief of Evidence at p. 134.
³⁰⁷ Exhibit 32A, Brief of Evidence at pp. 691-692.
³⁰⁸ Exhibit 32A, Brief of Evidence, Tab 60 (recording 16:33).

d. At 4:35pm, Brett Miller, Deputy Captain of the Wyaliba RFS Brigade, radioed the IMT:

*'Fire Comm, Fire Comm, Emergency, Emergency. Wyaliba 7 ... We have fire impacting the whole of the west end of Wyaliba. It is an extremely dangerous situation. We are pulling as many people out as we can.'*³⁰⁹

30. At 4:39pm, after the completion of the rapid appreciation fire spread prediction map and Mr Miller's call, a MFU was issued by the RFS and published on the Fires Near Me App. That update recorded the alert status as W&A with the advice that:

*'People in areas along Mann River, near the Mann River Nature Reserve and Newtown Boyd should monitor conditions. Watch out for burning embers which may start spot fires ahead of the main fire front. Check and follow your Bush Fire Survival Plan. If you do not have a plan, decide what you will do if the situation changes.'*³¹⁰

31. At 4:44pm, the alert status was upgraded in an RFS SITREP to EW 5, being a warning level of EW 5.³¹¹

32. At 4:46pm, a new MFU was issued by the RFS with the advice that 'people in the Wyaliba area should move to the community hall' but the alert status remained at W&A.³¹²

33. At 4:48pm, a voice and SMS warning campaign commenced informing residents of Wyaliba, 'if not prepared and path is clear, move towards Wyaliba Community Hall'.³¹³

34. At 4:49pm, the rapid appreciation fire spread prediction map completed by Mr Gibb was uploaded to ICON and made available to the IMT. Mr Philp was made aware of this prediction via email and phone call from Mr Gibb at 4:50pm.³¹⁴

35. By about 5:00pm, Vivien Chaplain had told her daughter-in-law in a telephone call that her property was on fire³¹⁵ and by 5:18pm, the Wyaliba RFS Brigade fire shed in the centre of Wyaliba was affected by fire.³¹⁶

³⁰⁹ Exhibit 32A, Brief of Evidence, Tab 59 (recording 16:36).

³¹⁰ Exhibit 32A, Brief of Evidence, Tab 57.

³¹¹ Exhibit 32A, Brief of Evidence at p. 234.

³¹² Exhibit 32A, Brief of Evidence, Tab 57.

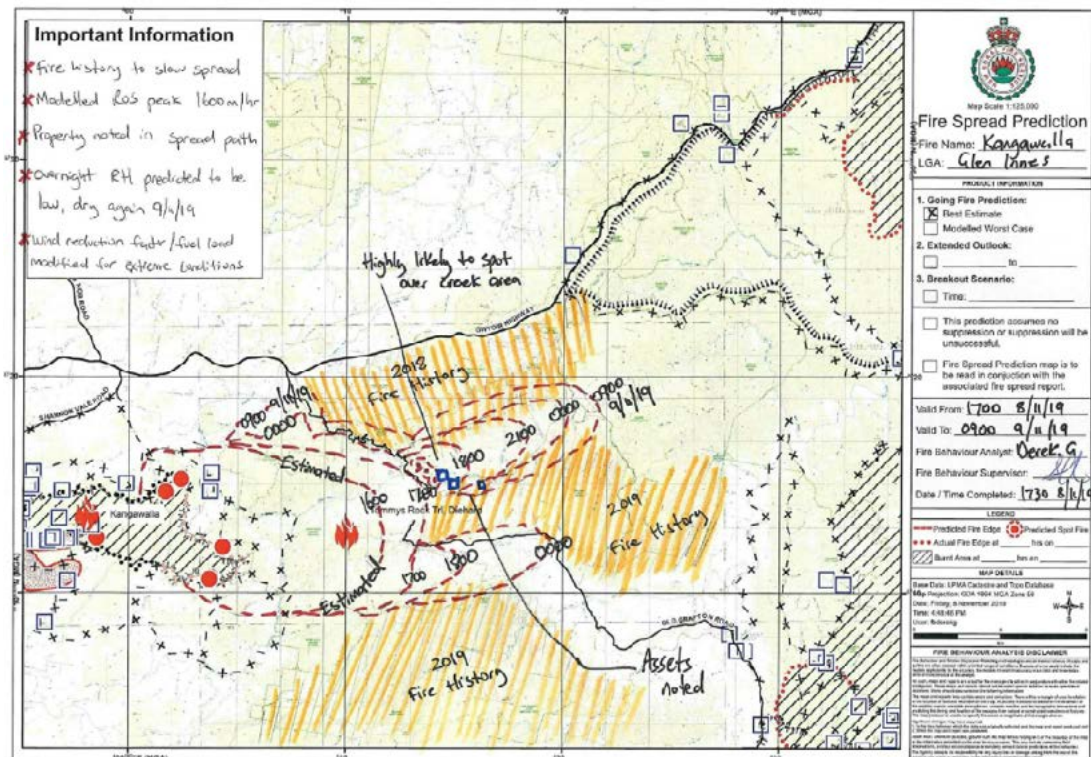
³¹³ Exhibit 32A, Brief of Evidence at p. 295-295-2; Tab 48.

³¹⁴ Exhibit 2A, Brief of Evidence at p. 957.

³¹⁵ Exhibit 33, Brief of Evidence at p. 19-8.

³¹⁶ Exhibit 32A, Brief of Evidence, Tab 59 (recording 17:18).

36. At 5:30pm, Mr Gibb completed the best estimate fire spread prediction map, a copy of which is reproduced below, and it too was uploaded to ICON at 5:43pm. Mr Philp was made aware of this prediction by email at 5:44pm. The best estimate fire spread prediction map applied to the period from 5:00pm on 8 November 2019 to 9:00am the following morning.³¹⁷ Mr Gibb stated that a best estimate, “Is an assessment of the fire behaviour that an analyst thinks is most likely, although does not take into account any suppression on the fireground.”³¹⁸



37. From 8 to 9 November 2019, fire progression mapping showed that the Kangawalla Fire made a significant run approximately 9.4 kilometres to the east, considered extreme and abnormal fire behaviour in a single day. Tragically, Wyalaliba residents Vivien Chaplain and George Nole lost their lives on 8 November 2019 when the Kangawalla Fire impacted upon their homes.³¹⁹

³¹⁷ Exhibit 32A, Brief of Evidence at p. 889, 892; Exhibit 2A, Brief of Evidence at p. 957.

³¹⁸ Exhibit 32A, Brief of Evidence at p. 884.

³¹⁹ Exhibit 32A, Brief of Evidence, pp. 388–389, 391.

The Badja Forest Fire

38. 30 and 31 December 2019 were days of particularly severe fire conditions. Five people lost their lives to the Badja Forest fire on these days alone. A sixth person, Ross Rixon, also suffered significant burns during this period, ultimately resulting in his death on 18 January 2020.
39. On 28 December 2019, in the first 24-hours following the Fire's ignition, the Badja Forest Fire was mapped as progressing distances up to 6 kilometres through dense forest. On 29 December 2019, the Fire was mapped as spreading approximately 3 kilometres to the north-west with new separate areas of fire mapped west of the main fire.
40. After the Fire's ignition on 27 December 2018, FBA David Philp prepared a series of predictions:
 - a. on 28 December 2018 at 1:20pm, being a best estimate fire spread prediction for the period 1:00pm to 5:00pm that day;³²⁰
 - b. at 6:20pm that evening, a further best estimate fire spread prediction map which was valid from 6:00pm that evening until 8:00am on 29 December 2019;³²¹ and
 - c. on 29 December 2019 at 1:53pm, a Phoenix RapidFire fire spread prediction map, covering the period 1:00pm that day until 10:00pm on 31 December 2019;³²²
 - d. on that same day, 29 December 2019, Mr Philp prepared an extended outlook fire spread prediction map valid from 11:00am that morning until midnight on 31 December 2019.³²³
41. A separate FBA carried out a further best estimate prediction at 10:45am on 30 December 2019, covering the period of 8:00am that day until 2:00pm on 31 December 2019.³²⁴
42. The Bureau Incident Weather Forecast for the Badja Forest Fire for the afternoon of 30 December 2019 showed:
 - a. temperatures of up to 34 degrees;
 - b. a negative dew point;
 - c. RH of 11% at 5:00pm and 88% by 8:00pm;
 - d. north-westerly winds reaching up to 30 kilometres per hour, with wind gusts up to 50 kilometres per hour; and
 - e. a CHI ranging from 2 to 13.
43. At 3:58pm on 30 December 2019, the Fire was reported to have spotted with properties under threat.
44. Just over one hour later, at 5:06pm, the Fire was reported to have rapidly increased and created a pyro-cumulus column.
45. The first fire spread prediction map that afternoon was completed at 7:40pm on 30 December 2019.³²⁵ The map, which predicted the movement of the Fire to 5:00pm on Tuesday, 31 December 2019, depicts the predicted fire edge extending that evening in a southward direction of the 'actual fire edge.'
46. The map reveals the townships of Nerrigundah (to the north-west), Wandella, Coolagolite and Cobargo (all to the east and south-east) falling outside the predicted fire edge. These were towns where John Smith, Robert and Patrick Salway, and Richard Steele, lost their lives on 31 December 2019, as well as Ross Rixon who was impacted by the Fire on that day, and subsequently died on 18 January 2020.

³²⁰ Exhibit 2A, Brief of Evidence at p. 550.

³²¹ Exhibit 2A, Brief of Evidence at p. 551.

³²² Exhibit 2A, Brief of Evidence at p. 551-1.

³²³ Exhibit 2A, Brief of Evidence at p. 552.

³²⁴ Exhibit 2A, Brief of Evidence at p. 553.

³²⁵ Exhibit 2A, Brief of Evidence at p. 554.

The Currowan State Forest Fire

47. In the days leading up to 31 December 2019, the Currowan Fire was mapped as spreading relatively short distances on 28 and 29 December 2019 of between 1 to 6 kilometres in various directions. On 30 December 2019, the Fire was mapped as having spread up to 7 kilometres to the north-west.³²⁶
48. The Parks and Conservation Service Fire Behaviour Report of 29 December 2019 noted the following weather prediction for 30 December 2019:
 - a. hot and dry with extremely dry air sitting over the surface;
 - b. maximum temperature of 37 degrees;
 - c. minimum RH of 13%; and
 - d. winds shifting to the north-west, light in the morning becoming gusty in the afternoon.
49. A series of predictions were carried out for 30 and 31 December 2019:
 - a. on 27 December 2019, a Phoenix RapidFire fire spread prediction map was prepared, valid to 30 December from 11:00am to 11:00pm;³²⁷ and
 - b. on 29 December 2019, a series Phoenix RapidFire fire spread prediction maps were prepared, valid for 30 December from 10:00am to 10:00pm:
 - i. two Phoenix RapidFire predictions cover the Turpentine sector which encompasses the township of Sussex Inlet;³²⁸ and
 - ii. two further Phoenix RapidFire predictions show the Yatte Yattah sector.³²⁹
50. The Parks and Conservation Service Fire Behaviour Report of 29 December 2019 noted the weather prediction for 31 December 2019 to include a continuation of dry air, with strong, gusty winds and a highly unstable atmosphere with the potential for a fire-generated thunderstorm.
51. On 31 December 2019 at 10:44am, a best estimate fire spread prediction map was prepared, valid for 31 December 2019 from 11:00am to 2:00pm.³³⁰
52. On 31 December 2019, the Fire spread rapidly on multiple fire fronts, including a progression of 20 kilometres to the north and a 6 kilometres progression to the east-southeast.³³¹
53. The Fire impacted townships including Yatte Yattah and Sussex Inlet, being the locations of John Butler, Laurence Andrew, and Michael Campbell. This reach was mapped on 1 January 2020.³³²

³²⁶ Exhibit 19A, Brief of Evidence at p. 2020.

³²⁷ Exhibit 19A, Brief of Evidence at p. 2027-3.

³²⁸ Exhibit 19A, Brief of Evidence at p. 2027-9, 2027-10.

³²⁹ Exhibit 19A, Brief of Evidence at p. 2027-11, 2027-12.

³³⁰ Exhibit 19A, Brief of Evidence at p. 2033.

³³¹ Exhibit 19A, Brief of Evidence at p. 2021.

³³² Exhibit 19A, Brief of Evidence at p. 2022.

Evidence received during the Inquiry

Processes for predictions and emergency alerts

Warnings generally

ISSUE 1 – COMMUNICATIONS AND WARNINGS

The process for issuing emergency alerts, including:

- a. the process for deciding when a telephone-based emergency alert is issued;*
- b. the process for defining the geographic reach of an emergency alert; and*
- c. the additional steps required for areas with poor mobile reception, black spots and/or where there is no telecommunication coverage.*

54. Warnings, and public information, are a critical component of managing and reducing the impact of emergency incidents to enhance public safety. In the bushfire context, a warning provides point-in-time information about a fire that is impacting or is expected to impact communities and provides advice on what people should do.³³³
55. The RFS uses multiple platforms to provide warnings and information to the public about the spread of bushfires. These include:
 - a. the Fires Near Me App;
 - b. the NSW RFS website;
 - c. voice messages to landlines;
 - d. text messages to mobile phones;
 - e. social media;
 - f. radio broadcasts;
 - g. community meetings and newsletters;
 - h. doorknocking; and
 - i. firefighters of local brigades communicating directly with residents.³³⁴
56. The last four platforms are of particular relevance for remote communities like Wyaliba, in relation to the Kangawalla Fire, where residents may have limited to no access to telecommunications. Newsletters, doorknocking, and the use of local brigades to contact residents directly, all take time to prepare and carry out and could require 24 hours.³³⁵
57. Peter McKechnie, RFS Deputy Commissioner Field Operations, and Mr Williams both gave evidence that the longer the timeframe the RFS has, then the more strategies it can put in place to notify the public and the better the communication can be.³³⁶ Ultimately that time, or advanced warning, is provided through fire prediction. Mr Williams agreed that fire prediction takes on more significance where there are remote communities with communications limitations.³³⁷

³³³ Exhibit 61, General Brief of Evidence at p. 2496, 2498.

³³⁴ Exhibit 61, Brief of Evidence at p. 2506–2509, 2418–2419.

³³⁵ Exhibit 32A, Brief of Evidence at p. 706-707; Transcript for 23 September 2022 T 836:20-36.

³³⁶ Transcript for 23 September 2022 T 836:20-36; Transcript for 23 September 2022 T 892:16-27.

³³⁷ Transcript for 23 September 2022 T 847:8-16.

58. The evidence of Ms Burford was that:

*'There was no warning that the fire was going to impact Wyaliba before it did on 8 November 2019. Had it been predicted that the fire had the potential to impact Wyaliba on 8 November 2019, I would have undertaken pre-planning for Wyaliba as part of the public liaison plan, organised for community newsletters to be issued and for door knocking to occur Due to the speed with which the fire impacted Wyaliba, the only option available for community messaging was to issue an Emergency Alert.'*³³⁸

Emergency alerts

59. Emergency alerts are typically issued through the Emergency Alert Telephone System. During the 2019/2020 bushfire season, that system was operated by Telstra. Voice messages to landlines and text messages to mobile phones can be sent to devices within a defined warning area or polygon zone.³³⁹ The RFS can elect to send the messages to devices currently located within a polygon, or those that have their registered address within a polygon, or both. The Telstra system sat alongside the RFS ICON system.³⁴⁰

60. The need for an emergency alert is typically first identified within the IMT. The PLO will prepare public liaison plans, pre-planned messaging for emergency alerts, and polygons which they would submit to ICON for potential emergency alerts.³⁴¹

61. The decision to issue an emergency alert is also first made within the IMT by the IC in consultation with the PLO. It is standard practice that the PLO will consult with the State PLO within State Command to discuss proposed emergency alerts before the proposal is put to the State Warning Cell.³⁴²

62. Ms Burford gave evidence that she first became aware that the Kangawalla Fire had broken out at 3:50pm on 8 November 2019. Although her recollection was understandably limited,³⁴³ Ms Burford was surprised that the Fire had re-ignited as it had been at 'Patrol' status since 2 November 2019 with no reports of smoke or fire activity for several days. Due to this, Ms Burford's first priority was to confirm the accuracy of the information that had been received, a process she referred to in her oral evidence as ground-truthing. Whilst awaiting that confirmation from the Operations Cell and in the event the information was in fact correct, Ms Burford and the State PLO agreed that an emergency alert would need to be issued to Wyaliba residents. As a result, Ms Burford commenced preparation of the polygon and considered the most appropriate messaging.³⁴⁴

63. At the time, the IMT had received reports from:

a. Mr Donnelly at 3:15pm, which included that the Kangawalla Fire had broken out and was:

*'Heading east. More than likely in the Mann River Nature reserve by now ... and heading towards Old Grafton Road ... Wyaliba might have to look at some strategies there off the Old Grafton Road... it's potentially threatening Wyaliba'*³⁴⁵

b. James Gresham, a member of the RFS, at 3:26pm that he:

*'Just got a call from a neighbour... Glen Elgin Road meets the Highway, then it's the Old Grafton Road turns off to the right. That property there, Phil Dawson's place. Just got word that there seems to be smoke billowing up from behind that property. That would be over the edge of the escarpment down back into the valley again, upstream from Wyaliba...'*³⁴⁶ and

³³⁸ Exhibit 32A, Brief of Evidence at p. 709.

³³⁹ Exhibit 61, Brief of Evidence at p. 2418; Transcript for 23 September 2022 T 869:31-47.

³⁴⁰ Transcript for 23 September 2022 T 870-871.

³⁴¹ Exhibit 32A, Brief of Evidence at p. 705-706, 711-712.

³⁴² Exhibit 32A, Brief of Evidence at p. 705-706, 709, 711-712; Transcript for 23 September 2022 T 872:27-44.

³⁴³ Exhibit 32A, Brief of Evidence at p. 708, 755.

³⁴⁴ Exhibit 32A, Brief of Evidence at p. 708-709; Transcript for 21 September 2022 T 814:21-37.

³⁴⁵ Exhibit 32A, Brief of Evidence, Tab 60 (recording 15:15).

³⁴⁶ Exhibit 32A, Brief of Evidence, Tab 60 (recording 15:26).

c. a member of the public at 3:39pm that there was a:

*'New Fire on Tommy's Rock Trail which comes off the main road there Grafton Road. Apparently, it's half-way up to Tommy's Rock lookout. It's in the Mann River Nature Reserve. It's a new fire. He said it started from an ember from a nearby fire, but this is a separate fire.'*³⁴⁷

64. Tommy's Rock is about 1.5 kilometres west of Wyaliba.³⁴⁸
65. In relation to these calls, the RFS in its submissions in reply noted that Mr Donnelly was not present at the scene of the Fire but was relaying early, incomplete information that he had received from crews in the field. The calls of Mr Gresham and the member of the public also assumes that it was evident that the calls were in relation to the same fire. However, this was not something that was easily appreciated at the time noting that Mr Gresham was reporting information he had received from a neighbour and there was no information as to what experience that member of the public had, if any, informing their observations.

Ground-truthing

66. It is unclear which calls, and how much of their content, were conveyed to Ms Burford in relation to the Kangawalla Fire. As noted, Ms Burford first became aware that the Kangawalla Fire had broken out at 3:50pm on 8 November 2019. An entry in her operational log at 3:50pm relevantly recorded *'Kangawalla - Re-ignition - properties along Browns Road'*.³⁴⁹ This appears to align with a call received at 3:42pm that a property was under threat at Browns Road, Bald Nob, which was north of the Kangawalla fireground³⁵⁰ noting that the call from Mr Donnelly at 3:15pm, which alerted the IMT to the potential threat to Wyaliba, was only logged on ICON at 4:13pm; almost one hour after it was made.³⁵¹
67. Ms Burford's evidence was that ground-truthing involves seeking confirmation that the reports are true, primarily whether the Fire has re-ignited, where it is heading, and whether properties are impacted. She emphasised that it was critical that she receive that information before issuing a warning because of a concern for messaging fatigue.³⁵²
68. That confirmation is ideally provided by firefighters in the field. When aircraft are grounded, as was the case on 8 November 2019 in relation to the Kangawalla Fire, it is entirely dependent upon those firefighters. If a firefighter has already provided the notification, then Ms Burford's evidence was that a different firefighter would be sent to confirm reports.³⁵³ However, that would potentially not occur if there was an imminent risk.³⁵⁴
69. In this case, the IMT had received information from Mr Donnelly as to the likely progression of the Kangawalla Fire. The evidence of Mr Williams in relation to the initial response to a fire breaking out was that:

*'... every firefighter from basic firefighter through to Incident Controllers at my level are all trained to do that rapid assessment, they have that fire background knowledge that we can ascertain the basics to note that if the fire's burning upslope it's going to burn quicker, if it's got a wind pushing it from behind, the likes of that, we know generally where the fire's going to be heading to and we can do that rapid assessment, noting what is in line with that potential impact of the fire.'*³⁵⁵

³⁴⁷ Exhibit 32A, Brief of Evidence, Tab 60 (recording 15:39).

³⁴⁸ Exhibit 32A, Brief of Evidence at p. 690.

³⁴⁹ Exhibit 32A, Brief of Evidence at p. 755.

³⁵⁰ Exhibit 32A, Brief of Evidence, Tab 60 (recording 15:42).

³⁵¹ Exhibit 32A, Brief of Evidence, Tab 48.

³⁵² Transcript for 21 September 2022 T 814:29-37.

³⁵³ Transcript for 21 September 2022 T 815:3-50.

³⁵⁴ Transcript for 21 September 2022 T 816:7-10.

³⁵⁵ Transcript for 23 September 2022 T 865:11-27.

70. Mr Donnelly's crew appear to have made such an assessment and communicated it through him to the IMT. Had that communication been conveyed to Ms Burford, the need for ground-truthing in such circumstances is questionable. That is particularly the case where:
- the only community potentially under threat was Wyaliba;³⁵⁶
 - Wyaliba was a community with limited access to reliable telecommunications;³⁵⁷ and
 - therefore, there needed to be as much forewarning as possible.³⁵⁸
71. The evidence of Anthony Clark, RFS Director of Communications and Engagement, was that he would expect a call from a Captain of an RFS brigade to carry heavier weight but would still expect a degree of ground-truthing. That could simply involve looking at a map and working out where the fire is relative to the township and considering the likely conditions within the IMT.³⁵⁹
72. Similarly, in his evidence, Deputy Commissioner McKechnie accepted that Mr Donnelly's was valued and ground-truthing would not be a case of second guessing the Captain. However, there was information not available from Mr Donnelly's telephone call such as timeframe for impact, its intensity, and any mitigating factors that may limit the impact. Deputy Commissioner McKechnie did accept, however, that where it is known that there are north-westerly winds gusting in excess of 40 kilometres per hour, it would not be difficult to work out that the fire was going to head in a south-easterly direction at some speed.³⁶⁰
73. Ultimately, it does not appear that there was direct contact between Mr Donnelly and Ms Burford.³⁶¹ Given Ms Burford's operational log, and the late uploading of Mr Donnelly's call to ICON, it may be inferred that she was not aware of the telephone call. Mr Donnelly was a Brigade Captain and he and his brigade are likely to have been trained in rapid assessments and were on the ground. Had Ms Burford been made aware of Mr Donnelly's call, and contact been initiated, then further ground-truthing may not have been necessary, especially given the likely imminent threat to Wyaliba.
74. The first the Court heard about ground-truthing was in Ms Burford's oral evidence. There is no policy before the Court that sets out what is involved in the process, nor that provides guidance to PLOs on the considerations to be taken into account in deciding whether to carry out further ground-truthing. In its submissions in reply, the RFS noted that it deliberately has no policy in relation to ground-truthing as it relies on the professional judgment of its members in a dynamic and ever-changing environment to make common sense assessments of intelligence reports.
75. Given the lack of consistency between the witnesses as to when ground-truthing is required and in what form³⁶², it was ultimately proposed following the RFS' submissions in reply, that a recommendation be made requiring the RFS to review its training to better equip IMT staff in determining whether intelligence needs to be verified, and the appropriate steps that ought to be taken, with which the RFS agreed.

Decision to issue an emergency alert

76. Once a decision is made within the IMT of the need for an emergency alert to be issued, then the IC must call the RFS State Operations Red Phone immediately. The RFS State Warning Cell will then be activated to determine, in consultation with the IC, the appropriate course of action.³⁶³

³⁵⁶ Transcript for 21 September 2022 T 816:28-31.

³⁵⁷ Transcript for 21 September 2022 T 774:3-16; Transcript for 21 September 2022 T 805:7-50; Transcript for 21 September 2022 T 806:1-7.

³⁵⁸ Transcript for 23 September 2022 T 836:20-36; Transcript for 23 September 2022 T 892:16-27.

³⁵⁹ Transcript for 23 September 2022 T 871:24-50; Transcript for 23 September 2022 T 872:1-10.

³⁶⁰ Transcript for 23 September 2022 T 890:45-50; Transcript for 23 September 2022 T 891:1-14.

³⁶¹ Transcript for 21 September 2022 T 818:3-6.

³⁶² Transcript for 21 September 2022 T 814-816; Transcript for 23 September 2022 T 871-872; Transcript for 23 September 2022 T 890-891.

³⁶³ Exhibit 32A, Brief of Evidence at p. 447-448.

77. The RFS State Warning Cell comprises of the:
- a. Commissioner;
 - b. Deputy Commissioner;
 - c. Incident Controller;
 - d. State Operations Controller or State Deputy Operations Officer;
 - e. Public Liaison Coordinator;
 - f. State Duty Media Officer; and
 - g. Regional Major Incident Coordinator or Regional Duty Operations Officer.³⁶⁴
78. During an RFS State Operations Red Phone call, the State Warning Cell considers, and authorises, the issue of an emergency alert.³⁶⁵ On 8 November 2019, this process was followed 14 times for the Glen Innes IMT alone.³⁶⁶ This included the RFS State Operations Red Phone call for the Kangawalla Fire at 4:25pm.³⁶⁷
79. After an RFS State Operations Red Phone call, officers within State Command will go back to the IC to check the contents of the proposed emergency alert before it is sent. The Emergency Alert Operator within State Command then takes the polygon drawn by the PLO within the ICON system and reproduces it within the Telstra System, along with the contents of the emergency message. The emergency alert is sent to phones within the Telstra polygon.³⁶⁸
80. For the Kangawalla Fire, the process from the RFS State Operations Red Phone call to the issue of an emergency alert took about 21 minutes.³⁶⁹ Part of the reason for this was that the content of the emergency alert was changed at 4:40pm to advise Wyaliba residents that if they were not prepared, they should seek shelter at the Wyaliba Community Hall.³⁷⁰ By that time, the IMT had received the radio transmission of Mr Miller at 4:35pm and was aware that Wyaliba had been significantly impacted. This does not explain why the alert had not already been sent. The delay was longer than would ordinarily be expected.³⁷¹
81. As noted, the emergency alert was issued to Wyaliba residents at 4:48pm³⁷², that is:
- a. one hour and 33 minutes after Mr Donnelly first informed the IMT at 3:15pm that the Kangawalla Fire was potentially threatening Wyaliba; and
 - b. 55 minutes after Mr Jermey's call at 3:53pm advising that the Kangawalla Fire was heading towards Wyaliba.
82. Mr Williams could not provide any other explanation for the delay.³⁷³ Nor could Mr Clark, although it is accepted that Mr Clark would not have been directly involved in the sending of the emergency alert.³⁷⁴ Whilst State Command was dealing with a particularly bad fire day, and a large number of emergency alerts, there were no other emergency alerts issued between the issue of an emergency alert for the Mile Creek Fire at 4:28pm (roughly one minute after the end of the RFS State Operations Red Phone call for the Kangawalla Fire) and the emergency alert for the Kangawalla Fire issued at 4:48pm.³⁷⁵

³⁶⁴ Exhibit 61, Brief of Evidence at p. 2512.

³⁶⁵ Exhibit 32A, Brief of Evidence at p. 448.

³⁶⁶ Exhibit 32A, Brief of Evidence at p. 601; Exhibit 32A, Brief of Evidence at p. 708.

³⁶⁷ Exhibit 32A, Brief of Evidence, Tab 60 (recording 16:25).

³⁶⁸ Exhibit 32A, Brief of Evidence at p. 601; Transcript for 23 September 2022 T 873-874.

³⁶⁹ That is, from the end of the RFS State Operations Red Phone call at about 4:27pm to 4:48pm when the emergency alert was issued.

³⁷⁰ Exhibit 32A, Brief of Evidence at p. 600.

³⁷¹ Transcript for 23 September 2022 T 875:27-35.

³⁷² Exhibit 32A, Brief of Evidence at p. 295-295-2; Tab 48.

³⁷³ Transcript for 23 September 2022 T 857:3-27.

³⁷⁴ Transcript for 23 September 2022 T 875:11-32.

³⁷⁵ Exhibit 32A, Brief of Evidence at p. 598-599; Transcript for 23 September 2022 T 875:4-32.

83. In its submissions in reply, the RFS noted that:
- a. this is not a long period of time within which to receive incomplete information from various sources, absorb it, ascertain its relevance, make assessments as to its spread, assess the appropriate warning, and issue that warning;
 - b. the conditions on 8 November 2019 were far from ideal, having regard to other ‘Going’ fires at the time, the need to issue 14 emergency alerts within the section 44 declaration area of the Glen Innes IMT alone, and the intense pressure that those working in the IMT, and State Command were subject to that day; and
 - c. there is a legitimate concern to ensure that any emergency alerts that are issued are accurate and properly justified within warning fatigue being a problem that needs to be managed carefully.
84. Further, the RFS asserted that following Mr Jermeý’s call at 3:53pm in which clear intelligence of the threat to Wyaliba was provided for the first time, the IMT in consultation with State Operations, presumably because of the importance of the information, commenced preparation of the polygons, initiating and holding the RFS State Operations Red Phone call, increasing the alert level first to W&A and then to EW, preparing and issuing MFUs and issuing the emergency alert itself.
85. In Counsel Assisting’s reply, it was submitted that:
- a. the threat to Wyaliba should have been evident after receipt of the initial call from Mr Donnelly at 3:15pm;
 - b. even if it was not clear then, the picture of an escalating and imminent threat to Wyaliba ought to have been clear at least 38 minutes after the initial call, at 3:53pm, when the IMT were contacted by Mr Jermeý and his colleague Mr Cook with the increasing urgency of the situation reflected in the voice of Mr Cook; and
 - c. that decision-making did not reflect the content of the reports from the ground, suggesting that their content was not fully relayed up the chain of command, dealt with further below under the sub-heading ‘Internal communications within the IMT’.
86. Counsel Assisting added that the above information provided by two experienced local RFS Captains was consistent with a rapid progression of the Kangawalla Fire towards Wyaliba. Further, Counsel Assisting noted that the RFS’ presumption that important information was being escalated within the IMT to State Operations following Mr Jermeý’s call at 3:53pm was not borne out by the evidence but was relayed because State Operations knew the area better.³⁷⁶
87. The RFS in its submissions in reply also noted that the evidence of Mr Jermeý and Wyaliba resident Philip Hine suggested that an earlier emergency alert would not have made much difference. Mr Hine attested in a statement that at about 2:50pm, he heard on a UHF radio the Wyaliba RFS Brigade ‘*telling everyone to get out*’.³⁷⁷
88. However, Counsel Assisting submitted in reply that Mr Hine’s account of the time of that radio message was not tested in cross-examination, and was inconsistent with the evidence of Mr Jermeý, that he made the decision to evacuate when he arrived at the Wyaliba fire shed at about 4:00pm.³⁷⁸

³⁷⁶ Exhibit 32A, Brief of Evidence, Tab 60 (recording 15:53).

³⁷⁷ Exhibit 34, Brief of Evidence at p. 95.

³⁷⁸ Exhibit 32A, Brief of Evidence at pp. 690-691; Transcript for 21 September 2022 T 780:42-46.

89. Counsel Assisting added that it cannot be asserted that an earlier alert would have made no difference, nor that the communication at a local level completely made up for the delay in issuing the emergency alert. In so far as there is evidence that the Wyaliba RFS Brigade communicated with the Wyaliba community on 8 November 2019 about the risk of fire, the Court received evidence of residents who were not made aware of the potential for impact. For example:
- a. Wyaliba resident Allan Bacon gave evidence that:
*“When I woke up that morning, I heard that it was just a watch and act kind of situation. The RFS was pretty well just standing back, not really doing much. It wasn’t that much of a threat to any assets or anyone as far as I know. It wasn’t – there was no state of emergency, or emergency phone calls or – or contacts from anyone. Everyone was pretty sedated with the whole situation. No one – it’s just what’s been happening for the last four, five weeks.”*³⁷⁹
 - b. Matthew Smith gave evidence that:
*“No one told me that the fire had progressed. I dropped off the Bobcat and then I drove my truck back to drop it off at that front of the property where my ute was sitting because I was planning on jumping in my ute to go home, and when I jumped [out] of my ute and went up to let the people know that I was leaving my truck there, I noticed that there was smoke intensely – like, I could smell it stronger and it was visible coming over the hill. And I yelled out to the people inside the house to come out and have a look at what was going on, and within 30 seconds, a minute, there was ember attack raining down and everyone just started going where they had to go.”*³⁸⁰
90. Further, it was highlighted by Counsel Assisting that there was some duplication throughout the process:
- a. polygons need to be uploaded onto the ICON system and then re-drawn on the Telstra System; and
 - b. the decision to issue an alert is made at the IMT level and then again at the level of the State Warning Cell.
91. Mr Clark identified that there were inherent limitations in the telephone warning system in terms of limited integration into RFS’ operational systems. Since the 2019/2020 bushfire season, there have been changes in the emergency alert platform with a new provider with better opportunities for integration and expanded messaging content. Mr Clark’s evidence was that national changes to the system have opened the door to better integration.³⁸¹
92. In relation to this, a recommendation was proposed requiring the RFS to investigate the possibility of improved integration of the emergency alert system within the RFS system, with a view to limiting the duplication of the entry of information, such as polygons and the text of emergency warnings. In its submissions in reply, the RFS agreed with the proposed recommendation.
93. In terms of the second area of duplication, Mr Clark could not recall a situation where the State Warning Cell had refused an IC’s request to issue an emergency alert, suggesting that would vary rarely occur. He emphasised that the standard approach was for warnings to be centralised at the State Command level so that the approach taken to similar fires is consistent.³⁸²

³⁷⁹ Transcript for 8 March 2022 T 782:20-25.

³⁸⁰ Transcript for 8 March 2022 T 770:7-15.

³⁸¹ Transcript for 23 September 2022 T 875:45-50; Transcript for 23 September 2022 T 876:1-6.

³⁸² Transcript for 23 September 2022 T 872:46-50; Transcript for 23 September 2022 T 873:7-39.

CONCLUSION

Whilst it is accepted that the RFS was dealing with a particularly bad fire day, and a large number of emergency alerts, on 8 November 2019, it is apparent that there is scope for improvement to assist the RFS in its assessment of intelligence and, when required, the issuing of emergency warnings.

It is acknowledged that the RFS deliberately has no policy in relation to ground-truthing as it relies on the professional judgment of its members in a dynamic and ever-changing environment to make common sense assessments of intelligence reports.

However, as highlighted by the evidence, given the lack of consistency as to when ground-truthing is required and in what form, I consider it necessary and desirable in the circumstances to make the following Recommendations:

To the Commissioner of the NSW Rural Fire Service

Recommendation 13:

The NSW Rural Fire Service review its training for positions within an Incident Management Team to ascertain whether there is scope for improvement to better equip staff to determine:

- a. whether intelligence needs to be verified; and*
- b. the appropriate steps to be taken to obtain that verification.*

In relation to the duplication in the process identified by Counsel Assisting where polygons need to be uploaded onto the ICON system and then re-drawn on the Telstra System, I consider it is necessary and desirable in the circumstances to make the following Recommendation:

To the Commissioner of the NSW Rural Fire Service

Recommendation 14:

The NSW Rural Fire Service investigate the possibility of improved integration of the emergency alert system within the NSW Rural Fire Service system, with a view to limiting the duplication of the entry of information, such as polygons and the text of emergency warnings.

In relation to the decision to issue an emergency warning at the IMT level and then again at the level of the State Warning Cell, based on the evidence received, it is accepted that there is merit in this decision-making process for consistency. Further, when the NSW Rural Fire Service State Operations Red Phone call will only take 30 seconds to a couple of minutes, its contribution to any delay in the issuing of an emergency alert is considered to be limited. In these circumstances, no recommendations in relation to this issue are considered to be warranted.

The process for identifying when a fire prediction should be prepared

ISSUE 1 – FIRE PREDICTION MODELLING

Whether the process for identifying when a fire prediction should be prepared to assist the RFS with its operational planning is adequate.

The IMT

94. In relation to the Kangawalla Fire, 8 November 2019 was a particularly catastrophic fire day:
 - a. it was expected to be a ‘*blow up day*’;³⁸³
 - b. at 1:44pm, a Fire Weather Warning was issued for all northern firegrounds including the Kangawalla Fire;³⁸⁴ and
 - c. over the course of the day, there were approximately 14 active fires and 14 emergency alerts issued within the section 44 declaration area of the Glen Innes IMT alone.³⁸⁵
95. It is acknowledged that the IMT and State Command were under intense pressure. The RFS in its submissions in reply highlighted that the sheer number of fires added to the inherent complexities and challenges of responding to the outbreak of the Kangawalla Fire, given that members of the IMT, including operations and planning personnel, the PLO and the IC were required to respond to each of those 14 fires. This would have included developing situational awareness concerning possible threats to communities, estimating the timeframe in which threats may eventuate and co-ordinating resources, in an effort to suppress the fires.
96. On the morning of 8 November 2019, Mr Williams had a meeting with Mr Philp. They agreed to a list of 9 fires that required manual predictions and the list was emailed to Dr Heemstra at 10:15am. In order of priority, they were:
 - a. Liberation Trail;
 - b. Wandworth;
 - c. Gulf Road;
 - d. River Tree Road;
 - e. Rowleys Gorge;
 - f. Kangawalla;
 - g. Shultz Road;
 - h. Mount Street; and
 - i. Captains Creek.³⁸⁶

³⁸³ Exhibit 32A, Brief of Evidence at p. 213.

³⁸⁴ Exhibit 32A, Brief of Evidence at p. 786; Transcript for 23 September 2022 T 841:43-45.

³⁸⁵ Exhibit 32A, Brief of Evidence at p. 708.

³⁸⁶ Exhibit 2A, Brief of Evidence at p. 957.

97. In determining that list of priorities within the IMT, Mr Williams and Mr Philp would take into account factors including:
 - a. the overall weather conditions across the section 44 declaration area;³⁸⁷
 - b. the fire danger rating for different districts within that area;³⁸⁸
 - c. the status of the fires, including whether a fire was on 'Patrol' status and within containment lines;³⁸⁹
 - d. whether a fire was burning very close to containment lines with a threat to escape;³⁹⁰ and
 - e. whether fires were running.³⁹¹
98. In formulating the list of prediction priorities in consultation with Mr Williams, Mr Philp did not take into account any likely difficulties in communicating warnings to communities if a fire, such as the Kangawalla Fire, broke containment. It was beyond the scope of his role as a FBA.³⁹²
99. The PLO within the IMT is responsible for obtaining information about communication challenges faced by communities. The PLO briefs the IC, who then sets prediction priorities in consultation with the FBA within the IMT.³⁹³
100. In response to the RFS' submissions in reply, rather than disturbing the chain of command by requiring consultation with the PLOs on setting priorities for prediction, a recommendation was ultimately proposed requiring the RFS to update their training for PLOs and ICs that addresses the significance of early warning to communities with limited access to reliable communication systems, with which the RFS agreed.

State Command

101. State Command from time to time uses computer-generated Phoenix RapidFire predictions as a means to triage priorities for prediction. Despite concerns about its accuracy, which are dealt with under the sub-headings 'Internal communications: breakout predictions' and 'Phoenix RapidFire' below, Phoenix RapidFire can provide a rapid appreciation of a fire's potential.³⁹⁴
102. The RFS used the software to prepare break out scenario predictions during the 2019/2020 bushfire season. These produce maps which show a hypothetical prediction of potential fire behaviour if the fire escapes at a specific location and time. It is created by placing a series of ignition points outside the identified containment line, regularly spaced across an entire perimeter, or at particular areas of concern. The program then simulates where a fire would go if it broke out at those points.³⁹⁵
103. The maps which are produced show how often different cells are burnt when the results of the modelled fire runs are combined. A view is then formed as to whether further prediction is required, either manual or a further computer simulation. In the lead up to 8 November 2019, priority was given to those fires that posed an immediate threat.³⁹⁶

³⁸⁷ Transcript for 4 April 2023 T 1307:25-35.

³⁸⁸ Transcript for 4 April 2023 T 1307:25-35.

³⁸⁹ Transcript for 23 September 2022 T 838:28-46.

³⁹⁰ Transcript for 23 September 2022 T 839:3-11.

³⁹¹ Transcript for 4 April 2023 T 1307:48-50; Transcript for 4 April 2023 T 1308:1-2.

³⁹² Transcript for 4 April 2023 T 1307:37-40.

³⁹³ Exhibit 32A, Brief of Evidence pp. 705-706; Transcript for 4 April 2023 T 1307:11-16.

³⁹⁴ Exhibit 2A, Brief of Evidence at p. 1007.

³⁹⁵ Exhibit 2A, Brief of Evidence at p. 1008.

³⁹⁶ Exhibit 2A, Brief of Evidence at p. 1008.

104. Two of these breakout scenario maps were prepared for the Kangawalla Fire on 6 November 2019:
- at 5:48pm, covering the period from 11:00am until 11:00pm on 7 November 2019, which showed some of the western and south-western parts of Wyaliba as being impacted by fire in 1 to 5 simulations.³⁹⁷
 - at 6:05pm, covering the period from 11:00am until 11:00pm on 8 November 2019, which showed various parts of Wyaliba as being impacted by fire in 11 to 15 simulations.³⁹⁸
105. Neither of these maps were provided to the IMT on or before 8 November 2019. Normally only a manual prediction is released to the IMT.³⁹⁹

CONCLUSION

The events of 8 November 2019 with respect to the Kangawalla Fire point to prediction being of great significance where there is a potential risk to remote communities with limited to no access to reliable telecommunications and this should be included in the determination of priorities for fire prediction. This may better ensure that such considerations will be the subject of informed decision making in setting priorities for fire prediction.

In the circumstances, I consider it necessary and desirable in the circumstances to make the following Recommendation:

To the Commissioner of the NSW Rural Fire Service

Recommendation 15:

The NSW Rural Fire Service develop training for Public Liaison Officers and Incident Controllers that addresses the significance of early warning to communities with limited access to reliable communication systems.

³⁹⁷ Exhibit 32A, Brief of Evidence at p. 871-3.

³⁹⁸ Exhibit 32A, Brief of Evidence at p. 871-4.

³⁹⁹ Exhibit 2A, Brief of Evidence at p. 1009.

Communication of predictions and emergency alerts

The adequacy of Rural Fire Service communications and emergency warning systems

ISSUE 2 – COMMUNICATIONS AND WARNINGS

The adequacy of RFS communications and emergency warning systems on 8 November 2019 in respect of the Kangawalla Fire and its likely impact on the community of Wyaliba.

ISSUES 3 & 4 – FIRE PREDICTION MODELLING

Whether the process for the communication of predictions within the RFS is adequate to enable warnings to be communicated with sufficient notice to landowners, the community and/or other stakeholders.

Whether the RFS process for communicating predictions to landowners, the community and/or other stakeholders is adequate.

106. It was submitted by Counsel Assisting that within the RFS, the flow of information concerning the Kangawalla Fire was sub-optimal:
- neither the IC,⁴⁰⁰ FBA,⁴⁰¹ nor PLO⁴⁰² were made aware of the breakout scenario maps prepared on 6 November 2019 showing the potential impact of the Kangawalla Fire on Wyaliba;
 - the PLO did not appear to have been informed of the call from Mr Donnelly at 3:15pm;⁴⁰³
 - information was logged within the ICON system a considerable time after it was received;⁴⁰⁴
 - as a consequence, the FBA carrying out the fire prediction for the Kangawalla Fire was not aware of reports from the fireground;⁴⁰⁵ and
 - those within the IMT do not appear to have been made aware:
 - during the early stages, that the Kangawalla Fire had broken out; and
 - the gravity of the risk that had been communicated by those on the ground.⁴⁰⁶
107. This fed into the communications issued to members of the public. In their oral evidence, Deputy Commissioner McKechnie and Mr Williams agreed that with the benefit of hindsight, the warning levels issued to the public did not reflect the reality of the situation on the ground.⁴⁰⁷
108. It is accepted that this may have been as a result of the extraordinary conditions in which the RFS were working on 8 November 2019. Nonetheless, there appears to be scope for improvement.

⁴⁰⁰ Inferred from Transcript for 23 September 2022 T 839:34-45.

⁴⁰¹ Transcript for 4 April 2023 T 1308:9-19.

⁴⁰² Inferred from Exhibit 32A, Brief of Evidence at p. 709.

⁴⁰³ Exhibit 32A, Brief of Evidence at p. 708, 755.

⁴⁰⁴ Exhibit 32A, Brief of Evidence, Tab 48.

⁴⁰⁵ Transcript for 4 April 2023 T 1320:6-16.

⁴⁰⁶ Exhibit 32A, Brief of Evidence at p. 709; Transcript for 4 April 2023 T 1320:6-16; Transcript for 23 September 2022 T 845:42-50.

⁴⁰⁷ Transcript for 23 September 2022 T 891:31-49; Transcript for 23 September 2022 T 853:24-33.

Internal communications: breakout predictions

109. The Phoenix RapidFire breakout prediction map carried out on 6 November 2019 at 6:05pm showed a potential impact on Wyaliba on 8 November 2019 in 11 to 15 simulations however, it was not provided to the IMT. This is partially explained by the RFS' concerns with the accuracy of Phoenix RapidFire and due to their detailed nature, they require expert interpretation,⁴⁰⁸ dealt with further below under the sub-heading 'Phoenix RapidFire'.
110. Mr Philp, who was based at the IMT at the time with unparalleled experience as a FBA, gave evidence that:
- '... had that prediction of 6 November been available, that would have been an incentive at least for me to bring Kangawalla up on my radar and at least have done some very approximate assessment of what it could do and make sure that the Public Liaison Officer was aware of those concerns.'*⁴⁰⁹
111. Although the 6 November 2019 Phoenix RapidFire breakout prediction was not available to the Court when Ms Burford gave evidence, she said in her statement, reproduced again for convenience, that:
- 'There was no warning that the fire was going to impact Wyaliba before it did on 8 November 2019. Had it been predicted that the fire had the potential to impact Wyaliba on 8 November 2019, I would have undertaken pre-planning for Wyaliba as part of the public liaison plan, organised for community newsletters to be issued and for door knocking to occur... Due to the speed with which the fire impacted Wyaliba, the only option available for community messaging was to issue an Emergency Alert.'*⁴¹⁰
112. In their submissions in reply, the RFS noted that 11 to 15 simulations are a small subset of the 200 simulations undertaken, so the vast majority of the simulations showed no impact on Wyaliba.
113. Further, the RFS submitted that the non-provision of the 6 November 2019 Phoenix RapidFire breakout prediction constituting a failure should be rejected by the Court. This is because it was inconsistent with the RFS' practice not to release that information due to the limitations identified in evidence and the prioritisation of fires that were uncontained at that time, noting that the Kangawalla Fire was at 'Patrol' status.
114. In reply, Counsel Assisting respectfully submitted that the RFS' submissions in reply did not fully engage with:
- a. the reason for the practice of not providing breakout predictions to IMTs; and
 - b. the evidence from those within the IMT.
115. Counsel Assisting noted that Dr Heemstra's evidence was that, given the limitations of Phoenix RapidFire breakout predictions, they are best used for contingency planning to understand risk. Had the prediction been provided to those with expert knowledge within the IMT, being the FBA/s involved in setting prediction priorities, then it could have been used as suggested by Dr Heemstra.⁴¹¹
116. Counsel Assisting highlighted that ultimately, State Command had information that it did not share with experts within the IMT who had the ability, and training, to use the predictions in the very way that the RFS intended for them to be used. In circumstances where the IMT had the expertise to interpret the Phoenix RapidFire breakout prediction maps, accuracy concerns should not have prevented its distribution at least to Mr Philp, or his predecessor on 7 November 2019. Whether the non-provision of the Phoenix RapidFire breakout prediction is classified as a failure or not was considered by Counsel Assisting to be immaterial. Had the prediction been provided to the FBA within the IMT then the FBA may have alerted Ms Burford, and steps may have been taken to provide advanced warning to the residents of Wyaliba.

⁴⁰⁸ Exhibit 32A, Brief of Evidence at p. 871-4; Exhibit 2A, Brief of Evidence at p. 1008.

⁴⁰⁹ Transcript for 4 April 2023 T 1308:9-19.

⁴¹⁰ Exhibit 32A, Brief of Evidence at p. 709.

⁴¹¹ Exhibit 32A, Brief of Evidence at pp. 916-917; Exhibit 2A, Brief of Evidence at p. 1008.

117. It is understood that since the 2019/2020 bushfire season, Phoenix RapidFire predictions such as those produced on 6 November 2019 are available to ICs and FBAs through the Athena program. Mr Philp suggested that they could also be placed on ICON, so that all within the IMT could be made aware of the existence of the prediction.⁴¹²
118. Counsel Assisting submitted that given the RFS' concerns about the limitations of Phoenix RapidFire and the need for expert interpretation, the existence of the prediction could be notified in ICON. This would provide an impetus for those with access to Athena to either individually access the prediction, or for others concerned about potential communications difficulties, like the PLO, to cause them to access the prediction.
119. Laurence McCoy, RFS Acting Director of Community Risk, also gave evidence that the new SPARK fire spread simulator has the ability to send automated alerts.⁴¹³ Counsel Assisting added that it could be used to the same end, to provide a notification to relevant officers that Mr Philp suggested would be of assistance.
120. Ultimately, a recommendation was proposed that the RFS amend its policies and training (where required) to ensure that where a breakout prediction has been carried out, the completion of the prediction is logged in the ICON system. The RFS in its submissions in reply agreed with the proposed recommendation noting that such predictions have been routinely logged in the ICON system since the 2019/2020 bushfire season and automation of this process is proposed as a future enhancement to the Athena system.
121. Further, a recommendation was proposed that in establishing the automated alerts in the Athena system, the RFS be required to ensure that alerts are sent to the IC, FBAs within the IMT, and the PLOs on the completion of any fire prediction within the section 44 declaration area of that IMT. The RFS in its submissions in reply agreed to the proposed recommendation.

Internal communications: information provided to Fire Behaviour Analysts

122. At about 3:20pm on 8 November 2019, Mr Gibb was requested by Dr Heemstra to undertake a rapid appreciation prediction for the Kangawalla Fire, at which time there was limited information, followed by a best estimate prediction. This suggested to Mr Gibb that there was a degree of urgency.⁴¹⁴
123. Neither Mr Gibb nor Dr Heemstra could recall why the prediction was requested, however Dr Heemstra suggested that it could have been prompted by his monitoring of available intelligence at the time such as satellite imagery, information logged into ICON or from conversations with the Major Incident Coordinator of the State Operations Coordinator.⁴¹⁵
124. The Intelligence Report for the Kangawalla Fire revealed that between 9:30am and 3:36pm on 8 November 2019, there were no entries logged on ICON for the Kangawalla Fire. The entry at 9:30am was that no resources were allocated to the Fire and the entry at 3:36pm read, '*Bald Nob has undertaken Patrol and investigated active fire. Crew getting to work. SitRep to follow.*'⁴¹⁶ Mr Philp was to be the conduit of information directly from the IMT to Mr Gibb.⁴¹⁷ It was Mr Philp's evidence that information was not passed to him within the IMT about telephone calls or reports from the fireground about the Kangawalla Fire.⁴¹⁸ Mr Gibb could not recall being conveyed any information about the Fire from anyone within the IMT.⁴¹⁹

⁴¹² Transcript for 4 April 2023 T 1309:28-50.

⁴¹³ Transcript for 4 April 2023 T 1343:19-33.

⁴¹⁴ Exhibit 32A, Brief of Evidence at p. 889; Transcript for 4 April 2023 T 1318:17-33.

⁴¹⁵ Transcript for 4 April 2023 T 1318:25-29; Transcript for 4 April 2023 T 1337:1-13.

⁴¹⁶ Exhibit 32A, Brief of Evidence, Tab 48.

⁴¹⁷ Transcript for 4 April 2023 T 1312:19-26.

⁴¹⁸ Transcript for 4 April 2023 T 1312:34-37.

⁴¹⁹ Transcript for 4 April 2023 T 1320:14-16.

125. Whilst Mr Gibb was carrying out his prediction, as previously noted the RFS had received:
- a. the calls from Mr Donnelly at 3:15pm and 4:15pm detailing the potential threat to Wyaliba;
 - b. a call at 3:39pm that the Fire was half-way up to Tommy's Rock lookout; and
 - c. a call from Mr Jermey and his colleague Mr Cook at 3:53pm detailing that the Fire was below Tommy's Rock, and spotting in front of itself by 500 metres every couple of minutes.
126. None of that information was conveyed to Mr Gibb nor to Mr Philp, who would then have provided it to Mr Gibb. Nor was it uploaded promptly to ICON. Mr Gibb only had the benefit of the information provided by Mr Donnelly in his first call at 3:15pm when it was uploaded to ICON at 4:13pm.⁴²⁰
127. Mr Gibb's evidence was that the information would have been useful when carrying out his prediction.⁴²¹ It was information that he agreed he should have been given.⁴²²
128. Deputy Commissioner McKechnie gave evidence that those who were aware of information such as the initial report from Mr Donnelly, had a:
- '... responsibility to move that information to various points around the Incident Management Team, the Fire Behaviour Analyst or Analysts, the team that may exist, potentially to public information as well, to start building their situational awareness.'*⁴²³
129. Counsel Assisting submitted that it was not clear why the information was not provided to Mr Philp or Mr Gibb and a review by RFS of its systems to ensure that critical information is uploaded to ICON and provided to FBAs promptly, was warranted.

Internal communications within the Incident Management Team

130. Counsel Assisting submitted that the evidence was indicative of a disconnect between information provided to the IMT, and what was known by individuals within the IMT.
131. At 3:15pm, Mr Donnelly informed the IMT relevantly that:
- a. the Kangawalla Fire was likely in the Mann River Nature Reserve and heading towards Old Grafton Road; and
 - b. *'Wyaliba might have to look at some strategies there off the Old Grafton Road.'*⁴²⁴
132. 11 minutes later, at 3:26pm, in a call with Mr Gresham, Scott Keenan within the IMT stated:
- "There is activity at Kangawalla, but it wouldn't be enough. I don't think it would be enough to [caller cuts in 'be noticeable'] yeah, not from there. I'm just looking at the map and there's nothing down at Old Grafton Road. There's no known fire activity there."*⁴²⁵
133. Ms Burford was not aware that the Kangawalla Fire had broken out until she was informed at about 3:50pm.⁴²⁶ Mr Williams found out at 4:11pm.⁴²⁷ The delay was time that could have been spent ground-truthing and preparing for an emergency alert.

⁴²⁰ Exhibit 32A, Brief of Evidence, Tab 48.

⁴²¹ Transcript for 4 April 2023 T 1320:33-50; Transcript for 4 April 2023 T 1321:1-11.

⁴²² Transcript for 4 April 2023 T 1321:7-11.

⁴²³ Transcript for 23 September 2022 T 890:32-43.

⁴²⁴ Exhibit 32A, Brief of Evidence, Tab 60 (recording 15:15).

⁴²⁵ Exhibit 32A, Brief of Evidence, Tab 60 (recording 15:26).

⁴²⁶ Exhibit 32A, Brief of Evidence at p. 708.

⁴²⁷ Exhibit 32A, Brief of Evidence at p. 600.

134. When it was determined that an emergency alert should be issued, at 4:25pm, there was still a discrepancy between what appears to have been within the knowledge of those making decisions within the IMT and State Command, and what was occurring on the ground:
- a. during the RFS State Operations Red Phone call, it was determined to keep the warning level at W&A, specifically W&A 3;⁴²⁸ and
 - b. the SITREP issued 3 minutes later assessed the time for impact of the fire front to be 2 to 6 hours.⁴²⁹
135. The RFS' alert level guidance matrix indicates that a W&A 3 level will be adopted on days of severe fire danger where the time to impact is 2 to 6 hours.⁴³⁰ A time to impact of less than 2 hours in those conditions, warranted an EW 5 rating. At the time, the RFS had been informed:
- a. at 3:53pm by Mr Jermey and a colleague, that the Fire was 3 kilometres from the town and spotting ahead of itself by 500 metres every couple of minutes;⁴³¹ and
 - b. at 4:15pm, from Mr Donnelly in which he gave a situation update from the fireground and stated, *'you'll probably need to evacuate Wyaliba.'*⁴³²
136. Mr Williams was not aware of the call from Mr Donnelly nor was he informed of the extreme spotting reported in the call from Mr Jermey. Nor had he been informed after the radio call at 4:35pm from Mr Miller of the Wyaliba RFS Brigade.⁴³³ Ms Burford was not aware of either call.⁴³⁴
137. Both Deputy Commissioner McKechnie and Mr Williams accepted that, with the benefit of hindsight, had they been apprised of that information, then it would have been appropriate to adopt an alert level of 'EW'.⁴³⁵
138. The content of calls received by the Glen Innes FCC was typically written onto a note and then passed on to the relevant person within the IMT, presumably someone within the Operations Cell of the IMT.⁴³⁶ A similar process occurred with radio messages.⁴³⁷ They were then separately logged onto ICON.
139. Not only do significant notes not appear to have been passed upwards through the chain to be actioned by relevant officers (such as the PLO, FBA, and IC), but there was a delay in including information on ICON, which would have been visible to all.
- a. Mr Donnelly's initial call at 3:15pm was logged on ICON at 4:13pm;⁴³⁸
 - b. Mr Jermey's call at 3:53pm was logged at 5:14pm, after the Kangawalla Fire impacted Wyaliba;⁴³⁹ and
 - c. Mr Donnelly's call at 4:15pm, was not logged until 5:54pm.⁴⁴⁰

⁴²⁸ Exhibit 32A, Brief of Evidence, Tab 60.

⁴²⁹ Exhibit 32A, Brief of Evidence at p. 230.

⁴³⁰ Exhibit 61, Brief of Evidence at p. 2503.

⁴³¹ Exhibit 32A, Brief of Evidence, Tab 60 (recording 15:53).

⁴³² Exhibit 32A, Brief of Evidence, Tab 60 (recording 16:15).

⁴³³ Transcript for 23 September 2022 T 850:1-15; Transcript for 23 September 2022 T 854:3-6, 22-35.

⁴³⁴ Transcript for 21 September 2022 T 818:8-10.

⁴³⁵ Transcript for 23 September 2022 T 853:24-33; Transcript for 23 September 2022 T 891:31-49.

⁴³⁶ Transcript for 23 September 2022 T 842:21-28.

⁴³⁷ Transcript for 21 September 2022 T 793:28-35.

⁴³⁸ Exhibit 32A, Brief of Evidence, Tab 48.

⁴³⁹ Exhibit 32A, Brief of Evidence, Tab 48.

⁴⁴⁰ Exhibit 32A, Brief of Evidence, Tab 48.

140. Mr Williams gave evidence that given the number of incidents and the workload of those within the IMT, they often fell behind with the entry of the intel into ICON.⁴⁴¹ When asked whether he agreed there appeared to be a disconnect between what was happening on the fireground and what was occurring inside the IMT, Mr Williams said that:

*'Yes, certainly with any incident there's a time lag in between what occurs out on the fireground and what actually gets logged and actioned within an Incident Management Team, and that's natural. Given the level of activity that we had around the section 44 declaration, with those 14 other incidents, a lot of which were at Emergency Alert, there's obviously an additional delay that can be expected, I guess, as much as unwanted, that occurs as a result of that. So, I wouldn't call it a disconnect, I'd just say it would probably be a delay in that information being registered and ... potentially being actioned in other ways.'*⁴⁴²

141. In relation to this, the RFS in its submissions in reply emphasised the inherent complexity of digesting what is usually imperfect information being received from multiple sources in a short time period within a high-pressure environment with competing demands, all of which potentially involve threat to life. The RFS further asserted in its submissions in reply that there was no evidence of delays in inputting information into ICON as causing any delay. However, in Counsel Assisting's reply, it was respectfully submitted that there was in fact evidence to conclude that it made the work of some officers within the IMT more difficult.

142. Both Ms Burford,⁴⁴³ and Mr Gibb,⁴⁴⁴ identified that it would have been useful on the day had they been able to hear the content of the calls made to the IMT.

143. Ms Burford identified that the manner of the delivery of messages could also be improved. Her evidence was that that:

*'One limitation is the physical form in which messages are passed to functional heads within the IMT, being a piece of paper, it's relying on humans giving and receiving that piece of paper to ensure that it is actioned.'*⁴⁴⁵

144. Counsel Assisting submitted that there is scope for improvement to ensure that critical information is provided to those who need it. To that end, a recommendation was proposed targeted at the improvement of internal communications, and the logging of information on ICON, with which the RFS agreed.

145. It is noted that the Court does not have evidence of the feasibility of measures that could include:

- a. making of recordings of radio and telephone conversation available to division heads; or
- b. means to better integrate note taking from phone calls to limit the need to separately input data into ICON.

Communications with the public

146. Counsel Assisting submitted that the disconnect between the information provided to key personnel ultimately affected the timeliness and accuracy of the information given to the public about the Kangawalla Fire. As set out above:

- a. alerts were not issued as early as they could have been;
- b. means of notification tailored to the communication limitations faced by the Wyaliba community could not be adopted;
- c. warning levels were adopted that did not reflect the situation that had been communicated by those on the ground; and
- d. the text of the alert initially determined to be sent did not accord with the situation on the ground, although this was corrected before the alert was sent.

⁴⁴¹ Transcript for 23 September 2022 T 849:16-24.

⁴⁴² Transcript for 23 September 2022 T 851:7-16.

⁴⁴³ Transcript for 21 September 2022 T 826:19-25.

⁴⁴⁴ Transcript for 4 April 2023 T 1320:24-41; Transcript for 4 April 2023 T 1321:7-11.

⁴⁴⁵ Transcript for 21 September 2022 T 826:11-17.

147. Counsel Assisting submitted that each was a function, not of problems with the alert or public communications systems adopted by RFS, but of the necessary information not being provided to the right people as early as possible.
148. In those circumstances, no additional recommendations are considered warranted beyond those already considered in relation to the flow of information internally within the RFS.

CONCLUSION

There appears to be scope for improvement to ensure that critical information is provided to those who need it within the IMT and State Command in a timely manner. If the RFS is to have sufficient time to warn communities particularly those that are remote and experience communication difficulties, they require advanced warning and accurate and timely prediction is pivotal, which is also reliant on the optimal flow of information and intelligence.

Based on the evidence received, I consider it necessary and desirable in the circumstances to make the following Recommendations:

To the Commissioner of the NSW Rural Fire Service

Recommendation 16:

The NSW Rural Fire Service amend its policies and training (where required) to ensure that where a breakout prediction has been carried out, the completion of that prediction is logged in the ICON system.

Recommendation 17:

In establishing automated alerts in the Athena system, the NSW Rural Fire Service ensure that alerts are to be sent to the Incident Controller, Fire Behaviour Analysts within the Incident Management Team, and the Public Liaison Officer of the completion of any fire prediction within the section 44 declaration area of that Incident Management Team.

Recommendation 18:

The NSW Rural Fire Service carry out a review to determine:

- a. appropriate means to better ensure the prompt uploading of reports from the fireground onto the ICON system, including through the use of technology in note taking;*
- b. whether there is a need for further training of Incident Management Team personnel to ensure that information relevant to fire prediction is provided promptly to Fire Behaviour Analysts; and*
- c. whether there is a means to make available to NSW Rural Fire Service staff recordings of telephone calls and radio messages in the period immediately after the receipt of that call or message.*

Operational communications

Rural Fire Service communications with ground crews

ISSUES 3 & 4 – COMMUNICATIONS AND WARNINGS

The adequacy of RFS communications systems between ground crews in the field, including with respect to black spot areas and/or network failures, and contingency planning for operational continuity.

The adequacy of RFS communications systems between ground crews and FCCs (or other operational command areas), including with respect to black spot areas and/or network failures, and contingency planning for operational continuity.

149. The RFS employs standardised communication systems and hardware to provide a higher degree of reliability for users during emergency situations. It commissions and maintains infrastructure to support operational requirements on the ground.⁴⁴⁶
150. The Court received evidence in relation to the Kangawalla Fire about the difficulties that some RFS officers experienced on 8 November 2019 when that fire impacted Wyaliba. Both RFS officers Mr Borgia and Mr Kirkman told the NSWPF that UHF radios do not transmit when crews are located on opposite sides of Wyaliba.⁴⁴⁷
151. In relation to this, Mr Jerney stated that since the 2019/2020 bushfire season, the Wyaliba RFS Brigade have installed UHF radios in all fire appliances, and they now have access to an increased number of portable radios on the Government Radio Network/Private Mobile Radio broadcast systems that work across the whole of Wyaliba.⁴⁴⁸
152. However, there was no evidence to suggest any failure on the part of the RFS in terms of its infrastructure and communications systems on the ground. The focus of the evidence was on communications within FCCs and State Command in response to communications received from the field.

CONCLUSION

Given the focus of the evidence was on communications within FCCs and State Command in response to communications received from the field, in the circumstances, no recommendations in relation to these issues are warranted.

⁴⁴⁶ Exhibit 61, Stage 2 General Brief of Evidence at p. 2539, 2548.

⁴⁴⁷ Exhibit 33, Brief of Evidence at p. 128, 134.

⁴⁴⁸ Exhibit 32A, Brief of Evidence at p. 688.

Technical issues concerning fire prediction

The adequacy of the fire predictions carried out by the Rural Fire Service

ISSUE 2 – FIRE PREDICTION MODELLING

Whether the fire predictions performed by the RFS were:

- a. carried out to an expected standard, having regard to available technology and information; and*
- b. reasonable, having regard to the broader operational context at the time.*

153. It is acknowledged that calculating fire behaviour is uncertain and challenging. It requires making predictions based on uncertain inputs of weather, fuel, and topography using models that are often being applied outside the conditions under which they were developed. This would have been exacerbated by the overwhelming volume and scale of fires and conditions experienced during the 2019/2020 bushfire season and it is acknowledged that the workload of the RFS FBAs during that time was extreme. Predictions would have had to be prepared quickly and only limited time would have been available for checking and re-assessing those predictions.⁴⁴⁹
154. In relation to fire prediction, the Court heard concurrently from:
 - a. David Field, Acting Manager, Predictive Services Unit, RFS;
 - b. Dr Heemstra, former Manager of Predictive Services Unit, RFS;
 - c. Dr Jonathan Marsden-Smedley, Court appointed expert; and
 - d. Mr McCoy, Acting Director, Community Risk, RFS.
155. The Court also had the benefit of evidence from Mr Philp and Mr Gibb.

Prediction tools used by the Rural Fire Service

156. Fire prediction has been described in evidence as an inexact science. Whilst accuracy is particularly important in the context of the risk to life posed by bushfires, an expectation of complete accuracy of a prediction is unrealistic and unachievable.⁴⁵⁰
157. During the 2019/2020 bushfire season, RFS FBAs used two methods of preparing fire spread predictions:
 - a. Phoenix RapidFire; and
 - b. manual fire spread prediction maps.⁴⁵¹

Phoenix RapidFire

158. Phoenix RapidFire is a computer-based program that uses several fire prediction models, in particular the McArthur model, to rapidly generate predictions using a variety of inputs. These include fire location, weather, fuel, fire history, and topography, which are contained on an RFS State-wide data set and weather data downloaded from the Bureau. The predictions initially take about half an hour to be generated compared to a manual prediction, which can take an hour at the minimum.⁴⁵²
159. The RFS generally uses Phoenix RapidFire to triage which fires need to undergo further fire behaviour or risk analysis modelling. Phoenix RapidFire predictions are not routinely released to an IMT without an accompanying report or manual prediction due to accuracy and interpretation concerns.⁴⁵³

⁴⁴⁹ Exhibit 2A, Brief of Evidence at p. 1169; Exhibit 32A, Brief of Evidence at p. 951-23.

⁴⁵⁰ Exhibit 2A, Brief of Evidence at p. 1183; Transcript for 4 April 2023 T 1343:46.

⁴⁵¹ Exhibit 2A, Brief of Evidence at p. 1006; Exhibit 32A, Brief of Evidence at p. 903.

⁴⁵² Exhibit 2A, Brief of Evidence at p. 1006, 1009.

⁴⁵³ Exhibit 2A, Brief of Evidence at p. 1007; Exhibit 32A, Brief of Evidence at p. 905.

160. Prior to the 2019/2020 bushfire season, the RFS developed the prototype FBA supervisor module. It uses Phoenix RapidFire to automatically generate Phoenix RapidFire predictions following reports of a new ignition or a fire polygon (map) update. These predictions would be reviewed by the FBA Supervisor as a method of triaging priority fires that may then require manual analysis. These automatically generated Phoenix RapidFire predictions can take a matter of minutes to be prepared.⁴⁵⁴
161. The RFS also utilised Phoenix RapidFire to prepare break out scenario predictions, as was done for the Kangawalla Fire on 6 November 2019.⁴⁵⁵ As noted, these provide a hypothetical prediction of potential fire behaviour if the fire escapes at a specific location and time and are created by placing a series of ignition points outside the identified containment line of a fire to test where a fire could go if it broke out.⁴⁵⁶
162. Dr Marsden-Smedley did not recommend use of Phoenix RapidFire due to it having a lower performance than vegetation specific fire behaviour models. In addition, the relationships between different predictor factors, such as wind speed, fuel moisture, fuel hazard, contained within the Phoenix RapidFire product have not been published or documented and are hence unknown.⁴⁵⁷
163. The RFS are aware of the limitations of Phoenix RapidFire. It is typically used as a tool to triage, and provide a check against, manual predictions. The RFS have implemented processes to address any doubts concerning the reliability of the Phoenix RapidFire software and to build confidence in the predictions. These include measures such as:
 - a. the manual and Phoenix RapidFire predictions being undertaken by different FBAs;
 - b. the FBA preparing the manual prediction must not see the computer-generated Phoenix RapidFire prediction so as to not be biased by the results; and
 - c. a Supervisor must review both the manual and Phoenix RapidFire predictions to compare them before a prediction is released.⁴⁵⁸

Manual predictions

164. In preparing a manual prediction, a FBA enters weather, fuel, and topography information into a spreadsheet. The weather information includes temperature, RH, wind speed, wind direction and the drought factor sourced from the Bureau. The fuel is estimated either using local information and knowledge, or alternatively using an RFS calculator, which has basic fuel information for the whole of the State. The topography of the fire is contained on an RFS spatial database.⁴⁵⁹
165. By preparing a manual prediction, a FBA can incorporate the current fire situation in an attempt to increase the reliability of the prediction, being an advantage over Phoenix RapidFire.⁴⁶⁰
166. Manual predictions are validated using satellite imagery, linescans, radar, local knowledge, field observations, and footage from aircraft. The predictions can be adjusted to incorporate additional inputs and extreme fire behaviour or fire behaviour exceeding the model inputs.⁴⁶¹
167. Manual predictions are usually completed without accounting for fire suppression by crews and aircraft. Although fire spread can be slowed by suppression, FBAs generally do not assume that suppression is occurring as it is difficult to know exactly where and how effective the suppression effort might be.⁴⁶²

⁴⁵⁴ Exhibit 2A, Brief of Evidence at p. 1007, 1009; Exhibit 32A, Brief of Evidence at p. 904.

⁴⁵⁵ Exhibit 2A, Brief of Evidence at p. 1008.

⁴⁵⁶ Exhibit 2A, Brief of Evidence at p. 1008.

⁴⁵⁷ Exhibit 2A, Brief of Evidence at p. 946.

⁴⁵⁸ Exhibit 2A, Brief of Evidence at p. 1007, 1009; Transcript for 4 April 2023 T 1335.

⁴⁵⁹ Exhibit 2A, Brief of Evidence at pp. 1009–1010.

⁴⁶⁰ Exhibit 2A, Brief of Evidence at p. 1010.

⁴⁶¹ Exhibit 2A, Brief of Evidence at p. 1010.

⁴⁶² Exhibit 2A, Brief of Evidence at p. 1010.

Fire prediction models

168. Fire behaviour predictions are undertaken with the support of an appropriate fire behaviour model. The RFS uses various models with FBAs trained in and having access to 10 models for different fuel types, each with its own strengths and limitations.⁴⁶³
169. Most fire behaviour models used by the RFS are empirical models, meaning they involve sophisticated averages of a number of experimental fires and wildfires that the researcher chooses to use to develop a model. These models are not a precise expression of fire behaviour and when compared to a separate database of fires, the actual fire rate of spread can vary by 30% or more from the model output, based on a number of variables.⁴⁶⁴
170. One of the tasks of a FBA involves making a judgment call about the appropriate model to use based on fuel type and weather conditions. They are also required to consider other factors impacting fire behaviour and make adjustments that need to be made to the model used to reflect the conditions.⁴⁶⁵
171. During the 2019/2020 bushfire season, the RFS used several prediction models, including:
 - a. the McArthur model;
 - b. the Project Vesta I model; and
 - c. the 10% rule of thumb.⁴⁶⁶
172. The experts offered differing opinions about the suitability of each of these models.

McArthur

173. During the 2019/2020 bushfire season, the RFS primarily used the McArthur model, which has been in operational use since 1967 with a range of subsequent modifications. It is an empirical model based upon observations of a number of experimental low intensity fires on Black Mountain, near Canberra.⁴⁶⁷
174. Dr Marsden-Smedley does not recommend the use of the McArthur model for predicting fire rate of spread and intensity. While it has been shown to work adequately during low spread rate and intensity fires, it has been shown to significantly underpredict during moderate or higher spread rate and intensity fires noting that the McArthur model was developed having regard to low intensity research burns.⁴⁶⁸ The magnitude of this underprediction has been shown to increase during higher spread rate and intensity fires. For higher spread rate and intensity fires, the McArthur model relies heavily on adjustments for its accuracy. Beyond a moderate level of fire behaviour, the adjustments required to produce realistic predictions are themselves considered unrealistic, and not independently verified.⁴⁶⁹
175. Mr Philp shared a similar concern. His evidence was that he is very cautious about using the McArthur model in situations of extreme fire behaviour. When there are very strong wind conditions that drive a fire, the McArthur model could very quickly become inappropriate.⁴⁷⁰ He would use the Project Vesta I model when winds reached above 25 to 30 kilometres per hour.⁴⁷¹ This is because the McArthur model was more likely to underpredict for wind speeds beyond that level.⁴⁷²

⁴⁶³ Exhibit 2A, Brief of Evidence at p. 954; Exhibit 2A, Brief of Evidence at p. 1010.

⁴⁶⁴ Exhibit 2A, Brief of Evidence at p. 954; Exhibit 2A, Brief of Evidence at p. 1010.

⁴⁶⁵ Exhibit 2A, Brief of Evidence at p. 954.

⁴⁶⁶ Exhibit 32A, Brief of Evidence at p. 907; Exhibit 2A, Brief of Evidence at p. 954.

⁴⁶⁷ Exhibit 32A, Brief of Evidence at pp. 905-906; Exhibit 2A, Brief of Evidence at p. 1011.

⁴⁶⁸ Exhibit 2A, Brief of Evidence at p. 871.

⁴⁶⁹ Transcript for 4 April 2023 T 1348:1-6.

⁴⁷⁰ Transcript for 4 April 2023 T 1301:16-50.

⁴⁷¹ Transcript for 4 April 2023 T 1303:4-9.

⁴⁷² Transcript for 4 April 2023 T 1297:1-18; Exhibit 2A, Brief of Evidence at p. 954.

176. The evidence of the RFS was that when the McArthur model is used dynamically, by properly trained FBAs, it is capable of producing accurate predictions and should remain as one of the tools available to FBAs. Dr Heemstra emphasised that it was, and remains, an important tool of which FBAs within the RFS have a good understanding. In his experience, having authorised and signed off on fire predictions well into the thousands, the McArthur model, when adjusted, often outperforms the Project Vesta I model.⁴⁷³

Project Vesta I

177. The Project Vesta I model was based on moderate to high intensity fire in dry eucalypt forest in Western Australia.⁴⁷⁴ It requires information on the level of fuel hazard, which can be obtained using the CSIRO Project Vesta fuel hazard score.⁴⁷⁵
178. Dr Marsden-Smedley highlighted that a major issue with the Project Vesta I model is its sensitivity to fuel inputs and the estimation of fuel hazard. He was of the opinion that this issue can be addressed through training in the assessment of fuel hazard and with such training, the Project Vesta 1 model has the potential to provide robust predictions of fire spread.⁴⁷⁶
179. Dr Heemstra stated that the Project Vesta 1 model is appropriate to predict the behaviour of a fire that has reached a 'quasi steady state' rate of spread, meaning it is relatively constant⁴⁷⁷, and has the potential to provide an improved prediction in high intensity bushfires. However, he stated that it is not appropriate for a fire that is not a running fire or is one that is slowly building up. This is because there is not sufficient consumption of the shrub layer to produce an accurate prediction. In circumstances of a building fire, the Project Vesta 1 model tends to overpredict the potential spread.⁴⁷⁸
180. Dr Heemstra also noted the limitations of the Project Vesta 1 model, primarily relating to how the fuel model works. The Project Vesta 1 model is heavily influenced by the fuel load inputs; it uses an overall fuel hazard model, where each of the surface, near surface, elevated and bark fuels are subjectively assessed, with the result varying depending on the person undertaking the assessment. According to Dr Heemstra, due to the Project Vesta 1 model's sensitivity to these inputs, any inaccuracies in the available information significantly impacts the accuracy of the prediction, where a relatively small error in fuel hazard inputted can lead to the prediction being more than 100% out.⁴⁷⁹
181. Another issue identified by Dr Heemstra with the Project Vesta 1 model is that fire spotting is integrated into the model. However, spotting varies depending on the vegetation type and this has not been factored in. This is compared to the McArthur model where spotting sits outside of the model so that FBAs can incorporate it at their discretion and can make judgements about the amount of spotting based upon the type of vegetation in which the fire is burning.⁴⁸⁰

10% rule of thumb

182. The 10% rule of thumb is a method that provides a rapid assessment of a likely bushfire spread in forest. It assumes that under dry windy conditions, a running forest bushfire will spread at about 10% of the wind speed.⁴⁸¹ The threshold conditions outlined in the research, published in April 2019, for this method includes wind speeds over 30 kilometres per hour and a fine fuel moisture of less than 7.5%.⁴⁸²

⁴⁷³ Exhibit 2A, Brief of Evidence at p. 1171; Transcript for 4 April 2023 T 1348:42-50.

⁴⁷⁴ Exhibit 32A, Brief of Evidence at p. 907.

⁴⁷⁵ Exhibit 2A, Brief of Evidence at p. 867.

⁴⁷⁶ Exhibit 2A, Brief of Evidence at p. 868.

⁴⁷⁷ Exhibit 2A, Brief of Evidence at p. 1011.

⁴⁷⁸ Exhibit 32A, Brief of Evidence at p. 907.

⁴⁷⁹ Exhibit 32A, Brief of Evidence at pp. 907-908.

⁴⁸⁰ Exhibit 32A, Brief of Evidence at p. 908.

⁴⁸¹ Exhibit 2A, Brief of Evidence at p. 869.

⁴⁸² Exhibit 32A, Brief of Evidence at pp. 908-909; Exhibit 2A, Brief of Evidence at p. 1014.

183. Dr Marsden-Smedley suggested that a combination of the 10% rule of thumb in forests for rapid assessments and the use of the Project Vesta I model for comprehensive assessments would have been more appropriate for use by the RFS.⁴⁸³
184. However, the RFS:
- a. used the 10% rule of thumb occasionally during the 2019/2020 bushfire season, despite it being published only some months prior, and it was found to overpredict fire spread;⁴⁸⁴ and
 - b. since the 2019/2020 bushfire season, have incorporated the 10% rule of thumb into training modules for FBAs to provide a simple and rapid method of estimating the spread of a forest fire as a secondary method.⁴⁸⁵

Fire spread predictions for the Kangawalla, Badja, and Currowan State Forest Fires

185. There are several ways to assess the accuracy of a fire spread prediction, including:
- a. comparing the area actually burnt with the area predicted to be burnt (referred to as areal spread); and
 - b. comparing the predicted rate of spread with the observed rate of spread (referred to as linear spread).⁴⁸⁶
186. Dr Marsden-Smedley found that the majority of the RFS predictions in relation to the fires that were the subject of the general inquiries were underpredictions. However, the RFS found that overall, the RFS predictions had an underprediction bias of 500 metres per hour which is within the acceptable range for a fire spreading rapidly. This was the lowest bias of any of the fire spread prediction models and the use of the Project Vesta I model in particular, would have led to an overall overprediction bias of 890 metres per hour.⁴⁸⁷
187. It is understood that a widely accepted standard for prediction accuracy is 35%, constituting an acceptable error for rate of spread predictions. Whilst it is thought that overprediction of fire spread may be preferable to an underprediction, to retain credibility, the RFS maintains that predictions should be as accurate as possible, with which Dr Marsden-Smedley agreed, to avoid warning fatigue which can result in mistrust of the warnings issued. To highlight the significance of this, the example provided by the RFS was a situation where an overprediction would lead to a premature 'shelter in place' warning when an 'evacuate now' warning would be more appropriate, delivering a greater level of public safety.⁴⁸⁸
188. In relation to the Kangawalla Fire, Dr Marsden-Smedley agreed that the manual fire spread predictions carried out on 8 November 2019 were 'fairly close' in that there was a high agreement between the fire spread prediction maps and the eventual mapped fire spread. There was only a very minor overprediction.⁴⁸⁹ Mr Field agreed with that conclusion, noting that the RFS' implementation of the adjusted McArthur model in preparing the manual fire spread predictions was relatively accurate to what happened on that day.⁴⁹⁰
189. The Badja Fire, however, was different. In terms of the critical period of the Badja Fire, from the evening of 29 December 2019 through to the afternoon of 30 December 2019, Dr Marsden-Smedley emphasised that the predicted fire spread was 13 kilometres. The actual run mapped by RFS was 44 kilometres.⁴⁹¹

⁴⁸³ Exhibit 2A, Brief of Evidence at p. 857.

⁴⁸⁴ Exhibit 32A, Brief of Evidence at p. 909; Exhibit 2A, Brief of Evidence at p. 1014.

⁴⁸⁵ Exhibit 2A, Brief of Evidence at p. 1014.

⁴⁸⁶ Exhibit 2A, Brief of Evidence at p. 1171.

⁴⁸⁷ Exhibit 2A, Brief of Evidence at p. 1190.

⁴⁸⁸ Exhibit 2A, Brief of Evidence at pp. 1183-1184; Transcript for 4 April 2023 T 1344:36-44.

⁴⁸⁹ Transcript for 4 April 2023 T 1329:38-43.

⁴⁹⁰ Transcript for 4 April 2023 T 1330:40-47.

⁴⁹¹ Exhibit 2A, Brief of Evidence, p. 951-33-951-34.

190. Carrying out his own calculations, Dr Marsden-Smedley's opinion was that the model which best performed in relation to the Badja Fire was the Project Vesta I fuel hazard rating.⁴⁹² That still produced an underprediction of at least 50%.⁴⁹³
191. Ultimately, the overnight conditions were significantly different than that anticipated by the incident weather forecast.⁴⁹⁴ That limits the accuracy of any prediction. Mr Philp's evidence, with which Dr Marsden-Smedley agreed was a plausible explanation, was that the sheer spread was a consequence of long-distance spotting as the Badja Fire moved down the valley. That could entail spotting 30 kilometres and beyond downwind.⁴⁹⁵ Spotting at such distances was beyond the comprehension of any of the fire prediction models used by RFS during the 2019/2020 bushfire season.⁴⁹⁶
192. Dr Marsden-Smedley's analysis of the Phoenix RapidFire prediction for the Currowan State Forest Fire on 31 December 2019 was that the:
 - a. southern breakout towards Jervis Bay was realistically predicted; but
 - b. there was a significant over-prediction of the northern breakout towards Nowra.⁴⁹⁷
193. It was Dr Marsden-Smedley's opinion that the discrepancy in relation to the progress of the Currowan State Forest Fire to the north was likely the result of fire suppression operations. On average, the RFS predictions underpredicted the rate of spread by about 500 metres per hour.⁴⁹⁸

Improvements to fire prediction systems

194. There have been two important developments to fire prediction modelling since the 2019/2020 bushfire season. They are:
 - a. the Vesta Mk II model; and
 - b. the SPARK fire spread simulator.⁴⁹⁹
195. Dr Marsden-Smedley recommended that the utility of the Vesta Mk II model be investigated and further recommended the operational implementation of SPARK noting the rollout at that time was planned for late March/early April 2023.⁵⁰⁰
196. The RFS jointly funded with the CSIRO the development of the Vesta Mk II model for predicting wildfire rate of forward spread in eucalypt forest. It was designed to build upon the strengths and advantages of the previous models and address their operational limitations. The Vesta Mk II model utilises existing, easy-to-obtain inputs, and has applicability over a broad range of eucalypt forest types and burning conditions.⁵⁰¹
197. By utilising simplified fuel inputs, the need to come up with a fuel rating like the Project Vesta I model is avoided and subsequently reduces the margin for error. Vesta Mk II also enables the application of a broader range of weather to a fire, whilst requiring much more simplified inputs in higher intensity fires. It was Dr Marsden-Smedley's opinion that in such fires, the model greatly simplifies the process by coming down purely to inputs of fuel moisture and wind speed.⁵⁰²
198. It is acknowledged that the RFS has already started operational use of the Vesta Mk II model, trained FBAs in its use, and incorporated the model into its training modules since 2022.⁵⁰³

⁴⁹² Transcript for 4 April 2023 T 1337-8.

⁴⁹³ Transcript for 4 April 2023 T 1337:47-50; Transcript for 4 April 2023 T 1338:1-7.

⁴⁹⁴ Transcript for 4 April 2023 T 1338.

⁴⁹⁵ Transcript for 4 April 2023 T 1314.

⁴⁹⁶ Transcript for 4 April 2023 T 1314.

⁴⁹⁷ Exhibit 2A, Brief of Evidence at p. 951-37.

⁴⁹⁸ Exhibit 2A, Brief of Evidence at p. 951-37, p. 1190.

⁴⁹⁹ Exhibit 2A, Brief of Evidence at pp. 1012-1013.

⁵⁰⁰ Exhibit 2A, Brief of Evidence at p. 896.

⁵⁰¹ Exhibit 2A, Brief of Evidence at p. 1013.

⁵⁰² Transcript for 4 April 2023 T 1341:11-20.

⁵⁰³ Exhibit 2A, Brief of Evidence at p. 1013.

199. In 2021, the CSIRO and AFAC announced the development of a nationally consistent bushfire modelling and prediction capability. Since the project was commenced, the RFS contributed both in-kind support and funding. This led to the development of SPARK, which is a toolkit for the end-to-end processing, simulation, and analysis of wildfires. It has been designed to utilise and incorporate different fire behaviour modelling algorithms. Because SPARK utilises an open framework, the models and equations used will be visible which means that users will be able to see what assumptions have been made and will be able to assess whether the models and assumptions are appropriate for their use. It can also be easily adapted to incorporate new fire prediction models.⁵⁰⁴
200. The RFS began testing SPARK in 2022. At the time of the general inquiries, SPARK was not yet operational and formal evaluations had not been completed although the release of version 1 was imminent. It was anticipated that within two years, SPARK will be fully operational, during which time the RFS will test the model in an operational setting.⁵⁰⁵
201. In the current rollout of SPARK, it was not planned to include the Vesta Mk II model, which Dr Marsden-Smedley believed ought to be included.⁵⁰⁶ Due to the nature and design of SPARK, he was of the view that this would be quick and easy to do. Dr Heemstra's evidence was that Vesta Mk II will be included in the next phase of SPARK, noting that it is open to adaption and development.⁵⁰⁷ It was also suggested by Mr Field that this should be a relatively simple and straightforward task.⁵⁰⁸
202. Given the agreement between the experts as to the benefits of the Vesta Mk II model, a proposed recommendation as to its inclusion in SPARK was considered appropriate. Notably, the RFS in its submissions in reply agreed to the proposed recommendation and indicated that it had already engaged with AFAC and the CSIRO on the incorporation of Vesta Mk II into future releases of SPARK.

Further areas of research and development

203. It is understood that atmospheric stability is a measure that determines the likelihood that air will change its altitude (i.e., rise, sink, or remain at the same altitude). Dr Marsden-Smedley highlighted that this factor is of critical importance to fire management because the normal situation is that air at higher altitude has higher wind speeds and lower humidity. If this air is brought down to the ground surface, it will increase its temperature which means its humidity (which is highly temperature dependent) will be reduced. This, in association with increased wind speeds, has the potential to greatly increase the level of fire danger. In addition, under highly unstable atmospheric conditions, fires may form pyro-cumulus convection columns which are often associated with erratic wind speed and direction, downbursts, and dry lightning.⁵⁰⁹
204. Currently, there is no fire prediction model that can adequately take into account precisely how atmospheric instability affects the rate of spread and intensity of fires.⁵¹⁰ The absence of direct input of atmospheric instability into fire behaviour prediction models means that its effect on fire behaviour needs to be incorporated subjectively. In general, when the atmosphere is highly stable, bushfires burn with lower than expected rates of spread and intensity, when the atmosphere is neutral fires burn as predicted by the fire prediction models, but when the atmosphere is unstable bushfires burn with enhanced rates of spread, intensity, and spotting. When the atmosphere is highly unstable, marked increases in fire spread rate, intensity and spotting normally occur.⁵¹¹

⁵⁰⁴ Exhibit 2A, Brief of Evidence at p. 1011-1012; Transcript for 4 April 2023 T 1341-1342.

⁵⁰⁵ Exhibit 2A, Brief of Evidence at p. 1013; Transcript for 4 April 2023 T 1341:40-40; Transcript for 4 April 2023 T 1353:42-47.

⁵⁰⁶ Exhibit 2A, Brief of Evidence at p. 896.

⁵⁰⁷ Transcript for 4 April 2023 T 1341-1342.

⁵⁰⁸ Transcript for 4 April 2023 T 1342.

⁵⁰⁹ Exhibit 2A, Brief of Evidence at pp. 868-869.

⁵¹⁰ Exhibit 2A, Brief of Evidence at p. 1005; Exhibit 32A, Brief of Evidence at p. 909.

⁵¹¹ Exhibit 2A, Brief of Evidence at p. 869.

205. There are currently several measures available to measure atmospheric instability, including:
- a. the CHI which is a composite measure of atmospheric instability and dryness, with high values indicating the atmosphere is both dry and unstable. The CHI is calculated from the temperature and humidity at two fixed heights in the atmosphere. The RFS noted that this is a serious limitation of the index as conditions can change at other levels which can have an effect on the stability but may not be reflected in the CHI.⁵¹²
 - b. another approach, considered a more superior and accurate method, is to observe the atmosphere with an atmospheric sounding. An atmospheric sounding is obtained by launching a weather balloon that measures the temperature dew point pressure and wind speed through the atmosphere as it rises. The RFS has developed the capacity to deploy portable atmospheric soundings to look at upper atmospheric instability and it is the only agency in Australia to do so. The RFS utilised this method during the 2019/2020 bushfire season.⁵¹³
 - c. during the 2019/2020 bushfire season, RFS FBAs also had regard to aerological diagrams. Such diagrams show the distribution of temperature and moisture within part of the atmosphere. It was Mr McCoy's evidence that these provide a much finer instrument than the CHI to understand potential interaction between a fire and the atmosphere.⁵¹⁴
206. In relation to the Kangawalla, Badja, and Currowan State Forest Fires, 8 November 2019 and 30 to 31 December 2019 were all forecast as days of high atmospheric instability respectively.
207. There was agreement amongst the experts about the need to incorporate the influence of atmospheric instability into fire prediction.⁵¹⁵ Mr Field's evidence was that it was potentially significant for the Badja Fire on 30 and 31 December 2019 as there was potentially an inversion over the Fire that meant that it was subject to greater winds than other parts of the landscape.⁵¹⁶
208. Further, it was agreed by the experts that rather than FBAs taking into account atmospheric instability subjectively in their predictions, a more objective and qualitative method of assessing atmospheric instability's effect on a fire should be developed.⁵¹⁷
209. To this end, the RFS is trialling the Pyrocumulonimbus Firepower Threshold tool developed by the Bureau. It is also engaged with the Bureau in the development of research of fire-atmosphere coupled modelling. That research has involved the use of case studies including the Green Valley Fire. Further research was due to commence with the Bureau in relation to the Lake Conjola Fire.⁵¹⁸
210. Acknowledging this, and the potential significance of atmospheric instability to fire behaviour, it was submitted that a proposed recommendation that the RFS continue to work with the Bureau towards developing fire-atmosphere coupled modelling; and obtaining a better understanding of the interrelationship between atmospheric instability and bushfire to be integrated into training of FBAs and the development or refinement of models for fire prediction, would be considered appropriate. The RFS in its submissions in reply indicated that it agreed to the proposed recommendation and noted that it should be extended to include working with the Bureau to develop ensemble forecasting capabilities.

⁵¹² Exhibit 2A, Brief of Evidence at p. 1005; Exhibit 32A, Brief of Evidence at p. 909.

⁵¹³ Exhibit 2A, Brief of Evidence at p. 1005; Exhibit 32A, Brief of Evidence at p. 910; Transcript for 4 April 2023 T 1339:1-6.

⁵¹⁴ Transcript for 4 April 2023 T 1339:39-46.

⁵¹⁵ Transcript for 4 April 2023 T 1338-1340.

⁵¹⁶ Transcript for 4 April 2023 T 1340:1-9.

⁵¹⁷ Exhibit 2A, Brief of Evidence at p. 899, 1187.

⁵¹⁸ Exhibit 2A, Brief of Evidence at p. 1187; Transcript for 4 April 2023 T 1343:33-49.

CONCLUSION

It is accepted that in relation to fire prediction, there are a range of models used in Australia which are empirically derived, and which require a wide range of inputs, so there is a degree of uncertainty in all the fire prediction models currently in existence.

Further, it is accepted that there are inherent complexities and challenges involved in fire prediction noting that it is an inexact science and whilst accuracy is particularly important in the context of bushfires and warning communities, an expectation of complete accuracy of a prediction is unrealistic and unachievable.

Although the McArthur model has some limitations, the evidence on balance does not support a recommendation that it be abandoned. It is accepted that it is a key part of the arsenal of fire prediction tools used by FBAs. Moreover, it is one of the models with which many RFS FBAs are proficient to produce reliable predictions that often outperform alternatives.

The RFS' commitment to learning from these events with the aim to improve its systems and processes is commended. It is evident, however, that there is room for improvement.

It is acknowledged that the RFS has taken steps to cause the Vesta Mk II fire prediction model to be incorporated into future releases of SPARK and there was agreement amongst the experts on its inclusion. Nonetheless, I consider it necessary and desirable in the circumstances to make the following Recommendations, noting the benefits of the Vesta Mk II fire prediction model:

To the Commissioner of the NSW Rural Fire Service:

Recommendation 19:

The NSW Rural Fire Service, either itself (if feasible) or through the Australasian Fire Authorities Council, cause the Vesta Mk II fire prediction model to be incorporated within the SPARK software.

Further, there was agreement amongst the experts that a more objective and qualitative method of assessing the effect of atmospheric instability on a fire should be developed rather than FBAs factoring atmospheric instability subjectively in their predictions.

Therefore, I consider it necessary and desirable to make the following Recommendation to enable the NSW Rural Fire Service to continue its work with the Bureau of Meteorology on atmospheric instability:

To the Commissioner of the NSW Rural Fire Service

Recommendation 20:

The NSW Rural Fire Service continue to work with the Bureau of Meteorology towards:

- a. developing fire-atmosphere coupled modelling; and*
- b. obtaining a better understanding of the interrelationship between atmospheric instability and bushfire, including to develop ensemble forecasting capabilities, to be integrated into training of Fire Behaviour Analysts and the development or refinement of models for fire prediction.*

Recommendations

ISSUE 5 - COMMUNICATIONS AND WARNINGS & FIRE PREDICTION MODELLING

Whether it is otherwise necessary or desirable for the Coroner to make recommendations pursuant to section 82 of the Coroners Act 2009 (NSW) in relation to any matter connected with these fire inquiries.

211. In light of the evidence received in the general inquiries, Counsel Assisting's submissions and the RFS' submissions in reply, the following Recommendations are made to the Commissioner of the RFS:

To the Commissioner of the NSW Rural Fire Service

Recommendation 13:

The NSW Rural Fire Service review its training for positions within an Incident Management Team to ascertain whether there is scope for improvement to better equip staff to determine:

- a. whether intelligence needs to be verified; and*
- b. the appropriate steps to be taken to obtain that verification.*

Recommendation 14:

The NSW Rural Fire Service investigate the possibility of improved integration of the emergency alert system within the NSW Rural Fire Service system, with a view to limiting the duplication of the entry of information, such as polygons and the text of emergency warnings.

Recommendation 15:

The NSW Rural Fire Service develop training for Public Liaison Officers and Incident Controllers that addresses the significance of early warning to communities with limited access to reliable communication systems.

Recommendation 16:

The NSW Rural Fire Service amend its policies and training (where required) to ensure that where a breakout prediction has been carried out, the completion of that prediction is logged in the ICON system.

Recommendation 17:

In establishing automated alerts in the Athena system, the NSW Rural Fire Service ensure that alerts are to be sent to the Incident Controller, Fire Behaviour Analysts within the Incident Management Team, and the Public Liaison Officer of the completion of any fire prediction within the section 44 declaration area of that Incident Management Team.

Recommendation 18:

The NSW Rural Fire Service carry out a review to determine:

- a. appropriate means to better ensure the prompt uploading of reports from the fireground onto the ICON system, including through the use of technology in note taking;*
- b. whether there is a need for further training of Incident Management Team personnel to ensure that information relevant to fire prediction is provided promptly to Fire Behaviour Analyst; and*
- c. whether there is a means to make available to NSW Rural Fire Service staff recordings of telephone calls and radio messages in the period immediately after the receipt of that call or message.*

Recommendation 19:

The NSW Rural Fire Service, either itself (if feasible) or through the Australasian Fire Authorities Council, cause the Vesta Mk II fire prediction model to be incorporated within the SPARK software.

Recommendation 20:

The NSW Rural Fire Service continue to work with the Bureau of Meteorology towards:

- a. developing fire-atmosphere coupled modelling; and*
- b. obtaining a better understanding of the interrelationship between atmospheric instability and bushfire, including to develop ensemble forecasting capabilities, to be integrated into training of Fire Behaviour Analysts and the development or refinement of models for fire prediction.*

212. I wish to express my sincere gratitude to those who have aided and provided information to the Court to assist with the general inquiries that considered the topics of Fire Prediction Modelling and Communications and Warnings.
213. I again wish to express my sincere condolences to the family, friends, and communities, of:
 - a. Laurence Andrew;
 - b. Colin Burns;
 - c. John Butler;
 - d. Michael Campbell;
 - e. Vivien Chaplain;
 - f. George Nole;
 - g. Ross Rixon;
 - h. Patrick Salway;
 - i. Robert Salway;
 - j. John Smith; and
 - k. Richard Steele.

4. Vehicle Design and Safety

Why was a general inquiry held?

1. General inquiries were held under section 32(3) of the Act into three tragic incidents in respect to the safety of firefighting vehicles used by the RFS and FRNSW:
 - a. Geoffrey Keaton and Andrew O'Dwyer died responding to the Green Wattle Creek (Lake Burragorang) fireground on 19 December 2019 after the RFS truck they were travelling in was struck by a burning tree at Wilson Drive, Buxton. Their colleagues, Carlos Quinteros, Benjamin Fraser, and Timothy Penning were seriously injured.
 - b. Samuel (Sam) McPaul died responding to the Green Valley Fire, Talmalmo on 30 December 2019. His RFS truck was lifted from the ground by a FGV and dropped on its roof. Andrew Godde and Rodney O'Keefe were seriously injured.
 - c. two further firefighters, Darryl Aldridge and Irene Pachos from FRNSW, sustained serious injuries in a separate incident on 10 November 2019. A tree fell onto their appliance whilst they were responding to the Kian Road, South Arm Fire.
2. In each of the three incidents, the vehicle's cabin was partially crushed.
3. Each incident raised the issue of the adequacy of the design of firefighting vehicles to protect those who dedicate themselves to the service of their community.

What issues did the inquiry examine?

4. Prior to the commencement of the inquiry a list of issues was circulated to the parties granted leave to appear, identifying the scope of the inquest and the issues to be considered. No application was made by any of the interested parties to amend to amend the Issues List. That List identified the following issues:

General

1. *Whether the NSW RFS and FRNSW fire appliance design during the 2019/2020 bushfire season, and now, complied with relevant standards and requirements for truck occupant cabins to protect the driver and/or passengers from rollover, impact crash, and any tree fall incident, including:*
 - a. *crashworthiness strength or energy dissipation requirements; and*
 - b. *active safety systems (such as seat belts, airbags, padding, windows with safety glazing, and emergency braking systems).*
2. *Whether the fire appliance designs referred to in 1 above were (and are):*
 - a. *fit for purpose; and*
 - b. *otherwise, adequate.*

Vehicle Design and Safety – Green Wattle Creek (Lake Burragorang) Fire and related inquests into the deaths of Geoffrey Keaton and Andrew O'Dwyer

3. *Whether the particular appliance was 'fit for purpose' in terms of:*
 - a. *cabin protection during a vehicle roll-over*
 - b. *cabin protection if objects are falling on the roof of the cabin; and*
 - c. *active safety systems.*
4. *Whether a FOPS or ROPS is suitable and/or achievable for use in fire appliances.*

Vehicle Design and Safety – Green Valley, Talmalmo Fire and related inquest into the death of Samuel McPaul

5. Whether the particular appliance was ‘fit for purpose’ in terms of:
 - a. cabin protection during a vehicle roll-over
 - b. cabin protection if objects are falling on the roof of the cabin; and
 - c. active safety systems.
6. Whether a FOPS or ROPS is suitable and/or achievable for use in fire appliances.

Vehicle Design and Safety – Kian Road, South Arm Fire

7. Whether the particular appliance was ‘fit for purpose’ in terms of:
 - a. cabin protection if objects are falling on the roof of the cabin; and
 - b. active safety systems.
8. Whether an Operator Protective Structure (**OPS**) and/or FOPS would be suitable and/or achievable for use in fire appliances.

Other matters

9. Whether Recommendation 40(c) of NSW Independent Inquiry, with respect to vehicle design and safety is sufficient, including specifically, whether further direction should be given to the RFS and FRNSW of the most appropriate cabin protection for different frontline vehicles.
10. The adequacy of steps taken by RFS in response to Recommendation 40(c).
11. Whether it is otherwise necessary or desirable for the Coroner to make recommendations pursuant to section 82 of the Coroners Act 2009 (NSW) in relation to any matter connected with these fire inquiries.

5. Each of these issues is considered in further detail below.

Earlier Inquiries

NSW Bushfire Inquiry

6. The issue of firefighting vehicle design was previously considered by the NSW Bushfire Inquiry in 2020.
7. That Inquiry recommended relevantly that:
 - a. all light tankers across NSW fire authorities be fitted with a single point crew protection safety spray system and radiant heat protection (Recommendation 40(a));
 - b. all medium/heavy tankers across NSW fire authorities be fitted with radiant heat protection blankets, wheel, and halo sprays (Recommendation 40(b)); and
 - c. additional research be undertaken to determine the most appropriate cabin protection for different frontline vehicles (Recommendation 40(c)).

8. In response to the first two Recommendations:⁵¹⁹
 - a. the NSW Government, in June 2022, allocated a further \$105.6 million to the RFS to deliver new trucks and retrofit old trucks. This builds on the \$67.9 million allocated since the 2019/2020 bushfire season to the RFS, FRNSW, NPWS, and FCNSW;
 - b. from 1 January 2021 to 30 September 2022, 71 compliant Light Tankers (Category 9) were built and handed over to RFS Brigades and the construction of 30 new CAT 9 appliances commenced which will replace the remainder of the Light Tankers identified as requiring improved firefighting safety; and
 - c. from 1 January 2021 to 30 September 2022, 177 new compliant Medium Tankers (Category 7) and Heavy Tankers (Category 1) were built and handed over to RFS brigades. Further, 62 existing Heavy Tankers were refurbished with appropriate crew protection systems and returned to RFS brigades; the RFS continues to build new CAT 1 and CAT 7 appliances to replace the Heavy and Medium Tankers identified as requiring improved safety mechanisms.
9. In respect of the third recommendation, namely cabin protection, the RFS is in partnership with the MUARC to determine the appropriateness and feasibility of further developing the new and existing fleet to provide greater cabin protection, including through FOPS.
10. Additionally, the RFS will be seeking industry engagement to develop new generation fire tankers.

Auditor-General

11. The management of firefighting assets was also the subject of a report by the NSW Auditor-General.
12. The Auditor-General's focus was not on the improvement of vehicles to protect firefighters, but instead on how effectively the RFS plans and manages its equipment, particularly its vehicle fleet, to prevent, mitigate, and suppress bushfires.
13. The Auditor-General, found that the average age of the RFS vehicle fleet has been reduced from 21 years in 2017, to 16 years in 2022. This reflects a considerable investment in new vehicles by the RFS to renew some of its fleet.

Kian Road Fire Incident

14. At about 3:14pm on 10 November 2019 at Coulters Road, North Congarinni, Tanker 397S had parked at a fire ground to clear a fallen tree.⁵²⁰
15. The tanker was a FRNSW Isuzu FTS700 4x4 (6-Locker) which provided seating for a crew of six. It is believed to have been manufactured before 2000 and possibly around 1994. It had a GVM of about 12.5 tonnes.
16. In the left rear passenger seat was Ms Pachos. Mr Aldridge was in the right rear passenger seat, with Luke Babula and Leslie McQueen occupying the two front seats of the vehicle.
17. As Ms Pachos began to alight from the truck's cabin, a tree about 60 metres tall, and with a diameter of 1 metre, snapped at its trunk, fell, and landed across the rear of the passenger cabin. Irene was knocked to the ground. Mr Aldridge, in the right rear passenger seat, was struck by the collapsing roof of the cabin and pushed against the truck's bench seating. Both sustained severe injuries.

⁵¹⁹ Exhibit 61, General Brief of Evidence at p. 4803.

⁵²⁰ Exhibit 52A, Brief of Evidence at p. 1498-1499.

18. The damage to the vehicle is shown in this image:⁵²¹



Green Wattle Creek (Lake Burragorang) Fire Incident

19. Shortly before 11:30pm on 19 December 2019, Geoffrey Keaton was driving fire appliance Horsley Park 1 Alpha along Wilson Drive, Buxton, in response to the Green Wattle Creek Fire.⁵²²
20. Andrew O'Dwyer was in the front passenger seat. Three of their crewmates were seated in the rear of the vehicle, Mr Quinteros, Mr Fraser, and Mr Penning.
21. Horsley Park 1 Alpha was an RFS Isuzu Chassis Dual Cab, Category 1 Heavy Tanker appliance, with a GVM of 13.7 tonnes.
22. Whilst the truck was travelling at about 70 kilometres per hour, a large burning iron bark gum tree, of approximately 30 metres in height, broke away from its burning base and impacted the top of the vehicle's roof and windscreen section.
23. The force of the impact and damage to the vehicle likely caused Geoffrey to immediately lose consciousness and as a consequence, lose control of the vehicle.
24. Horsley Park 1 Alpha continued travelling forward from the south bound lane into the north bound lane, dragging a tree branch which had broken away from the main section of the tree.
25. At a location approximately 60 metres from the initial collision, the appliance left the north bound lane and continued travelling up and along a dirt and vegetated embankment.
26. After travelling a further 32 metres, Horsley Park 1 Alpha started to rotate in a clockwise direction. It rolled 270 degrees before coming to rest on the offside of the vehicle.

⁵²¹ Exhibit 52A, Brief of Evidence at p. 1449.

⁵²² Exhibit 52A, Brief of Evidence p. 1499-1501.

27. The cabin was compressed significantly rearwards past the steering wheel:⁵²³



28. Tragically, Geoffrey and Andrew died from their injuries. Mr Quinteos, Mr Fraser, and Mr Penning sustained serious injuries.

Green Valley (Talmalmo) Fire Incident

29. Late in the afternoon on 30 December 2019, at a property known as 'Lightwood' in Jingellic, the crew of appliance Culcairn 2 Alpha were responding to the Green Valley Fire.⁵²⁴
30. Culcairn 2 Alpha was an RFS Isuzu Motors Limited FSS500 Category 2 Crew cab manufactured in 1999. That afternoon, the vehicle was reportedly fully laden with 1800 litres of water with a mass of 1.8 tonnes. The GVM of the vehicle was estimated at between 11.8 and 15 tonnes.
31. Just after 5:00pm, the vehicle is believed to have been lifted at the rear by a FGV. The truck was inverted and dropped on its roof, resulting in significant cabin roof crush:⁵²⁵



⁵²³ Exhibit 52A, Brief of Evidence at p. 1450.

⁵²⁴ Exhibit 52A, Brief of Evidence at p. 1501-1503.

⁵²⁵ Photograph taken after the truck was returned to its upright position. Exhibit 52A, Brief of Evidence at p. 1503.

32. At the time, Mr Godde was driving the vehicle. Sam McPaul and Mr O’Keefe were in the rear of the vehicle in an area known as the crew refuge area. That area is an open area within the rear tray of the tanker.
33. Tragically, Sam died as a result of his injuries. Mr Godde and Mr O’Keefe sustained serious injuries.

Evidence received during the Inquiry

34. The Court has received into evidence two expert reports prepared by Emeritus Professor Raphael Grzebieta, Court-appointed expert dated 14 December 2022 and 27 March 2023, and two reports dated March 2023 from MUARC relating to their recent work with the RFS, as well as statements from RFS and FRNSW personnel.
35. The following witnesses gave oral evidence on 29 March 2023:
 - a. Emeritus Professor Grzebieta, Court-appointed expert, from the University of New South Wales and associated with the Transport and Road Safety Research Unit and Adjunct Professor with the Department of Forensic Medicine at Monash University;
 - b. Dr Shane Richardson, Forensic Engineer and Director of Delta-V Experts forensic engineering consultancy, in the context of his engagement with the MUARC and RFS partnership;
 - c. Associate Professor David Logan, Senior Researcher at MUARC; and
 - d. Mr Kyle Stewart, RFS Deputy Commissioner, Preparedness and Capability Directorate.

ROPS and FOPS terminology

36. Professor Grzebieta, Dr Richardson and Associate Professor Logan (together ‘**the experts**’) provided the following general terms explanation for FOPS:

a falling object protection system, depending on where it’s placed on the vehicle, is meant to protect the compartment occupants against any object that would potentially crush or deform the compartment in order to protect the occupants from serious injury or death.⁵²⁶
37. The experts also provided the following general terms explanation for a ROPS:

a roll-over protection system is designed for when the vehicle rolls over and also prevents deformation of the occupant compartment in order to protect the occupants from serious injury or death. It could include internal systems such as air curtains, seat belt pre-tensioners. While it is also a FOPS, the ROPS can be isolated and defined as simply the structural component which assists with protecting the occupants within the vehicle.⁵²⁷

⁵²⁶ Transcript for 29 March 2023 T 1241:31-49.

⁵²⁷ Transcript for 29 March 2023 T 1242:5-25.

ISSUE 1

Whether RFS and FRNSW fire appliance design during the 2019/2020 bushfire season, and now, complied with relevant standards and requirements for truck occupant cabins to protect the driver and/or passengers from rollover, impact crash, and any tree fall incident, including:

- a. crashworthiness strength or energy dissipation requirements; and
- b. active safety systems (such as seat belts, airbags, padding, windows with safety glazing, and emergency braking systems).

Issue 1(a): Standards and requirements for truck occupant cabins – crashworthiness strength or energy dissipation requirements

38. There was consensus amongst the experts, that during the 2019/2020 bushfire season and now, there were (and are):
- a. no compliance crashworthiness strength or energy dissipation requirements for truck occupant cabins to protect the driver and/or passengers in the event of any rollover or impact crash (frontal or side impact) or tree fall incident;⁵²⁸
 - b. no mandatory ADR or AS that cover this aspect of truck cabin design;⁵²⁹ and
 - c. no mandatory ADRs governing the minimum SRT for heavy trucks in Australia.⁵³⁰

Other standards and requirements

39. Some standards exist in Europe.
40. United Nations Economic Commission for Europe (UNECE) Regulation No.29, Addendum 28 (Revision 2), dated January 2012 (**UNECE R29**), covers ‘Uniform provisions concerning the approval of vehicles with regard to the protection of the occupants of the cab of a commercial vehicle’.⁵³¹
41. The UNECE R29 relevantly applies to Category N3 vehicles which exceed 12 tonnes. MUARC states that this corresponds to RFS vehicle categories 1 and 7.⁵³² The standards of UNECE R29 have not been incorporated into the ADRs.⁵³³
42. UNECE R29 is a mandatory standard that aims to protect cabin occupants from the risk of injury in the event of a crush and comprises two front impact tests and a roof strength test. The roof strength test (Test ‘C’) involves a horizontal static roof loading of a magnitude equivalent to the front axle mass of the vehicle by a steep impactor. For N3 vehicles and N2 vehicles of greater than 7.5 tonne maximum mass, an additional dynamic pre-load of 17.6 kJ is applied to the cab at 20 degrees from vertical.⁵³⁴
43. MUARC commented that the current version of UNECE R29 was designed to reflect the typical loadings encountered in real-world crashes and largely reflects the recommendations of the Global Road Safety Partnership Informal Group on Cab Strength. While it appears that UNECE R29 was developed primarily to protect heavy vehicle occupants in on-road crashes, MUARC is of the view the standard is likely to provide a practical minimum level of protection for occupants of compliant RFS vehicles.

⁵²⁸ Exhibit 52A, Brief of Evidence at p. 1982; Transcript for 29 March 2023 T 1242:5-45.

⁵²⁹ Exhibit 52A, Brief of Evidence at p. 1493; Transcript for 29 March 2023 T 1242:47–1243:11.

⁵³⁰ Exhibit 52A, Brief of Evidence at p. 1493; Transcript for 29 March 2023 T 1243:18-22.

⁵³¹ Exhibit 52A, Brief of Evidence at p. 1494.

⁵³² Exhibit 52A, Brief of Evidence at p. 1916.

⁵³³ Transcript for 29 March 2023 T 1243:39–1244:3.

⁵³⁴ Exhibit 52A, Brief of Evidence at p. 1515–1519.

44. However, MUARC stresses that no standard can allow for all possible crash situations, nor protect occupants of all heights, weights, and ages in every seating position.⁵³⁵
45. New Zealand has set the minimum SRT at 0.35g for goods service vehicles with a GVM over 12 tonnes. Australia has not adopted any such criterion. Professor Grzebieta stressed the need for Australia to develop a criterion for SRT so that potential is not lost in terms of any appliance re-design.⁵³⁶
46. MUARC and Professor Grzebieta also observed that AS ISO 3449:2020 '*Earth-moving machinery – Falling object protective structures – Laboratory tests and performance requirements*' specifies laboratory tests to measure the structural characteristics of, and performance requirements for, FOPS fitted to ride-on earthmoving machinery.⁵³⁷
47. According to the AS, a FOPS should '*provide operators with reasonable protection from falling objects (trees, rocks, small concrete blocks, hand tools, etc.*' Level II protection specifies impact strength suitable to provide protection from trees and rocks, and involves dropping a cylindrical test object from a height sufficient to develop an energy of 11,600 J.⁵³⁸
48. MUARC have expressed the view that ISO 3449 appears, on its face, to be broadly appropriate for RFS vehicles. However, it would be desirable to evaluate real-world incidents with the aim of understanding the nature of the experience of tree impacts. On their view, this will ensure that an internal FOPS standard is 'fit for purpose' for RFS vehicles.⁵³⁹

Issue 1(b): Standards and requirements for truck occupant cabins – active safety systems

Seatbelts

49. During the 2019/2020 bushfire season (and currently), fire appliances were (and are) required to comply with ADR 32 and ADR 32A for three point seat belts for the front driver and front passenger.
50. Medium goods vehicle (GVM exceeding 4.5 tonnes but not 12 tonnes) and heavy goods vehicles (GVM exceeding 12 tonnes) manufactured prior to 1 July 1992, are not required to have seat belts installed in the second or third row of a crew cabin. Both medium, and heavy, goods vehicles manufactured after that date are required to have only lap belts in second and third row seats.⁵⁴⁰
51. There is no suggestion that the RFS vehicles did not comply with relevant standards for seatbelts.

Advanced braking systems

52. ADR 97/100 '*Advanced Braking for Omnibuses, Medium and Heavy Goods Vehicles and Vehicle Standard*' and ADR 35/07 '*Commercial Vehicle Brake Systems (Electronic Stability Control)*' have been introduced in Australia, albeit with commencement in February 2025 for heavy vehicles.
53. Professor Grzebieta noted that it is important to prevent roof/cabin structural intrusion into the occupant survival space to allow these active safety systems to function and help restrain and provide ride down decelerations for the occupants, in the event where circumstances inadvertently lead to a rollover, tree fall or tree impact.⁵⁴¹
54. There is also UNECE Regulation No.131, which sets out uniform provisions in relation to AEBS. It was adopted in November 2012 and made compulsory in the EU in 2013 for new trucks. There is no similar standard or requirement in Australia, nor has an AEBS system been incorporated into RFS trucks.
55. An AEBS senses an imminent collision and will activate if the brakes of the vehicle have not been applied such as to bring the vehicle to rest or at least to a survivable impact speed.

⁵³⁵ Exhibit 52A, Brief of Evidence at p. 1916.

⁵³⁶ Transcript for 29 March 2023 T 1264:43 – 1265:2.

⁵³⁷ Exhibit 52A, Brief of Evidence at p. 1522, 1546, 1916.

⁵³⁸ Exhibit 52A, Brief of Evidence at p. 1917.

⁵³⁹ Exhibit 52A, Brief of Evidence at p. 1917.

⁵⁴⁰ Exhibit 52A, Brief of Evidence at p. 1493, 1509.

⁵⁴¹ Exhibit 52A, Brief of Evidence at p. 1493–1494.

56. Deputy Commissioner Stewart observed in relation to AEBS that:

The NSW RFS considers further research is needed prior to consideration of implementing this safety feature. The nature of driving in grass or bushland means that there would be frequent interference from objects which could render the AEBS ineffective. In addition, AEBS would be ineffective for falling object protection in incidents such as the Green Wattle Creek incident where the object falls from above the vehicle.⁵⁴²

ISSUE 2

Whether the fire appliance designs referred to in Issue 1 above were (and are):

- a. fit for purpose; and
- b. otherwise, adequate.

57. The experts all acknowledged that there is currently a regulatory vacuum with the absence of any compliance crashworthiness strength or energy dissipation requirements for truck occupant cabins in Australia. It follows that a broad assessment of ‘fitness for purpose’ and adequacy of fire appliance designs against standards in Australian cannot be addressed.⁵⁴³
58. However, where an appliance has been exposed to a particular set of circumstances and has been shown to be structurally weak or to have not performed, this provides a specific foundation to assess how fire appliance design can be improved from a FOPS and/or ROPS perspective to provide protection to occupants in a future equivalent event or a similar event, where possible.⁵⁴⁴

CONCLUSION

There was consensus among the experts that, during the 2019/2020 bushfire season there were, in Australia:

- a. no compliance crashworthiness strength or energy dissipation requirements for truck occupant cabins to protect the driver and/or passengers in the event of any rollover or impact crash (frontal or side impact) or tree fall incident;
- b. no mandatory ADRs or AS that cover this aspect of truck cabin design; and
- c. no mandatory ADRs governing the minimum SRT for heavy trucks in Australia,

and this remains the case today.

It follows that a broad assessment of ‘fitness for purpose’ and adequacy of fire appliance designs against standards in Australian cannot be addressed.

However, where an appliance has been exposed to a particular set of circumstances and has been shown to be structurally weak or to have not performed, this provides a specific foundation to assess how fire appliance design can be improved from a FOPS and/or ROPS perspective to provide protection to occupants in a future equivalent event or a similar event, where possible.

The relevant “purpose” is the vehicle withstanding the extraordinary circumstances of each crash environment. There is no suggestion that the vehicles were not ‘fit for purpose’ in the context of their core purpose, which is to enable ordinary, everyday firefighting duties. It is important to note that the purpose of a firefighting appliance is not to withstand all tree fall incidents or protect occupants from all roll-over scenarios.

Notwithstanding this, there was a consensus amongst the experts that engineering solutions need to be explored to maximise the protection of firefighters within RFS vehicles. The precise protection required needs further review and testing.

⁵⁴² Exhibit 52A, Brief of Evidence at p. 1636.

⁵⁴³ Transcript for 29 March 2023 T 1269:8.

⁵⁴⁴ Transcript for 29 March 2023 T 1268:24–1269:6.

Green Wattle Creek (Lake Burragorang) Fire and related inquests into the deaths of Geoffrey Keaton and Andrew O'Dwyer

ISSUES 3 & 4

3. Whether the particular appliance was 'fit for purpose' in terms of:

- a. cabin protection during a vehicle roll-over
- b. cabin protection if objects are falling on the roof of the cabin; and
- c. active safety systems.

4. Whether a FOPS or ROPS is suitable and/or achievable for use in fire appliances.

59. Professor Grzebieta commented that the Horse Park 1 Alpha Category 1 appliance specifications indicated that the cabin was UNECE R29 compliant.
60. However, given the appliance was travelling at about 70 kilometres per hour, the energy demand on the truck's front portion from the falling tree was overwhelming. On his view, compliance with the standard was never going to mitigate such an impact. The kinetic energy was around 47 times the minimum energy required by the European standard in respect of front pillar impact test 'B'.
61. Professor Grzebieta stressed that the speed at which the crash occurred was very high and the severity of the impact would have been particularly difficult and very complex, if not impossible to design against.⁵⁴⁵ To design a structure to withstand that falling object is not possible without substantial increases in mass and weight which may have the unintended consequence of perhaps increasing roll-over propensity.⁵⁴⁶
62. Further, it is quite possible that an AEBS would not have detected and mitigated the falling branch.⁵⁴⁷
63. Dr Richardson agreed that he did not think fitting any systems would have mitigated the impact and noted that automatic braking systems, the way they're designed, are not going to look for falling trees or falling objects. With extreme caution, he commented that ESC may have helped in respect of the rollover, but that's a real question mark. He stressed that the incident was probably an unsurvivable event in almost all vehicles that are currently on the road.⁵⁴⁸
64. Associate Professor Logan endorsed the views of Professor Grzebieta and Dr Richardson as to the survivability of the crash and the high unlikelihood that AEBS would have been able to effectively avoid a falling tree.⁵⁴⁹
65. Professor Grzebieta separately surmised that if the appliance had been travelling at 40 kilometres per hour, the kinetic energy would have been around 28 times the minimum energy required by the European standard in respect of front pillar impact test 'B'. Accordingly, Professor Grzebieta commented that compliance with UNECE R29 would not have been sufficient to have protected the driver and front seat passenger, even at the lower nominated speed.⁵⁵⁰

⁵⁴⁵ Transcript for 29 March 2023 T 1244:19-21; 1244:34-35.

⁵⁴⁶ Transcript for 29 March 2023 T 1245:16-20; 1246:20-28.

⁵⁴⁷ Transcript for 29 March 2023 T 1245:11-12.

⁵⁴⁸ Transcript for 29 March 2023 T 1245:27-37. Professor Richardson gave this evidence based on the overview of information contained in Professor Grzebieta's Report (Exhibit 52A, Brief of Evidence, Tab 38).

⁵⁴⁹ Transcript for 29 March 2023 T 1245:48-1246:7; Associate Professor Logan gave this evidence based on the overview of information contained in Professor Grzebieta's Report (Exhibit 52A, Brief of Evidence, Tab 38).

⁵⁵⁰ Exhibit 52A, Brief of Evidence at p. 1543-5.

66. Professor Grzebieta ultimately expressed the opinion that the fire appliance was not 'fit for purpose' under the specific circumstances encountered. However, the incident was very severe and would require further research to explore how the crash could be made survivable. He proffered that it is feasible that the crash could be made survivable with a combination of reduced travel speed to 40 kilometres per hour, significantly strengthened A pillars (front pillars) to the levels proposed by Herbst et al (2013),⁵⁵¹ Batzer et al (2009),⁵⁵² and Richardson et al (2010),⁵⁵³ and possibly the application of an airbag in front of the windscreen as well as occupant frontal airbags inside the vehicle. This would require further engineering design/development research by an experienced team of crashworthiness experts to finetune all the components.⁵⁵⁴
67. On his view, the fact that the three occupants in the rear of the cabin survived is in itself an indicator that if there is enough deceleration distance between the occupants and the object being struck, it is possible to design the event to be survivable for all crew members.⁵⁵⁵
68. Professor Grzebieta also commented that if the appliance had been subject to a rollover event where it rolls at least 180 degrees, like the Green Valley Fire incident, it would not be 'fit for purpose'. The rollbar installed just behind the crew cabin rear passenger section would also not provide 'fit for purpose' protection for the front seat occupants against roof crush if the vehicle pitches forward during a rollover event.⁵⁵⁶
69. He also maintained that if the appliance were to roll down a slope that it pitches forward approximately 5 degrees onto the cabin; the driver section of the truck cabin would likely crush in a similar manner as the roof has deformed in the Kian Road incident.⁵⁵⁷

CONCLUSION

In relation to the Green Wattle Creek (Lake Burragorang) Incident that claimed the lives of Geoffrey Keaton and Andrew O'Dwyer:

- a. the truck complied with relevant European standards.
- b. however, the evidence of Professor Grzebieta was that the energy demand on the truck's front portion from the falling tree was overwhelming. Compliance with the standard was never going to mitigate such an impact. The kinetic energy was around 47 times the minimum energy required by the European standard.
- c. Professor Grzebieta stressed that the speed at which the crash occurred was very high and the severity of the impact would have been particularly difficult and very complex, if not impossible to design against. This view was shared by Dr Richardson and Associate Professor Logan.
- d. Dr Richardson commented that he doubted that you could build a structure effectively and put it on a vehicle that would have protected a driver in that circumstance, and further, that he didn't think that fitting any systems would have mitigated the impact. He also expressed the view that the incident was probably an unsurvivable event in almost all vehicles currently on the road.

⁵⁵¹ Brian Herbst et al, 'Heavy Truck Rollover Crashworthiness Utilizing Sled Impact Testing' (2013) 87 Berichte der Bundesanstalt fuer Strassenwesen. Unterreihe Fahrzeugtechnik.

⁵⁵² Stephen Batzer et al, 'Heavy Truck Roll Cage Effectiveness' (2009) IMECE2009-12423 The American International Mechanical Engineering Congress and Exposition.

⁵⁵³ Shane Richardson et al, 'Rollover Protective Structural Criteria for Heavy trucks' ICrash 2010.

⁵⁵⁴ Exhibit 52A, Brief of Evidence at p. 1544-1545.

⁵⁵⁵ Exhibit 52A, Brief of Evidence at p. 1544-1545.

⁵⁵⁶ Exhibit 52A, Brief of Evidence at p. 1539-1541.

⁵⁵⁷ Exhibit 52A, Brief of Evidence at p. 1539-1540.

Green Valley, Talmalmo Fire and related inquest into the death of Samuel McPaul

ISSUES 5 & 6

5. Whether the particular appliance was 'fit for purpose' in terms of:
 - a. cabin protection during a vehicle roll-over;
 - b. cabin protection if objects are falling on the roof of the cabin; and
 - c. active safety systems.
 6. Whether a FOPS or ROPS is suitable and/or achievable for use in fire appliances.
70. Professor Grzebieta was also of the view that the Culcairn 2 Alpha appliance was not 'fit for purpose' regarding rollover crashworthiness under the specific circumstances encountered. This was clearly evident in the deformation of the cabin, with it having '*collapsed like a frame structure without any bracing*.'⁵⁵⁸ The cabin did not appear to be UNECE R29 compliant.⁵⁵⁹
71. Associate Professor Logan did not wish to add anything further, and Dr Richardson agreed that the structure did not survive the loading it had been exposed to.⁵⁶⁰
72. Professor Grzebieta commented that to provide 'fit for purpose' rollover protection, the cabins of such fire appliance vehicles would need to be reinforced to sustain the loads and energy applied as proposed by Herbst et al (2013), Batzer et al (2009), and Richardson et al (2010).⁵⁶¹
73. He also further commented that the crew refuge area could be designed to sustain rollover where the screen acts as a ROPS and also restraint and seating could be designed into that space. For example, flip up seating and shoulder mechanical swing around restraints similar to amusement rides for firefighters who find themselves in that space and need to seek immediate refuge because of an imminent rollover event.⁵⁶²
74. In respect of the recommendation of swing restraints in the crew refuse area or rear of the vehicles, Deputy Commissioner Stewart commented this will need to be considered quite carefully, and in more detail before it can be endorsed. The operating environment of the appliances and the purpose of the crew refuge area would need to be considered.⁵⁶³ This appears to align with the safe system approach which calls for a holistic approach to safety assessment and is the basis of the work by MUARC.

CONCLUSION

In relation to the Green Valley, Talmalmo Incident that claimed the life of Samuel McPaul:

- a. the evidence of Professor Grzebieta was that the truck was not 'fit for purpose' in circumstances where the cabin '*collapsed like a frame structure without any bracing*'.
- b. Dr Richardson agreed that the vehicle was not 'fit for purpose' in the particular circumstances, being the upending of the vehicle with a GVM of between 11.8 and 15 tonnes by a FGV which generated estimated winds in excess of 300 kilometres per hour.

⁵⁵⁸ Transcript for 29 March 2023 T 1248:30-39; Transcript for 15 September 2021 T 206:20.

⁵⁵⁹ Exhibit 52A, Brief of Evidence at p. 1501.

⁵⁶⁰ Transcript for 29 March 2023 T 1248:45; 1249:1-2; Associate Professor Logan and Dr Richardson gave this evidence based on the overview of information contained in Professor Grzebieta's Report (Exhibit 52A, Brief of Evidence, Tab 38).

⁵⁶¹ Exhibit 52A, Brief of Evidence at p. 1495.

⁵⁶² Exhibit 52A, Brief of Evidence at p. 1495.

⁵⁶³ Exhibit 52A, Brief of Evidence at p. 1635-1636.

Kian Road, South Arm Fire

ISSUES 7 & 8

7. *Whether the particular appliance was ‘fit for purpose’ in terms of:*
 - a. *cabin protection if objects are falling on the roof of the cabin; and*
 - b. *active safety systems.*
 8. *Whether an OPS and/or FOPS would be suitable and/or achievable for use in fire appliances.*
75. Professor Grzebieta expressed the opinion that the Tanker 397S appliance was not ‘fit for purpose’ under the specific circumstances encountered in respect of the falling object.⁵⁶⁴ The truck was subjected to a minimum load of 20-30 tonnes (half the tree weight) and possibly higher as a result of dynamic loading.⁵⁶⁵
76. Had the fire appliance been upgraded to have a FOPS/ROPS compliant with EN ISO 3449:2008 or the pillars of the crew cabin reinforced / strengthened as proposed by Richardson et al, it is likely that the roof crush could have been of a smaller magnitude. This might have produced a sufficient reduction in crush compared to what occurred, such that Ms Pachos and Mr Aldridge might have suffered only minor injuries.⁵⁶⁶
77. That evidence was largely uncontested by Associate Professor Logan and Dr Richardson although, Dr Richardson gave evidence that such a structure may not prevent all injuries and those same structures can create their own engineering issues and limitations.⁵⁶⁷
78. Although the appliance was not subjected to a rollover, Professor Grzebieta also commented that the crew cabin did not appear to be UNECE R29 compliant. It would not have been ‘fit for purpose’ in terms of occupant protection during a rollover crash had the appliance been subjected to a rollover greater than 180 degrees lateral rotation; the cabin would have deformed in a similar manner to the Green Valley Fire appliance.⁵⁶⁸

CONCLUSION

In relation to the Kian Road, South Arm incident where Ms Pachos and Ms Aldridge sustained serious injuries:

- a. the evidence of Professor Grzebieta was that had a FOPS or ROPS been installed, or the crew cabin appropriately strengthened, then this might have produced a sufficient reduction in crush, such that Ms Pachos and Mr Aldridge might have suffered only minor injuries.
- b. that evidence was largely uncontested by Associate Professor Logan and Dr Richardson, although Dr Richardson gave evidence that such a structure may not prevent all injuries, and those same structures can create their own engineering issues and limitations.

⁵⁶⁴ Transcript for 29 March 2023 T 1246:35-36.

⁵⁶⁵ Exhibit 52A, Brief of Evidence at p. 1495.

⁵⁶⁶ Exhibit 52A, Brief of Evidence at p. 1495, 1548-9; Transcript for 29 March 2023 T 1246:46-1247:2; Shane Richardson et al, ‘Rollover Protective Structural Criteria for Heavy trucks’ ICrash 2010.

⁵⁶⁷ Transcript for 29 March 2023 T 1247:30, 41, 1248:13.

⁵⁶⁸ Exhibit 52A, Brief of Evidence at p. 1539.

Other Matters

ISSUES 9 & 10

9. Whether Recommendation 40(c) of NSW Independent Inquiry, with respect to vehicle design and safety is sufficient, including specifically, whether further direction should be given to the RFS and FRNSW of the most appropriate cabin protection for different frontline vehicles.
10. The adequacy of steps taken by RFS in response to Recommendation 40(c).

The Rural Fire Service fleet

79. As of 24 March 2023, RFS firefighting appliances, namely category 1 appliances through to category 11 appliances, comprise of 4,017 appliances in total. Further, 173 appliances were being built, with an additional 22 appliance orders due to be placed by April 2023.⁵⁶⁹
80. The 4,017 appliances are broken into four key categories:
 - a. pre-2005 build dates;
 - b. 2004 – 2007 builds;
 - c. 2008 – 2012 builds; and
 - d. builds from 2013 onwards.
81. Within those four base categories, there are about several dozen other different types of vehicles.⁵⁷⁰
82. Deputy Commissioner Stewart stressed that within the dynamics of the RFS fleet, the ability to comprehensively influence a safety modification or design upgrade is challenged by the depth and breadth of the variations within the fleet.⁵⁷¹
83. Detailed in the following image is a breakdown of the safety features of RFS' current fleet assets (as at 24 March 2023):

Breakdown of Safety Profile

Data based on current assets, as of 24th March 2023

	Pre 2004	2004 - 2007	2008-2012	2013 Onwards
Crew Protection (Fire Overrun)	<ul style="list-style-type: none"> > Cat 1s, Cat 7s and other appliances fitted with either Single Point Spray or non-standard spray <ul style="list-style-type: none"> > No curtains > Wheel sprays either not fitted, or non-standard design > Cat 9s fitted with no spray 	<ul style="list-style-type: none"> > Cat 1s (Isuzu FTS750), Cat 2s (Isuzu FSS500) and Cat 7s (Mitsubishi Canter and Isuzu NPS) <ul style="list-style-type: none"> > fitted with single point spray > No curtains fitted > Blankets fitted > Wheels sprays fitted – not to current specification > Cat 9s fitted with current single point spray 	<ul style="list-style-type: none"> > Cat 1s (Isuzu FTS800) and Cat 7s (Isuzu NPS300) <ul style="list-style-type: none"> > fitted with "wide" Halo system > Curtains fitted > Blankets fitted > Wheels sprays fitted > Cat 9s fitted with current single point spray > Production of Cat 2s cease 	<ul style="list-style-type: none"> > Cat 1s (Isuzu FTS800) and Cat 7s (Isuzu NPS300) <ul style="list-style-type: none"> > fitted with "narrow" Halo system > Curtains fitted > Blankets fitted > Wheels sprays fitted to current specification > Cat 9s fitted with current single point spray > Cat 6 (Isuzu FVZ) introduced with same systems as Cat 1
Roll Over & Falling Object (Headboard & OEM Cab)	<ul style="list-style-type: none"> > No headboard of any structural strength 	<ul style="list-style-type: none"> > Cat 1s and 2s fitted with "light" headboard > Cat 7s fitted with "Light" headboard > Cat 9s fitted with Aluminium, non-structural headboard 	<ul style="list-style-type: none"> > Cat 1s fitted with current "heavy" headboard > Cat 7s fitted with current headboard > Cat 9s fitted with Aluminium, non-structural headboard > UN ECE R29 compliant cabins (Cat 1 & Cat 7) > Drivers Airbag - 2015 (Cat 1 & Cat 7) 	<ul style="list-style-type: none"> > Cat 1s and Cat 6s fitted with current "heavy" headboard > Cat 7s fitted with current headboard > Cat 9s fitted with Aluminium, non-structural headboard > Cat 9 headboards changed to steel in 2021 > Drivers and Passenger air bags (2015 onwards) > ABS (2015 onwards)
Totals	2,235	ISUZU CAT 1 DESIGN CHANGE →		1,782
				4,017

⁵⁶⁹ Exhibit 52A, Brief of Evidence, Tab 47.

⁵⁷⁰ Transcript for 29 March 2023 T 1271:18-28; Exhibit 52A, Brief of Evidence at p. 2072.

⁵⁷¹ Transcript for 29 March 2023 T 1271:30-36.

84. Generally, the RFS endeavours to retire principal firefighting appliances by the 25th year of their service.⁵⁷²
85. Category 1 appliances represent approximately 50% of the fleet composition and are considered to be RFS' principal firefighting response appliance. There are two key variations: single-cab, and crew-cab. It is principally designed as a bushfire firefighting and forest firefighting appliance.⁵⁷³ The 2008–2013 and 2013 category 1 builds have, relevantly included:
- a. UNECE R29 compliant cabins;
 - b. the current "heavy" headboard;
 - c. drivers, and passengers airbags (from 2015 onwards); and
 - d. ABS (from 2015 onwards).⁵⁷⁴
86. Deputy Commissioner Stewart advised that RFS fire appliances are constructed in accordance with the RFS fleet and appliance specifications which include some form of rollover protection for all vehicles constructed since 2000. All fire appliances constructed since 2006 contain the current ROPS of a headboard at the rear of the crew cabin which is secured to the chassis.⁵⁷⁵
87. He stated that a component of the MUARC research program included investigating the existing structural headboard situated behind the cabin of most RFS vehicles and mechanisms to improve the structural performance of the vehicles in the event of a rollover and potentially in falling object impacts. The existing structural headboard, and the additional rigid structure of the vehicle, helps to support the vehicle mass in a rollover and can assist in preventing some intrusion into the passenger compartment.⁵⁷⁶
88. A further safety feature which is currently installed in RFS vehicles manufactured after 2015 is ABS which helps to prevent the lock up of wheels during braking which helps maintain contact with road service so drivers can maintain control of the vehicle. Deputy Commissioner Stewart noted that this function needs to be disabled when operating off-road as it can interfere with the performance of low range and differential locks that are present within the vehicle, which allow it to perform as required.⁵⁷⁷
89. He further stressed that RFS vehicles operate close to the rated GVM of the base chassis which leaves very little scope to incorporate additional ROPS or FOPS without necessitating a significant redesign of other systems to either reduce weight or compromise water/payload capacity. This is a significant issue when considering the implementation of these systems on firefighting vehicles, particularly given that driving is generally not the primary focus of firefighting. While a high level of driving professionalism and vehicle safety is required, the nature of the RFS' role as the lead combat agency in NSW for bush firefighting, means that water capacity is integral to the RFS' ability to perform their functions and protect the community from fire.⁵⁷⁸

Monash University Accident Research Centre

90. Through its work with the RFS, MUARC have identified numerous challenges to improving cabin protection through adding FOPS to vehicles. These include:⁵⁷⁹
- a. the number of different apparatus categories, and the range of vehicle variants, makes and builders within each category;

⁵⁷² Transcript for 29 March 2023 T 1271:39-41; T 1272:40-44.

⁵⁷³ Exhibit 52A, Brief of Evidence at p. 2073; Transcript for 29 March 2023 T 1271:34.

⁵⁷⁴ Exhibit 52A, Brief of Evidence at p. 2072; Transcript for 29 March 2023 T 1271:25-28.

⁵⁷⁵ Exhibit 52A, Brief of Evidence at p. 1635.

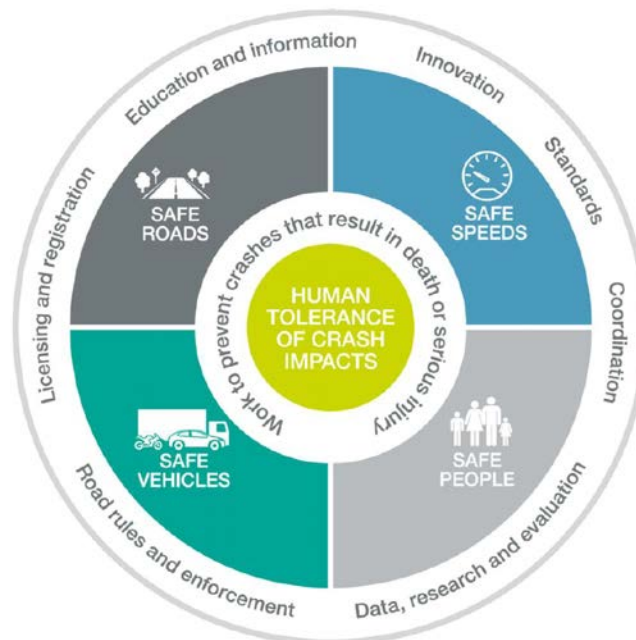
⁵⁷⁶ Exhibit 52A, Brief of Evidence at p. 1635.

⁵⁷⁷ Exhibit 52A, Brief of Evidence at p. 1635.

⁵⁷⁸ Exhibit 52A, Brief of Evidence at p. 1635.

⁵⁷⁹ Exhibit 52A, Brief of Evidence at p. 1742-1743; Transcript for 29 March 2023, T 1249:13-29.

- b. vehicle mass, as typically RFS vehicles already operate close to the rated GVM of the base chassis. This on their view, may leave little to no scope to incorporate a FOPS without necessitating a significant redesign of other systems to either reduce weight or compromise water/payload capacity;
 - c. the ability of a solution to complement existing tanker protection mechanisms whilst retaining a safe and operable space for firefighters; and
 - d. that existing FOPS designs serve as a protection mechanism for heavy plant, and the challenge of adapting this to a standard heavy vehicle with a forecast 25-year service life, whilst retaining ADRs and Workplace Health and Safety compliance.
91. Given these challenges, the MUARC team assert that it is important to consider the safety system in which RFS vehicles operate as a whole, in order that the context for ROPS and FOPS can be more clearly defined.⁵⁸⁰
92. Current road safety management in Australia is guided by the premise of a 'Safe System', capturing not only driver behaviour, but vehicle design, and also the roles of vehicles and roads, and the way in which these are managed and co-ordinated. Associate Professor Logan explained that this is a multi-faceted approach which requires looking at all possible elements of the system, including access to the system, the way the system is used and finally, in preventing crashes from occurring and mitigating the severity when a crash occurs. This is illustrated in the diagram below. Professor Grzebieta noted that this system is adopted globally.⁵⁸¹



SAFE SYSTEM APPROACH TO ROAD SAFETY

⁵⁸⁰ Exhibit 52A, Brief of Evidence at p. 1743.

⁵⁸¹ Exhibit 52A, Brief of Evidence at p. 1743; Transcript for 29 March 2023, T 1249:41–1251:4.

93. The MUARC team stressed that engineering solutions must be ‘fit for purpose’ and cannot be isolated from the rest of the system. In some circumstances, vehicle design solutions can increase the risk to drivers by promoting complacency or overconfidence or creating new hazards. For example, many existing solutions are not designed for older vehicles, making retrofitting difficult, and can add significant weight to emergency vehicles which, by design, are already approaching their GVM. Interactions with other safety features also need to be considered, including those specific to fire vehicles, such as burn-over protection (heat reflecting curtains and external water sprays).⁵⁸²
94. The MUARC team have undertaken a three staged approach to date.
95. Stage 1 has included a scientific literature review to identify what factors are associated with emergency vehicle safety.⁵⁸³
96. Stage 2 has comprised a data linkage and risk analysis, document analysis, site visits of vehicles and fleet practices, an online survey being sent to employees and volunteers at RFS, and a range of focus groups designed to establish the nature and extent of the problem.⁵⁸⁴
97. Stage 3 has included a vehicle engineering review consisting of:⁵⁸⁵
- a. a series of site visits to review a range of vehicle types and cabin structures;
 - b. document analysis to map key documentation related to cabin protection systems and RFS fleet structure; and
 - c. a review of standards to evaluate the suitability of current truck roof strength standards, including UNECE R29 and ISO 3449 in providing adequate protection for rollover and falling object incidents.
98. Professor Grzebieta’s view was that the quality of MUARC’s work for the RFS to date is at the highest levels of good investigative research.⁵⁸⁶
99. In respect of next steps, in summary, the MUARC team have recommended that the RFS:⁵⁸⁷
- a. firstly, develop a data conceptual framework for vehicle safety;
 - b. secondly, undertake a review of the framework underpinning driver training and safety to capture requirements for entry, training, licencing, re-entry where necessary and consider a wide range of options to support driver training at RFS;
 - c. thirdly, undertake a review of their fleet management practices and consider developing a high-level strategy. There will be likely compromises involved both in sourcing vehicles with enhanced primary safety features such as ESC, RSC, and in implementing one or more FOPS/ROPS solutions. Consequently, it may become necessary to consider better matching of vehicle deployment with the primary environment in which they will serve; and
 - d. fourthly, establish a ‘fit for purpose’ set of rollover/falling object test criteria and assess potential engineering solutions in an experimental setting.⁵⁸⁸

⁵⁸² Exhibit 52A, Brief of Evidence at p. 1745.

⁵⁸³ Exhibit 52A, Brief of Evidence at p. 1784.

⁵⁸⁴ Exhibit 52A, Brief of Evidence at p. 1784.

⁵⁸⁵ Exhibit 52A, Brief of Evidence at p. 1785.

⁵⁸⁶ Exhibit 52A, Brief of Evidence at p. 2011–2012; Transcript for 29 March 2023 T 1251:28.

⁵⁸⁷ Exhibit 52A, Brief of Evidence at p. 1942–1944.

⁵⁸⁸ Transcript for 29 March 2023 T 1252:35–1253:8.

100. In respect of the fourth recommendation, the MUARC team have identified potential engineering solutions to improve cabin performance for rollover and falling objects:⁵⁸⁹
- a. in-vehicle devices particularly, the redesign of the rear seats as a cost-effective solution to improve seatbelt use and overall safety. Bench seats could be replaced with moulded seats;
 - b. to better optimise for ROPS and FOPS, changes to the vehicle headboard including extending it out as high and wide to the maximum possible acceptable roadworthy limits of the vehicles and/or modification of the shape of the headboard to optimise load transfer to the truck chassis rails during rollover or falling object loading. The headboard would be diagonally braced so that the upper cross-member is supported for loads that come onto it, but those loads are taken to the chassis points of the vehicles. In lay terms the intention is to make the headboard wider and higher than the cabin so that it engages with the actual falling objects and/or rollover before it impacts the cabin of the vehicle. Professor Grzebieta saw sense in this proposal,⁵⁹⁰ and
 - c. improving structural performance of RFS trucks in rollover and potentially in falling object impacts, by using an intermediate solution involving foam-filling the void between the internal and external surfaces of the existing vehicle roof, 'A,' 'B' and 'C' pillars in the cabin, and the cabin rear wall. Testing would need to be undertaken to determine the level of protection this solution might offer. Professor Grzebieta saw great potential in this proposal combined with the proposal of replacing the headboard of vehicles.⁵⁹¹
101. Dr Richardson also noted that there is potential for appliances to hinge at their bases away from the cabin of the vehicle by way of some feature which integrates or links the structure and the cabin of the vehicle to make them structurally connected. This could be a loose connection rather than a rigid, locked connection, perhaps a tension member when it's under load so that the structure doesn't fold backwards out of the way. He noted there's an example of a Victorian vehicle that rolled over that has a similar type of structure, but essentially the headboard structure folded backwards and the cabin folded forwards because they weren't interconnected. He comments that this is a relatively simple system that could be retrofitted but would need to ensure it's not going to hinge at the base and fold backwards by way of putting a flexible linkage in there.⁵⁹² Professor Grzebieta agreed with this proposition and that it's an issue requiring resolution.⁵⁹³
102. In the longer term, the MUARC team recommends that consideration be given to addressing the rollover propensity of heavy-duty firefighting vehicles due to the inherently high centre of mass resulting from existing designs. This would necessitate a complete redesign of the vehicles, but in addition to reducing crash risk could also target the range of ergonomic and safety issues relating to cabin and equipment access that result in the majority of current injuries.⁵⁹⁴
103. Professor Grzebieta recommended in respect of redesign and manufacturing of fire trucks to provide improved FOPS protection that consideration be given to utilisation of ultra-high strength steels such as alloy and boron steels with higher elastic strength and ultimate tensile strength, with little weight penalty. This would of course require negotiation with the manufacturer but would ideally do away with the need to fit a FOPS or ROPS.⁵⁹⁵
104. Dr Richardson noted that the long-term solution of potential redesign of appliances would be subject to the buying power of the customer in being able to demand a safer system – which is where having an AS would be ideal. A standard would be able to guarantee a better base quality of all the vehicles that are supplied.⁵⁹⁶

⁵⁸⁹ Exhibit 52A, Brief of Evidence at p. 1761-1763.

⁵⁹⁰ Transcript for 29 March 2023 T 1257:47 -1258:24; T 1259:6-8.

⁵⁹¹ Transcript for 29 March 2023 T 1261:17-24; T 1262:15-16

⁵⁹² Transcript for 29 March 2023 T 1258:26-40.

⁵⁹³ Transcript for 29 March 2023 T 1259:6-8.

⁵⁹⁴ Exhibit 52A, Brief of Evidence at p. 1763.

⁵⁹⁵ Exhibit 52A, Brief of Evidence at p. 2013, 2016; Transcript for 29 March 2023 T 1253:40 -1254:45.

⁵⁹⁶ Transcript for 29 March 2023 T 1256:33-41.

105. Alternatively, in respect of retrofitting existing vehicles, Professor Grzebieta noted, subject to review of the relevant appliance structural substructure and measurements of the various cabin profiles and testing, it may be possible as an intermediate solution, to strengthen existing cabins, by inserting ultra-high strength steel round/square/rectangular tubes and by foam filling voids.⁵⁹⁷
106. Professor Grzebieta also commented that the original structure of the appliances requires further analysis in terms of tensile tests being conducted on existing headboards and making use of an elastoplastic program like Elastina and some tensile tests of the material to better understand the type of grade steel of the structure to inform whether you can actually retrofit with a little bit of bracing in the existing structures.⁵⁹⁸
107. Dr Richardson noted the utility of Professor Grzebieta's proposal but maintains, subject to further work, there may be more benefit in replacement of the headboard as MUARC has put forward.⁵⁹⁹

Implementation of MUARC's recommendations

RFS

108. MUARC's fourth recommendation, being the establishment of a 'fit for purpose' set of rollover/falling object test criteria and assessment of potential engineering solutions in an experimental setting was a large focus of this inquiry.
109. Deputy Commissioner Stewart gave an absolute assurance that the RFS will implement that recommendation.⁶⁰⁰ The aim is for the work to be completed through the course of the 2023-2024 financial year.⁶⁰¹
110. He also noted the recommendations proposed by MUARC with respect to retrofitting, to widen and raise the headboard and have different geometry will need to be tested, but consideration will also need to be given to ensuring that the headboard itself does not impede the ability for the Category 1 appliance to get into tight spaces on the fireground.⁶⁰² That will need to be part of the further investigation by MUARC and the RFS.

FRNSW

111. FRNSW has a fleet of 171 tankers. These tankers are primarily utilised in urban and urban fringe areas for rescue, hazmat, and firefighting operations.⁶⁰³
112. FRNSW is supportive of having systems on its bushfire tankers such as ROPS and FOPS to keep their firefighters as safe as possible.
113. Like RFS, FRNSW are monitoring the outcome of the work by the MUARC.
114. Following the results of MUARC's study, the AFAC (of which FRNSW is a member) intends to develop guidelines on ROPs and FOPs for tankers.⁶⁰⁴

⁵⁹⁷ Exhibit 52A, Brief of Evidence at p. 2013, 2016; Transcript for 29 March 2023 T 1253:40 –1254:45.

⁵⁹⁸ Transcript for 29 March 2023 T 1258:45 –1259:8.

⁵⁹⁹ Transcript for 29 March 2023 T 1259:45-50.

⁶⁰⁰ Transcript for 29 March 2023 T 1275:5.

⁶⁰¹ Transcript for 29 March 2023 T 1275:20.

⁶⁰² Transcript for 29 March 2023 T 1275:31:37.

⁶⁰³ Exhibit 52A, Brief of Evidence at p. 1625.

⁶⁰⁴ Exhibit 52A, Brief of Evidence at p. 1632.

CONCLUSION

I accept the evidence of Professor Grzebieta that the quality of MUARC's work for the RFS to date in respect of Recommendation 40(c) of the NSW Bushfire Inquiry is at the highest levels of good investigative research.

I also acknowledge the numerous challenges identified by MUARC to improving RFS cabin protection through adding FOPS to vehicles which, stated summarily include:

- a. the number of different apparatus categories, and the range of vehicle variants, makes and builders within each category.
- b. vehicle mass, as typically RFS vehicles already operate close to the rated GVM of the base chassis. This on their view, may leave little to no scope to incorporate a FOPS without necessitating a significant redesign of other systems to either reduce weight or compromise water/payload capacity.
- c. the ability of a solution to complement existing tanker protection mechanisms whilst retaining a safe and operable space for firefighters.
- d. that existing FOPS designs serve as a protection mechanism for heavy plant, and the challenge of adapting this to a standard heavy vehicle with a forecast 25-year service life, whilst retaining ADRs and Workplace Health and Safety compliance.

I accept that it is important to consider the safety system in which RFS vehicles operate as a whole, in order that the context for ROPS and FOPS can be more clearly defined.

In terms of next steps, MUARC's fourth recommendation, being the establishment of a 'fit for purpose' set of rollover/falling object test criteria and assessment of potential engineering solutions in an experimental setting was a large focus of this Inquiry.

Deputy Commissioner Stewart gave an absolute assurance that the RFS will implement that recommendation. The aim is for the work to be completed through the course of the 2023-2024 financial year. I will deal with the matter of whether any recommendations are necessary or desirable, separately.

FRNSW has advised that it is supportive of having systems on its bushfire tankers such as ROPS and FOPS to keep their firefighters as safe as possible. FRNSW are monitoring the outcome of the work by the MUARC.

Recommendations

ISSUE 11

Whether it is otherwise necessary or desirable for the Coroner to make recommendations pursuant to section 82 of the Coroners Act 2009 (NSW) in relation to any matter connected with these fire inquiries.

Implementation of the MUARC recommendations

115. Counsel Assisting submitted that there is a commitment by the RFS to implement the recommendations of MUARC and implement the next stage. Given the importance of the implementation of MUARC's fourth recommendation to ensuring that further work is undertaken towards the introduction of engineering solutions for the risk posed by rollover and falling objects, Counsel Assisting submitted that the following Recommendation to the RFS is warranted:

To the Commissioner of the NSW Rural Fire Service

Recommendation 21:

That the NSW Rural Fire Service engage Monash University Accident Research Centre, or an equivalent body, to:

- a. establish a fit for purpose set of rollover and falling object test criteria; and*
- b. assess potential design solutions for rollover and falling object production in an experimental setting.*

116. The RFS agreed with this proposed Recommendation, although submitted such a recommendation may be unnecessary noting the work already completed by the RFS. The RFS noted that Deputy Commissioner Stewart gave assurances that the recommendations of MUARC for further research would be implemented, with work to commence once the final engagement contract had been signed. The RFS advised that since the conclusion of this Inquiry, a formal commercial proposal for that work has been provided by MUARC and following finalisation of procurement matters, work will commence. The RFS confirmed the target for completion of the testing component of the project is the 2023/2024 financial year.
117. Counsel Assisting submitted in reply that despite those assurance, which they had no reason to doubt, a recommendation should be made to the same effect. This will ensure compliance with the recommendation is picked up by governance mechanisms for reporting, and not fall by the wayside (although given the RFS' commitment this is highly unlikely to occur).

CONCLUSION

The Recommendation put forward by Counsel Assisting is agreed by the RFS, whilst noting that work is underway. I am persuaded that the proposed Recommendation is necessary and desirable to ensure compliance by way of governance mechanisms for reporting, although I accept that the RFS has expressed commitment to complete the work.

An Australian Standard

118. Counsel Assisting submitted that:
- a. there is plainly a regulatory vacuum of standards for the construction of firefighting vehicles, particularly in relation to FOPS and ROPS;
 - b. Professor Grzebieta advocated for the establishment of an AS working group of experts, regulators, and practitioners to draft a standard for all emergency vehicles that addresses the crashworthiness test criteria and experimental setting for testing of rollover protection, FOPS and cabin strength for frontal impacts for firefighting trucks;
 - c. Professor Logan and Dr Richardson saw merit in this proposal, but they noted that this would lead to additional requirements being put in place specifically for firefighting; and
 - d. regardless, an Australian-wide standard, in conjunction with Deputy Commissioner Stewart's observation of NSW agencies' purchasing power as a bloc, could have great utility. It may be more likely to bring about design changes by manufacturers to produce vehicles that provided added, and effective, protection for firefighters in NSW.
119. The RFS raised concerns about the proposed recommendation that RFS engage with AFAC and Standards Australia with a view to the development of an AS. Those concerns were broadly twofold:
- a. the extent to which the proposed recommendation regarding an AS required RFS to act independently of other agencies (the RFS being only one member of AFAC); and
 - b. the need to ensure any work on an AS does not prejudice RFS' work with MUARC.
120. Counsel Assisting submitted in reply that:
- a. AFAC is the Australasian fire and emergency services council. It comprises emergency services agencies from across Australia and New Zealand. This Court cannot recommend that interstate agencies work with the RFS to pursue the development of an AS through AFAC. However, the RFS, like any member of AFAC, can itself raise matters with AFAC. It does not need cooperation from other firefighting agencies to do so, even though cooperation may be desirable;
 - b. in those circumstances, a recommendation that the RFS engage with AFAC for the purposes of the development of an AS is entirely appropriate. AFAC could then engage with Standards Australia. That process could be accelerated by those assisting providing the relevant evidentiary material directly to AFAC;
 - c. any concern that work on an AS could delay the RFS' work with MUARC, could be addressed by the proposed recommendation specifying that the RFS' work with MUARC is to be pursued parallel with, or alongside, work on an AS; and
 - d. an appropriate Recommendation is as follows:

To the Commissioner of the NSW Rural Fire Service

Recommendation 22:

That, in its role as a participating member of Australasian Fire Authorities Council, NSW Rural Fire Service is to make representations to Australasian Fire Authorities Council to the effect that Australasian Fire Authorities Council is to consider engaging with Standards Australia in relation to the development of a data supported minimum Australian Standard (or Standards) which addresses the crashworthiness test criteria and experimental setting for testing of rollover protection, falling object protection structures, and cabin strength for frontal impacts for such firefighting appliances, noting that any such representation should not impede the work of NSW Rural Fire Service in implementing safety measures at the State level.

- e. in order to assist the above process, the Court should make a further Recommendation in the following terms:

To the Commissioner of the NSW Rural Fire Service

Recommendation 23:

That the NSW Rural Fire Service provide the Australasian Fire Authorities Council with a copy of the following documents:

- a. *Expert Reports of Emeritus Professor Raphael Grzebieta dated 14 December 2022 and 26 March 2023;*
- b. *NSW Rural Fire Service: Fleet Safety Summary Report of Monash University Accident Research Centre dated March 2023;*
- c. *NSW Rural Fire Service: Vehicle Safety Technical Report of Monash University Accident Research Centre dated March 2023;*
- d. *Transcript of the oral evidence of Emeritus Professor Raphael Grzebieta, Associate Professor David Logan, and Dr Shane Richardson given on 29 March 2023; and*
- e. *Copy of any findings relevant to:*
 - i. *this Inquiry;*
 - ii. *the Inquest into the death of Geoffrey Keaton and Andrew O'Dwyer; and*
 - iii. *the Inquest into the death of Samuel McPaul.*

CONCLUSION

I highly commend the RFS for their work with MUARC to date, towards implementing a holistic solution to ensure occupant safety is paramount as part of the RFS' response to Recommendation 40(c) of the NSW Inquiry.

However, I am persuaded that an Australian-wide standard, in conjunction with Deputy Commissioner Stewart's observation of NSW agencies' purchasing power as a bloc, could have great utility. It may be more likely to bring about design changes by manufacturers to produce vehicles that are fit-for-purpose.

I consider that the two recommendations proposed by Counsel Assisting are necessary and desirable, and that they will not prejudice the RFS in its ongoing work.

121. I wish to express my sincere gratitude to those who have aided and provided information to the Court to assist with the general inquiry that considered the topic of Vehicle Design and Safety.
122. I also wish to express my sincere condolences to Geoffrey's, Andrew's, and Sam's families, friends, and communities, for their immense loss.

5. Backburning Operations – Planning and Execution

Why was a general inquiry held?

1. General inquiries were held under section 32(3) of the Act into the Grose Valley, Mount Wilson Fire and the Currowan Fire. These general inquiries focussed on:
 - a. the Grose Valley Mount Wilson Fire - with respect to the strategic backburn implemented on 14 December 2019 to the west of Mount Wilson Road and north of the Bells Line of Road (in response to the Gospers Mountain (Wollemi National Park) Fire burning to the north); and
 - b. the Currowan Fire – with respect to the strategic backburn implemented on 31 December 2019 (as part of the eastern containment strategy in response to that fire).
2. This general inquiry considered the planning and execution of these two strategic backburns implemented by firefighting authorities in 2019 under the control and direction of the RFS.
3. These two strategic backburns are only two amongst very many backburns that took place across the 2019/2020 season, noting perhaps as many as 260 backburns were conducted in December 2019 alone, according to the figures provided to the NSW Bushfire Inquiry.⁶⁰⁵
4. These two strategic backburns were treated as case studies in decision making challenges and consequences that were repeated across the state on hundreds of occasions and with decisions made at all levels, including many which were made by volunteer RFS members contributing as part of an IMT.

What issues did the inquiry examine?

5. Prior to the commencement of this inquiry, a list of issues was circulated amongst the interested parties, identifying the scope of the inquest and the issues to be considered. No application was made by any of the interested parties to amend the Issues List. That Issues List identified the following:

Strategies to control the spread of fire (context drawn from the Final Report of the NSW Bushfire Inquiry)

1. *What terminology is used around backburns (e.g. backburns versus hazard reduction burns, strategic backburns versus tactical backburns, offensive versus defensive strategies)?*
2. *What early suppression efforts (such as aerial attacks) were used in an effort to keep fires small across the 2019/2020 season?*
3. *Who has responsibility for decision making about backburns in circumstances where a declaration is in force pursuant to s.44 of the Rural Fires Act 1997 (NSW)?*

Grose Valley, Mount Wilson Strategic Backburn

4. *What containment strategies were considered to control the spread of the southern edge of the Gospers Mountain Fire in the period up to 12 December 2019 and how did such strategies fit within the wider context of responding to other fire edges for the Gospers Mountain Fire along with other fires burning within the State?*
5. *What prompted a change in the Southern Containment Strategy on 13 December 2019 and was the change reasonable in the circumstances?*
6. *How was the Southern Containment Strategy implemented on 14 December 2019 (including timing, ignition pattern, resources and monitoring) and what led to the initial introduction of fire to the east of Mount Wilson Road?*

⁶⁰⁵ Exhibit 61, General Brief of Evidence – Stage 2 at p. 342.

Currowan Strategic Backburn

7. *What containment strategies were considered to control the easterly spread of the Currowan Fire in the period up to 29 December 2019 and how did such strategies fit within the wider context of responding to other fire edges for the Currowan cluster of fires, along with other fires burning within the State?*
8. *Should the Eastern Containment Line Strategy have been varied in light of predicted weather conditions for 30-31 December 2019 and the resources available to execute the strategy?*
9. *How was the Eastern Containment Line Strategy implemented on 30-31 December 2019 in the vicinity of Porters Creek Road, Yatte Yattah (including timing, ignition pattern, resources and monitoring) and what was the result?*

Responding to recommendations from the NSW Bushfire Inquiry

10. *What if any response has there been to the following recommendations from the NSW Bushfire Inquiry:*

Recommendation 47: That, in order to enhance firefighting strategies in severe conditions, the NSW RFS implement the following in respect to backburning:

- a. *Establish protocols for each category (tactical and strategic) within their operational and training doctrine. These protocols should include lessons learnt from the 2019/2020 season;*
- b. *Modify 'ICON' to implement the capability to record all backburns, including whether or not they break containment lines;*
- c. *When fire conditions are approaching Severe or above, an independent review must be undertaken at State Operations Level before strategic backburns are implemented; and*
- d. *Where there is significant concern within a community regarding a backburn, the NSW RFS should undertake a community engagement session with affected residents to discuss the backburn, including any investigation and relevant findings.*

Recommendation 48: That Government commission further research on the potential risks and benefits of backburning during severe, extreme and catastrophic conditions and/or in particular terrain, and that the NSW RFS use this research to inform future backburning protocols and training.

Other matters

11. *Whether it is otherwise necessary or desirable for the Coroner to make recommendations pursuant to section 82 of the Coroners Act 2009 in relation to any matter connected with these fire inquiries.*

6. Each of these issues is discussed in further detail below.

Strategies to control the spread of fire

ISSUE 1

What terminology is used around backburns (e.g. backburns versus hazard reduction burns, strategic backburns versus tactical backburns, offensive versus defensive strategies)?

7. The AFAC is the Australian and New Zealand national council for fire and emergency services. Its website states it has 33 members as at January 2023, including FRNSW, the FCNSW, the NPWS and the RFS.
8. AFAC's Rural and Land Management Group published a Bushfire Glossary dated January 2012, which is publicly accessible on the AFAC website. The stated aim of the glossary is to '*facilitate a greater understanding by using common language between bushfire and land management agencies and support organisations involved in the prevention of, preparedness for, response to and recovery from bushfires*'.
9. Court appointed expert, Mr Geoff Conway AFSM provided three expert reports to the Court concerning the appropriateness of the containment strategies devised and implemented as the Grose Valley, Mount Wilson and the Currowan strategic backburns. Mr Conway adopted the terms of the AFAC Bushfire Glossary in his Reports.⁶⁰⁶
10. The following definitions are of particular relevance to the issues examined by the Court in this Inquiry:
 - a. **Direct Attack:** 'A method of fire attack where wet or dry firefighting techniques are used. It involves suppression *action right on the fire edge which then becomes the fireline*';
 - b. **Parallel Attack:** 'Method of fire suppression in which fireline is constructed approximately parallel to, and just far enough from the fire edge to enable workers and equipment to work effectively, though the fireline may be shortened by cutting across unburned bays. The intervening strip of unburned fuel is normally burned out as the control line proceeds, but may be allowed to burn out unassisted where this occurs without undue delay or threat to the fireline';
 - c. **Indirect Attack:** 'A method of suppression in which the control line is located some considerable distance away from the fire's active edge. Generally done in the case of a fast-spreading or high-intensity fire, and to utilise natural or constructed firebreaks or fuel-breaks, and favourable breaks in the topography. The intervening fuel is usually backburnt; but occasionally the main fire is allowed to burn to the line, depending on conditions'; and
 - d. **Defensive Strategy:** 'A firefighting strategy used where the protection of life and assets is a priority when a fire is:
 - i. located in inaccessible or remote locations; or
 - ii. too intense to be safely or effectively attacked directly';
11. The following definitions (drawn from the AFAC Bushfire Glossary but not specifically extracted in Mr Conway's reports) are also relevant:
 - a. **Backburn** [Australian definition]: 'A fire started intentionally along the inner edge of a fireline during indirect attack operations to consume fuel in the path of a bushfire;'
 - b. **Fireline:** 'A natural or constructed barrier, or treated fire edge, used in fire suppression and prescribed burning to limit the spread of fire;'
 - c. **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; and
 - d. **Hazard reduction:** (the AFAC's definition of **hazard reduction** redirects the reader back to the definition of **fuel management**, which is defined as 'modification of fuels by prescribed burning, or other means').

⁶⁰⁶ Exhibit 56A, Brief of Evidence at p. 3730.

CONCLUSION

For the purpose of these findings and recommendations, I adopt the AFAC Bushfire Glossary.

ISSUE 2

What early suppression efforts (such as aerial attacks) were used in an effort to keep fires small across the 2019/2020 season?

12. The circumstances surrounding the Currowan Fire provides a case in point representative of many of the fires throughout the 2019/2020 bushfire season and demonstrates why a focus on the early use of aerial resources and rapid responses, including RAFTs, is so important in attacking fires in their incipient stages.
13. The RART program is a joint NPWS and RFS initiative that assembles RAFT crews and dedicated rotary aircraft for immediate or rapid deployment on days when bushfire ignition is likely (such as following lightning storms) or when there is a risk of fires spreading rapidly (such as during severe fire weather conditions). The primary objective of RART is to respond rapidly in order to minimise fire size and potential for impact on assets.⁶⁰⁷
14. The Currowan Fire is believed to have commenced following a lightning strike in remote bushland within the Currowan State Forest on the evening of 25 November 2019. However, it did not become visible until the afternoon of 26 November, at which time (2:00pm) a resident called 000 to report it. Between 3:00pm and 11:00pm, the fire spread approximately 8.5 kilometres and grew in size by more than 2,000 hectares.⁶⁰⁸
15. The Currowan Fire spread so significantly that it was assigned new names as it spread into different LGAs and was managed by different IMTs across the south coast and rural areas south of Sydney. At least in respect of the Currowan Fire so named, the fire burned for 74 days, tragically resulted in the death of three civilians, and burned over 300,000 hectares in the Shoalhaven LGA alone.⁶⁰⁹
16. This example speaks to the importance of containing fires in their incipient stages where possible – including those which might burn for some time unnoticed in remote and difficult to access bushland – before spreading at risk to human life, property and flora and fauna.
17. Against this broader context, the NSW Bushfire Inquiry made Recommendation 45:⁶¹⁰

That, in order to prioritise early suppression and keep fires small:

 - a. *[NSW] Government set a KPI for NPWS regarding the percentage of fires that start on-park and are contained within 10 hectares, and consider whether 70% is an appropriate KPI for the NSW RFS and NPWS;*
 - b. *NSW fire authorities deploy remote area firefighting resources based on enhanced research and predictive modelling. In some circumstances, this may require prioritising the deployment of RART to enable rapid initial attack of new remote area ignitions over ongoing suppression operations, where supported by a relative risk assessment.*
18. This drew on evidence from the NSW Bushfire Inquiry which showed firefighting models used in South Australia and Victoria demonstrated the efficacy of initial aerial dispatch once a fire is detected followed by ground crew support to achieve early fire suppression.⁶¹¹

⁶⁰⁷ Exhibit 61, Brief of Evidence at p. 333–334.

⁶⁰⁸ Exhibit 19A, Brief of Evidence at p. 2619.

⁶⁰⁹ Exhibit 19A, Brief of Evidence p. 7–8.

⁶¹⁰ Exhibit 61, Brief of Evidence at p. 337.

⁶¹¹ Exhibit 61, Brief of Evidence at p. 331.

19. The NSW Bushfire Inquiry further found that early suppression of bushfires is essential to minimise the likelihood of bushfires growing into potentially large and damaging events, (which explains the significance of KPIs to keep fires small)⁶¹² and that the use of RAFTs are critical in keeping fires small.⁶¹³
20. The NSW Bushfire Inquiry was informed that RAFTs were used to great effect during throughout the 2019/2020 bushfire season, despite the severity of the fire conditions and the scale of the resulting fires in some areas. NPWS RART crews were critical in minimising the size of fire on NPWS managed land. Of the 243 fires that started on national parks land during the 2019/2020 season, a total of 161 (66%) were contained on that park's land and 145 fires (60%) were kept to less than 10 hectares in size.⁶¹⁴
21. Further, the NSW Bushfire Inquiry was advised that where RAFT teams could be deployed during the fire season, they were effective. Throughout the season, there were 41 ignitions (primarily as a result of lightning) across the Greater Blue Mountains World Heritage Area. Twenty of these ignitions were successfully contained by NPWS RAFTs to an average size of less than 1.2 hectares.⁶¹⁵
22. In the Quarterly Progress Report responding to these recommendations for the reporting period January to March 2022, the RFS was noted to have adopted the 70% KPI target and report on it annually.⁶¹⁶
23. In correspondence dated 27 June 2023, NPWS provided the following response in relation to Recommendation 45:

*NPWS has used the listed rapid response KPIs since 2011. They were reconsidered and readopted following the 2019/2020 [NSW] Bushfire Inquiry. Data on the NPWS performance against the KPIs can be provided on request.*⁶¹⁷
24. In the same Quarterly Progress Report, with respect to the second component of Recommendation 45, the RFS was noted as having embedded a predictive model into its systems that forecasts ignition potential and identifies areas expected to reach (and exceed) RART triggers up to four days in advance.⁶¹⁸
25. Recommendation 46 of the NSW Bushfire Inquiry was in the following terms:⁶¹⁹

That, in order to improve early fire suppression, the NSW RFS trial initial aerial dispatch in areas of high bush fire risk. The trial should identify the most appropriate and cost-effective mix of aircraft, and any associated infrastructure improvements that would be required.
26. The NSW Bushfire Inquiry commented that despite the range of aircraft available, aerial dispatch is not always automatically triggered when a fire is detected in NSW. The NSW Bushfire Inquiry noted that initial aerial attack combined with ground support is effective in keeping fires small. The rationale for this approach is that when a new fire is detected, an initial aerial rapid response is dispatched in concert with suitable ground firefighting resources (which may include RAFT), with the aim of limiting the spread of the fire. The objective is to keep fires small and limit their spread across the landscape, particularly fires in remote areas. Further, trialling initial aerial dispatch would complement the existing RART program, as it would enable aerial retardant/water-bombing to commence before RART crew arrive.⁶²⁰
27. The NSW Bushfire Inquiry also noted that research showed this approach corresponds with the increased likelihood of earlier control and a smaller total area burnt.⁶²¹ It is within this context that the NSW Bushfire Inquiry made Recommendation 46.

⁶¹² Exhibit 61, Brief of Evidence at p. 331.

⁶¹³ Exhibit 61, Brief of Evidence at p. 333.

⁶¹⁴ Exhibit 61, Brief of Evidence at p. 336.

⁶¹⁵ Exhibit 61, Brief of Evidence at p. 336.

⁶¹⁶ Exhibit 61, Brief of Evidence at p. 729.

⁶¹⁷ Exhibit 61, Brief of Evidence at p. 4941.

⁶¹⁸ Exhibit 61, Brief of Evidence at p. 729.

⁶¹⁹ Exhibit 61, Brief of Evidence at p. 339.

⁶²⁰ Exhibit 61, Brief of Evidence at p. 337.

⁶²¹ Exhibit 61, Brief of Evidence at p. 337–338.

28. In the Quarterly Progress Report for January to March 2022, the RFS was noted to have conducted a pre-determined dispatch trial between December 2020 and February 2021 in Wagga Wagga, Cowra, and Sydney.⁶²²

CONCLUSION

The evidence before the earlier NSW Bushfire Inquiry demonstrated the efficacy of using RAFTs to suppress fires in their infancy during the 2019/2020 bushfire season. NSW Bushfire Recommendation 45 is consistent with this position, as are the responses of the RFS and NPWS.

In response to Recommendation 46 around trialling initial aerial dispatch to complement the existing RART program, the RFS conducted a pre-determined Dispatch Trial in the 2020/2021 bushfire season.

ISSUE 3

Who has responsibility for decision making about backburns in circumstances where a declaration is in force pursuant to section 44 of the Rural Fires Act 1997 (NSW)?

29. Section 44 of the RF Act requires the Commissioner of the RFS to take charge of bushfire fighting operations and bushfire prevention measures and take necessary measures to control or suppress bushfires in certain circumstances, which include where a bushfire has, or is likely to, assume such proportions as to be incapable of control or suppression by local firefighting authorities.
30. An unprecedented number of section 44 declarations were made during the 2019/2020 bushfire season, and in some cases, there were so many bushfires within a LGA that all bushfires within a whole LGA were managed under a single declaration (such as the Shoalhaven section 44 declaration, which included the Currowan Fire).⁶²³
31. When a section 44 declaration is in force, the IC within the relevant IMT which is managing the section 44 fire has responsibility for decision-making about strategic backburns, while tactical backburns are the responsibility of the OIC of the area in which the tactical backburn is being conducted.⁶²⁴
32. There is an exception for strategic backburns when the Fire Behaviour Index in the next 36 hours from time of ignition exceeds or is forecasted to exceed 50. In those circumstances, the backburn must be independently reviewed by officers approved by the SOC.⁶²⁵
33. The significance of the distinction between strategic and tactical backburns (and who has responsibility for them) will be addressed later in this Section at paragraphs 302–328 dealing with the response to Recommendation 47 of the NSW Bushfire Inquiry.

CONCLUSION

When a section 44 declaration is in force, the IC within the relevant IMT which is managing the section 44 fire has responsibility for decision making about strategic backburns, while tactical backburns are the responsibility of the OIC of the area in which the tactical backburn is being conducted. However, in respect of strategic backburns, when the Fire Behaviour Index in the next 36 hours from time of ignition exceeds or is forecasted to exceed 50, the backburn must be independently reviewed by officers approved by the SOC.

⁶²² Exhibit 61, Brief of Evidence at p. 729.

⁶²³ Exhibit 19A, Brief of Evidence Tab 6.

⁶²⁴ Exhibit 56A, Brief of Evidence at p. 3409–3410.

⁶²⁵ Exhibit 56A, Brief of Evidence at p. 3410.

Grose Valley, Mount Wilson Strategic Backburn

34. The Gaspers Mountain (Wollemi National Park) Fire precipitated the Grose Valley (Mount Wilson) Fire.
35. On 14 December 2019, a strategic backburn was implemented to the west of Mount Wilson Road and north of the Bells Line of Road in Mount Wilson, by firefighting authorities under the control and direction of the RFS (the **Grose Valley Strategic Backburn**). This strategy was implemented in response to the southern perimeter of the Gaspers Mountain Fire burning to the north and of some distance away from the communities that were ultimately heavily impacted by the backburn.
36. On 14 June 2022, I visited the site of the strategic backburn with Counsel Assisting and the OIC, DS Laura Harvey, followed by Du Faurs Rocks Lookout near Mount Wilson Fire Station.
37. The Grose Valley Strategic Backburn ultimately spotted to the east of Mount Wilson Road and impacted upon properties in Mount Wilson and went on to impact communities including Mount Wilson, Mount Tomah, Berambing and Bilpin the next day, 15 December 2019, and in the subsequent days.
38. The Grose Valley Fire burned for approximately seven and a half weeks until it was declared 'Out' on 4 February 2020.
39. Court-appointed expert, Mr Geoffrey Conway AFSM, provided two expert reports in respect of the Grose Valley Fire. Mr Conway has extensive experience (more than 30 years) as a professional fire officer and private consultant to the fire and emergency services sector, providing advice and expert reports to many levels of governments and inquiries respectively. Mr Conway has also held several senior operational roles with fire agencies overseeing the management of fire mitigation, preparedness and response on public land. He has also been a part of a number of IMTs during emergency response events, maintains an endorsement as a Level 2 IC, a Level 3 Planning Officer, Level 3 Operations Officer and Level 3 Public Information Officer and has had operational involvement in incident teams and fireground management operational activities.
40. The Grose Valley AOCG led by members Jochen Spencer and Kooryn Sheaves engaged three experts:⁶²⁶
 - a. Mr Nicholas Gellie, Fire Ecologist Expert;
 - b. Mr Terence Kirkpatrick, Psychologist; and
 - c. Mr Brian Williams, Captain, Kurrajong Heights Rural Fire Brigade.
41. The Court also received into evidence affidavits from Grose Valley Fire affected owners and the Submission of the AOCG to the NSW Bushfire Coronial Inquiry was marked for identification.⁶²⁷
42. The following witnesses, who were directly involved in the planning and/or implementation of the Grose Valley Strategic Backburn, gave oral evidence during the week of 15 May 2023:
 - a. Mr James Carter, RFS Bell Division Commander;
 - b. Mr Kenneth Pullen, RFS Assistant Planning Officer, Hawkesbury IMT;
 - c. Mr Craig Burley, RFS Bell Division Operations Officer;
 - d. Mr Chris Banffy, NPWS AAS, Hawkesbury IMT;
 - e. Mr Daniel Gerzanics, RFS October South Sector Leader of the Bell Division;
 - f. Ms Elizabeth Raines, RFS October North Sector Leader of the Bell Division;

⁶²⁶ Exhibit 56A, Brief of Evidence at Tab 96 (Report of Mr Gellie), Tab 97 (Report of Mr Kirkpatrick) – this report was provided in response to NSW Bushfire Inquiry Recommendation 47 part d), Tab 100 (Report of Mr Williams).

⁶²⁷ Exhibit 56A, Brief of Evidence at Tab 99 (Affidavits from Grose Valley Fire Affected Owners); MFI-B (NSW Bushfire Coronial Inquiry Submission of the Bushfire Resident Group).

43. Evidence was also heard from:
- a. Mr Geoff Conway, the Court-appointed expert; and
 - b. Mr Peter McKechnie, RFS Deputy Commissioner, Field Operations.

ISSUE 4

What containment strategies were considered to control the spread of the southern edge of the Gospers Mountain Fire in the period up to 12 December 2019 and how did such strategies fit within the wider context of responding to other fire edges for the Gospers Mountain Fire along with other fires burning within the State?

The Gospers Mountain Fire

44. As previously stated in Volume 1, Part 6, Section 6, the Gospers Mountain Fire is believed to have originated because of a lightning strike to a tree, or perhaps, two trees in remote bushland in the Wollemi National Park on 26 October 2019. This was many kilometres north of the communities that border the Blue Mountains National Park, but the Gospers Mountain Fire burnt in excess of 500,000 hectares, making it the largest single forest fire in Australian recorded history.
45. Initial discussions between RFS and NPWS revolved around possible eastern containment strategies, west of the Putty Road and also, potential strategies should the Fire to cross to the east of that road.⁶²⁸
46. A pre-emptive section 44 declaration was made on the evening of 11 November 2019 in anticipation of forecasted catastrophic conditions for the following day. A multi-agency IMT was set up for the Hawkesbury region based at the Hawkesbury FCC at Wilberforce.⁶²⁹
47. On 12 November 2019, the forecasted conditions eventuated, with the Gospers Mountain Fire doubling in size to 56,000 hectares with a perimeter of 170 kilometres. The fire was seen to spread in the direction of all ‘points of the compass’ and had crossed to the east of the Putty Road and south of the Colo River to the west, the latter which had been considered a key southern containment line. The sheer speed of the Fire overwhelmed efforts to contain it.⁶³⁰
48. It became clear that extensive planning would need to be undertaken to form an overall containment strategy to fight the Gospers Mountain Fire and protect communities in the predicted path of its spread.⁶³¹

Gospers Mountain ‘Southern Containment Strategy’

49. The Hawkesbury IMT identified strategies to minimise the overall size of the Fire if conditions and circumstances allowed their implementation. These strategies were often hampered by poor weather conditions, fire behaviour and lightning sparking several new ignitions beyond key containment lines, some which were unable to be contained, and later joined with the Gospers Mountain Fire.⁶³²
50. Mr Conway commented that observations of fire behaviour and fire progression from the time of ignition to the time of the Grose Valley Strategic Backburn, including the effectiveness of containment strategies up to that time and weather forecasts, all indicated that direct and parallel attack strategies would be limited in their application. According to Mr Conway, this was due to fuel loads, fuel dryness and terrain which limited access to the fire edge. It followed that an indirect attack strategy, whilst taking opportunities for direct attack during lulls in weather and fire intensity, was applied.⁶³³

⁶²⁸ Exhibit 56A, Brief of Evidence at p. 590; Transcript for 16 May 2023 T 1498:17-34.

⁶²⁹ Exhibit 55A, Brief of Evidence at p. 660; Exhibit 56A, Brief of Evidence at p. 591.

⁶³⁰ Exhibit 56A, Brief of Evidence at p. 591.

⁶³¹ Exhibit 56A, Brief of Evidence at p. 591.

⁶³² Exhibit 56A, Brief of Evidence at p. 591-593.

⁶³³ Exhibit 56A, Brief of Evidence at p. 3730-3731; Transcript for 19 May 2023 T 1645:27-47.

51. Further, Mr Conway remarked that new fires outside of identified and established containment lines prompted the IMT to revise the strategy to a more conservative approach reflecting “*worst case scenario thinking*”.⁶³⁴
52. By about 18 November 2019, the IMT determined to implement a ‘Southern Containment Strategy’ to the south (west of Putty Road), notwithstanding that the Fire was still some 30 kilometres to the north.⁶³⁵ This involved securing containment lines extending from Upper Colo in the east, through Bilpin, Itchenstoke, Mount Irvine, Mount Wilson, and Bell in the south to Newnes and a number of smaller vulnerable communities in the west. To this end, extensive works were commenced to prepare containment lines.⁶³⁶
53. Mr Carter stated that the containment lines would provide the RFS with the option to undertake defensive firefighting or offensive backburning operations.⁶³⁷
54. It was in this context that a backburn anchored off the intersection of the Bells Line of Road and Mount Wilson Road was identified as a critical component of the wider containment strategy.
55. The IMT bore in mind that the area in and around Mount Wilson had experienced reasonably frequent fire history. Major recent events occurred in 1994, 2006 (on the south side of Bells Line of Road) and 2013, which was known as the State Mine Fire. On 17 October 2013, the State Mine Fire ran over 30 kilometres in approximately nine hours under strong winds from near Oaky Park just outside Lithgow to the north of Mount Tootie. Along the way, it impacted Mount Wilson and Mount Irvine resulting in property losses. The IMT considered that this Fire demonstrated the potential for the Gospers Mountain Fire to run through the landscape and vegetation type with extreme rates of spread.⁶³⁸
56. There were also 25-year-old fuels in the head of Bowen Creek, which is to the south of Mount Wilson and north of Bells Line of Road, that presented an extreme risk of fire crossing Bells Line of Road and into the Grose Valley.⁶³⁹
57. Long range forecasts issued in early December 2019 predicted very little to no rain. Accordingly, the Hawkesbury IMT placed no weight on the possibility of the Gospers Mountain Fire being contained by significant rainfall soon. They instead anticipated that the Gospers Mountain Fire would grow and threaten communities and assets in its path.⁶⁴⁰
58. Due to lack of rainfall, soil dryness, fuel conditions and having learnt from experience of other fires earlier in this extraordinary fire season, the IMT concluded that more conventional, natural containment options (such as the use of rivers, canyons, fire trails and hand tool lines) could not be relied upon to effectively suppress the Gospers Mountain Fire.⁶⁴¹
59. This thinking was apparently underscored by a linescan taken at 2:28pm on 5 December 2019 which Mr Carter stated demonstrated ‘*the vulnerability of these natural advantages, showing a significant crossing of the Wollangambe River near its junction with the Colo River, placing it within 7kms north of Mt Tootie, and 10kms NNE of Mount Irvine with no opportunities for containment*’.⁶⁴² Further, a linescan taken that evening at 7:08pm, showed there was just over 60 kilometres of fire front stretching from Colo Heights west to Newnes.⁶⁴³

⁶³⁴ Exhibit 56A, Brief of Evidence at p. 3731.

⁶³⁵ Exhibit 56A, Brief of Evidence at p. 592; Transcript for 15 May 2023 T 1418:18-35.

⁶³⁶ Exhibit 56A, Brief of Evidence at p. 592.

⁶³⁷ Transcript for 15 May 2023 T 1418:40-49.

⁶³⁸ Exhibit 56A, Brief of Evidence at p. 3555, 3580.

⁶³⁹ Exhibit 56A, Brief of Evidence at p. 3562.

⁶⁴⁰ Transcript for 15 May 2023 T 1418:9-16.

⁶⁴¹ Transcript for 15 May 2023 T 1417:26-36.

⁶⁴² Exhibit 56A, Brief of Evidence at p. 3554.

⁶⁴³ Exhibit 56A, Brief of Evidence at p. 3620.

60. Unprecedented levels of fire activity across NSW had also placed a large strain on available resources.⁶⁴⁴ This is partly evident in the below fire progression mapping for the Gospers Mountain Fire and surrounding fires on 4 December 2019 with the Putty Road the arterial road vertically dissecting the Gospers Mountain Fire:⁶⁴⁵

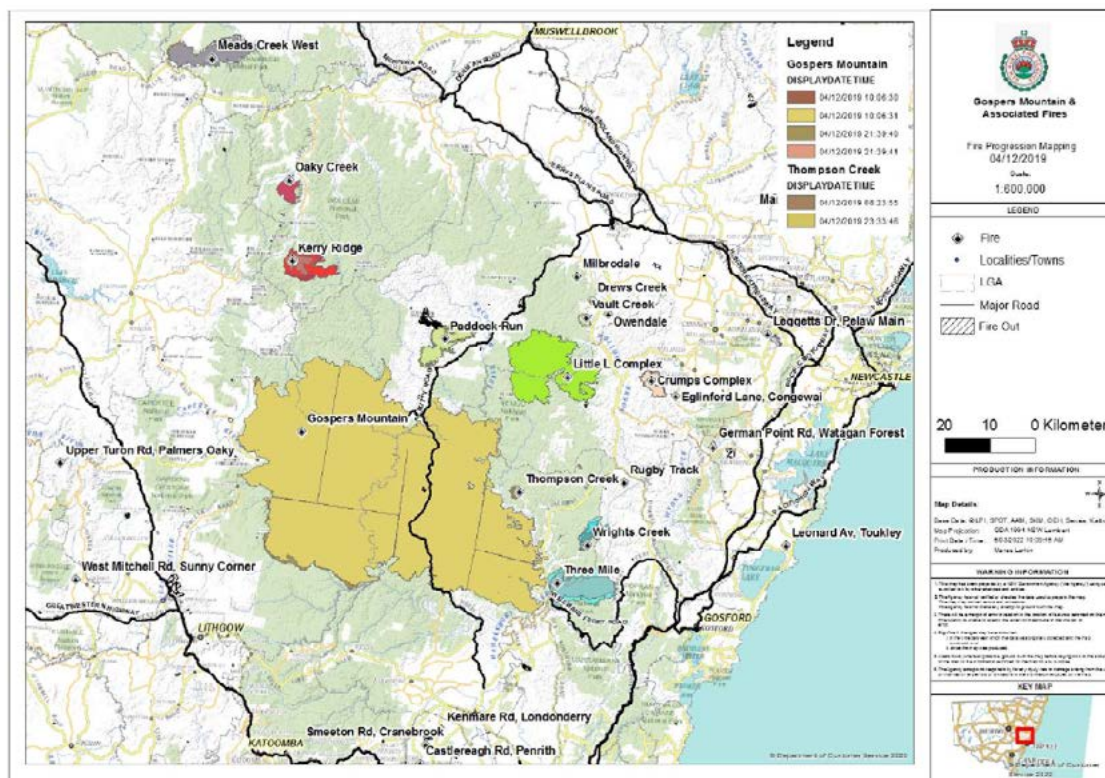


Figure 7 Gospers Mountain and Surrounding Fires 0000 04/12/2019 to 0000 05/12/2019 (1:600,000 scale)

61. RFS Deputy Commissioner McKechnie stated that:⁶⁴⁶

In December 2019, over 2,000 bush and grass fires were recorded, making it the most active month of the 2019/2020 fire season, with 120 fires active since November 2019. Five additional s. 44 Declarations were made throughout December 2019... There were 17 s. 44 Declarations in-force during December 2019... December 2019 was also the driest month on record for Australia, with most areas of New South Wales receiving less than 10mm rainfall...

62. Therefore, the IMT went on to consider alternate hard containment options, as well as the possibility of falling back to implement bare property defence or use of RAFT.⁶⁴⁷
63. Mr Conway opined that the containment strategy developed by the IMT following the fire runs on 12 November 2019, including the identification of the southern containment strategy, was appropriate.⁶⁴⁸

⁶⁴⁴ Exhibit 56A, Brief of Evidence at p. 3557.

⁶⁴⁵ Exhibit 55A Brief of Evidence at p. 1028.

⁶⁴⁶ Exhibit 56A, Brief of Evidence at p. 3644.

⁶⁴⁷ Exhibit 56A, Brief of Evidence at p. 3587.

⁶⁴⁸ Exhibit 56A, Brief of Evidence at p. 3731.

64. Additionally, he commented that:

No individual fire can be examined in isolation from the broader state situation. There were several other fires burning across NSW and South East Queensland from August of 2019. Victoria was also facing a high-risk fire season with significant rainfall deficit. The impact on resource availability on the eastern seaboard had been felt as early as September 2019, with deployment of interstate resources to support firefights in northern NSW ... This pressure on resources places constraints on decision makers at state, regional and incident level, and is reflected in the strategies they pursue.⁶⁴⁹

‘Northern Line Strategy’

65. The IMT identified the ‘Northern Line’ approach to be the most appropriate with respect to protecting Mount Wilson, Mount Irvine, and Bell. By the week commencing 9 December 2019, the southern edge of the Gospers Mountain Fire was approximately 3.7 kilometres to reaching the backburn which had been put in north of Mountain Lagoon and approximately 4.5 kilometres north of Mount Tootie.
66. This backburn had created an effective zone to protect townships from the easternmost section of Bilpin. However, fire was continuing to extend toward Mount Tootie. The need to burn around Mount Tootie and continue further west was becoming critical. It was also imperative that burning also continue west past Mount Wilson and Bell to north of Clarence and Dargan as the Fire was extending south toward Lithgow in the west. Protecting these communities was reliant upon completing the southern containment line between Bilpin and Newnes Plateau.⁶⁵⁰
67. The following map demonstrates the southward movement of the Gospers Mountain Fire and the backburn which had been put in from Mountain Lagoon to Bilpin.⁶⁵¹



⁶⁴⁹ Exhibit 56A, Brief of Evidence at p. 3731.

⁶⁵⁰ Exhibit 56A, Brief of Evidence at p. 3558, 3562, 3578–3579.

⁶⁵¹ Exhibit 56A, Brief of Evidence at p. 3579. Markers from left to right as follows: Mount Wilson, Mount Irvine, Mount Tootie, Bilpin, Glenwood, and Mountain Lagoon.

68. The ‘Northern Line Strategy’ involved implementing a backburn on the northern side of Mount Irvine and Mount Wilson utilising Mount Irvine Road and Bowen Creek Road. The backburn would extend from Bilpin and Mount Tootie east and west around the mountains, then south along the western side of Mount Wilson Road to Bells Line of Road, then west along the northern side of Bells Line of Road to Bell. This plan had been implemented previously in 2013 during the State Mine Fire and in 1994. Further, it eliminated the need to burn along the complex geometry of Bells Line of Road and the 25-year-old fuels in the upper Bowen Creek catchment which had last burnt in 1994. It was anticipated three or four days would be required to successfully execute the burn.⁶⁵²
69. The ‘99th parallel’ or ‘99 northing gridline’ was identified as a trigger point. The Factual Investigation Report prepared by Mr O’Donnell stated that this trigger was approximately nine kilometres north of Mount Wilson between Bells Line of Road in the west and Tootie Creek in the east.⁶⁵³ In the Bell and Bilpin Division Sub Plans for 12-13 December 2019 and for 14 December 2019, the ‘99 northing gridline’ was noted as being the southern-most point of Bungleboori Creek.⁶⁵⁴
70. Mr Carter stated the trigger was slightly north of the Wollangambe River and that it had been set on the basis that *‘once the fire crossed the Wollangambe north of Mount Wilson [they] would most likely be relying on defensive firefighting tactics (property protection)’*.⁶⁵⁵ Mr Pullen added that the Wollangambe River was chosen as the major trigger point as it provided *‘sufficient time for [a] backburn to be implemented well ahead of any impact by the fire’*.⁶⁵⁶
71. By 11 December 2019, firefighters had extended backburning operations from Bilpin towards Itchenstoke, along Mount Tootie Road.⁶⁵⁷ That same day, a discussion took place between the Hawkesbury and Blue Mountains IMTs and local RFS brigade representatives.⁶⁵⁸ The forecast that evening identified a potential window of favourable conditions on 15 December 2019 after a predicted southerly change had moved through the area. At that stage, 18 and 19 December were noted to be hot and potentially dry, but wind direction and strength was uncertain.⁶⁵⁹
72. Mr Carter believed that there was a general consensus that a defensive strategy was not a viable option and that every stakeholder strongly vocalised that an indirect attack through a strategic backburn was the most viable option in difficult circumstances.⁶⁶⁰ While he said some stakeholders may have wished to implement the backburn sooner rather than later, they aimed to implement it on 15 December in view of it being the *‘best looking weather window we felt we could conduct the burn the most safely.’*⁶⁶¹ Further he said, *‘I think in all our minds ... we knew we had between the 11th and the 18th to have this strategy implemented or it would be potentially too late.’*⁶⁶²
73. Mr Conway opined that the backburn planned for the Bell Division and implemented on 14 December was a critical component of the overall containment strategy along the southern boundary of the Fire. Forecast for deteriorating weather, fire spread predictions prepared for the IMT and the experience of significant fire runs throughout the firefight, were a valid indication of the risk of further fire extension.⁶⁶³
74. Further, *‘as long as the fuel moisture contents of the fuel that they were dealing with in this area remained as dry as they were, and the soil moisture remained as dry as it was; the potential for them to successfully contain the spread of the fire was quite limited.’*⁶⁶⁴

⁶⁵² Exhibit 56A, Brief of Evidence at p. 3558, 3651.

⁶⁵³ Exhibit 56A, Brief of Evidence at p. 165.

⁶⁵⁴ Exhibit 55A Brief of Evidence at p. 1195, 4064.

⁶⁵⁵ Exhibit 56A, Brief of Evidence at p. 3561; 4143–4144.

⁶⁵⁶ Exhibit 56A, Brief of Evidence at p. 3513.

⁶⁵⁷ Exhibit 56A, Brief of Evidence at p. 191.

⁶⁵⁸ Exhibit 56A, Brief of Evidence at p. 357-1; Transcript for 15 May 2023 T 1420:42.

⁶⁵⁹ Exhibit 56A, Brief of Evidence at p. 3563, 3588.

⁶⁶⁰ Transcript for 15 May 2023 T 1421:23-32.

⁶⁶¹ Transcript for 15 May 2023 T 1421:44-45.

⁶⁶² Transcript for 15 May 2023 T 1422:30-32.

⁶⁶³ Exhibit 56A, Brief of Evidence at p. 3731.

⁶⁶⁴ Transcript for 19 May 2023 T 1648:41-44.

75. These assessments, on Mr Conway's view, indicated the potential of fire runs to the south and south east under the influence of the weather forecast for 19 and 20 December. All indicators suggested further spread to the south was likely, if not inevitable. The IMT was planning for the potential spread of the Fire and took a conservative assessment of the effectiveness of fire suppression effectiveness which reflects "worst case scenario thinking".⁶⁶⁵
76. Mr Conway stated that given the experience of the IMT with the Gospers Mountain Fire to this time, such an approach was appropriate. Also, the use of an indirect attack strategy and the planning for the backburn was appropriate in the circumstances. On his view, it would have been negligent to adopt a strategic position that suggested containment of the Fire was possible without widespread rainfall in the fire area. No information available to the IMT from the Bureau suggested that this was likely.⁶⁶⁶
77. Mr Conway's attention was drawn by the AOCG to the following 'six backburns that failed' and 'got out of control' which were identified by Mr Gellie in his report:
- a. 15 November 2019 – Putty Road, Wallaby Swamp Trail and Staircase Trail;
 - b. 19 November 2019 – Colo Heights, Drip Rock Sector, Putty Road, Barina Drive;
 - c. 3–5 December 2019 – Colo Heights;
 - d. 5–6 December 2019 – Mountain Lagoon between the Colo River and Bilpin;
 - e. 7 December 2019 – Glow Worm Tunnel Road, Newnes Plateau; and
 - f. 12 December 2019 – Blackfellows Hand Trail, Newnes Plateau.⁶⁶⁷
78. Mr Conway was asked by the AOCG to comment whether those failed strategies had any bearing on the decision for the Grose Valley Strategic Backburn to be implemented on 14 December.
79. Mr Conway responded that he assumed that they would have been part of the considerations the IMT took into account. However, he added:
- ...I think the important thing to flag here in this conversation is that given the scale and the duration of the Gospers Mountain fire, all offensive strategies would have been applied at various times and at various points on the fireground. That a number of the backburns were not successful and were not contained is not unusual. This is something that you would expect in a fire of this scale and in these circumstances you will find that an indirect strategy is not always successful, in the same way that a number of attempts of direct attack on the fire weren't successful. The point I think that's most important to reflect on here, is just how complex that firefight was as a result of the ability of firefighters to access the fireground, the nature of the fuels, which we've already flagged as being significantly dry, and the challenges of all the offensive strategies that firefighters might use being challenged, particularly in - in difficult weather...*
- That some of the strategies that we'd applied earlier in the firefight hadn't been successful, doesn't mean that you stop... relying solely on a defensive strategy in the circumstances that the IMT were facing at that particular time in December, was just not appropriate. It would have put firefighters and residents at extraordinary risk and I think, as I've indicated, the decision the IMT took even with all the understanding they've had about the success or otherwise of the firefight up to that particular time, was still appropriate in the circumstances.*⁶⁶⁸
80. On 12 December 2019, light rain (approximately 2mm – 2.5mm) was received across the Mount Wilson and Beraming areas and approximately 6mm at Mount Tootie overnight.⁶⁶⁹ Test burns were unsuccessful, and conditions halted the backburn being taken further west along Mount Tootie Road. A decision was made to focus on consolidating containment lines by blacking out, mopping up and patrolling active edges as required.⁶⁷⁰

⁶⁶⁵ Exhibit 56A, Brief of Evidence at p. 3731, 3734; Transcript for 19 May 2023 T 1645:27-47.

⁶⁶⁶ Exhibit 56A, Brief of Evidence at p. 3731, 3734; Transcript for 19 May 2023 T 1645:27-47; T 1657:10-21.

⁶⁶⁷ Transcript for 19 May 2023 T 1665:19-48; Exhibit 56A, Brief of Evidence at p. 4156-6.

⁶⁶⁸ Transcript for 19 May 2023 T 1666:18 –1667:5.

⁶⁶⁹ Exhibit 56A, Brief of Evidence at p. 191, 3563; Transcript for 19 May 2023 T 1645:13.

⁶⁷⁰ Exhibit 56A, Brief of Evidence at p. 3563, 192, 3514, 564.

81. The footprint of the Gospers Mountain Fire and surrounding fires in fire progression mapping for 12 December 2019 below, comparative to fire progression mapping of 4 December 2019, illustrates that firefighting resources were further strained and stretched.⁶⁷¹

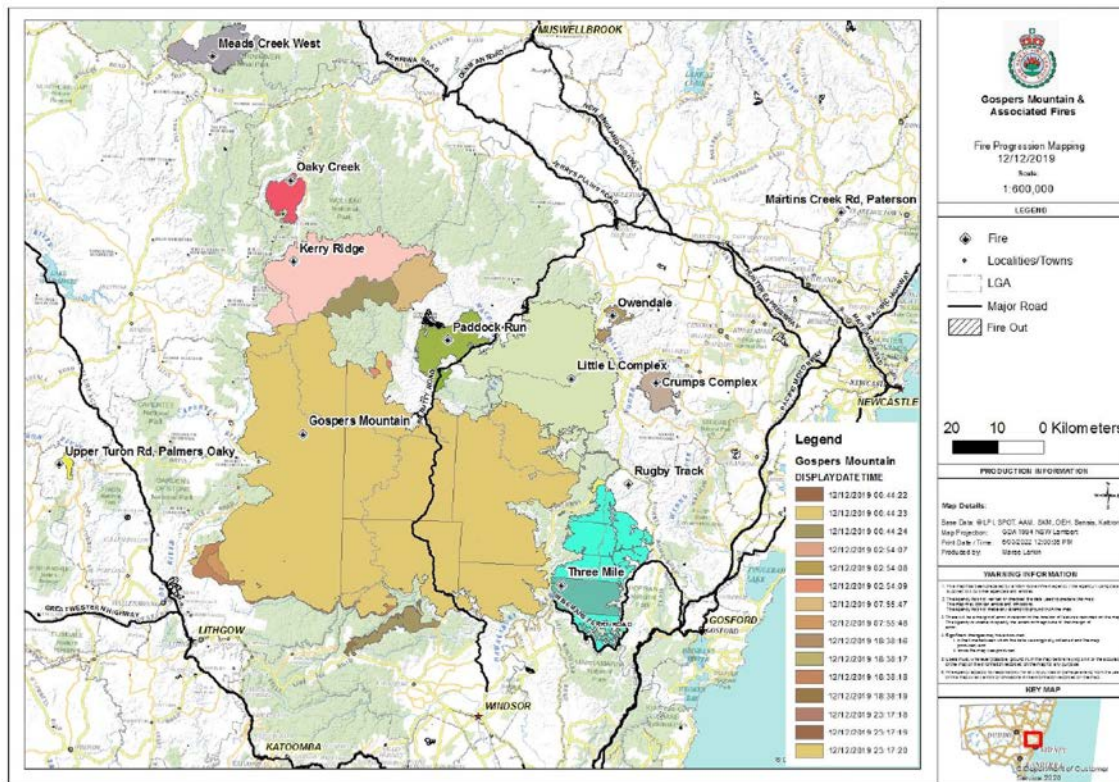


Figure 5 Fire Progression Mapping 0000, 12/12/2019 to 0000, 13/12/2019 (1:600,000 scale)

CONCLUSION

I accept the evidence that by 12 November 2019, the Gospers Mountain Fire had doubled in size to 56,000 hectares with a perimeter of 170 kilometres. The sheer spread of the Fire overwhelmed efforts to contain it. It became clear to the IMT that extensive planning would need to be undertaken to form an overall containment strategy to fight the Fire. The application of direct and parallel attack strategies had been limited in their application due to fuel loads, fuel dryness, and terrain which limited access to the fire edge. These challenges were combined with new fires igniting outside of identified and established containment lines which frustrated efforts. It followed that a more conservative approach, namely an indirect attack strategy, while taking opportunities for direct attack during lulls in weather and fire intensity was applied by the IMT, reflecting “worst case scenario thinking”.

Further, by about 18 November 2019, the IMT determined to implement a ‘Southern Containment Strategy’ which involved securing containment lines extending from Upper Colo in the east, through Bilpin, Itchenstoke, Mount Irvine, Mount Wilson, and Bell in the south to Newnes and a number of smaller vulnerable communities in the west.

The IMT identified the ‘Northern Line’ approach to be the most appropriate with respect to protecting Mount Wilson, Mount Irvine, and Bell. This involved implementing a backburn on the northern side of Mount Irvine and Mount Wilson utilising Mount Irvine Road and Bowen Creek Road. The backburn would extend from Bilpin and Mount Tootie east and west around the mountains, then south along the western side of Mount Wilson Road to Bells Line of Road, then west along the northern side of Bells Line of Road to Bell.

⁶⁷¹ Exhibit 56A, Brief of Evidence at p. 1090.

ISSUE 5

What prompted a change in the Southern Containment Strategy on 13 December 2019 and was the change reasonable in the circumstances?

A change in the Southern Containment Strategy on 13 December 2019

82. Forecasts issued on 13 December 2019 clarified the impending weather for the following week, relevantly including:
 - a. improvement in the forecast for 14 December;
 - b. deterioration for 16 December;
 - c. significant fire weather on 18 and 19 December; and
 - d. another significant fire day on 21 December.⁶⁷²
83. Further, the forecast for 14 December 2019 showed the winds to be light, with RH between 29% and 65% for the key part of the day. With RH not forecast to go below 29%, Mr Carter stated that would be quite desirable for conducting a backburn. The wind would also have *'an easterly component'*, which meant the smoke and embers would have been blowing away from the intersection, until the wind changed to the north-west later in the day at 5:00pm, which would be less favourable than wind with an easterly component, but the plan was to have the *'exposed parts of Mount Wilson Road completed by then'*. Also, wind speeds were generally forecast at 10 metres. On his view, *'it would've been significantly less at the surface and very favourable in terms of being able to conduct a successful backburn.'*⁶⁷³
84. Mr Carter stated that based on the updated 13 December 2019 forecast, which showed suitable conditions for burning until 6:00pm on 14 December 2019, and the expectation the Gospers Mountain Fire would continue to progress south, discussion again took place between the Hawkesbury and Blue Mountains IMTs and local Rural Fire Brigade representatives.⁶⁷⁴
85. The original plan was to start lighting at the Mount Wilson village near Du Fours Lookout and then to light down to Bells Line of Road. However, Mr Carter and Mr Pullen stated that given there had been some rainfall near that location, the concern was that if lighting commenced there, it would result in a patchy and incomplete burn which could still support the main fire running through it.⁶⁷⁵
86. Ms Raines stated that she put forward the original plan given the proposed anchor point was the highest point, and the mountain would act as a buffer. She also was of the view that the IMT wanted to implement the backburn due to concern about fire activity on the Newnes Plateau, north-west of Mount Irvine.⁶⁷⁶
87. Mr Burley added that the rainfall raised the fuel moisture content to a point where they probably weren't going to get the consumption of the ground fuels and the elevated fuels that was desired to put in a solid buffer between the assets of Mount Wilson and the approaching firefront.⁶⁷⁷
88. Ms Raines stated that Mount Irvine had received more rain than Mount Wilson had; the latter had very little – on her view, it would not have hampered a backburn at all.⁶⁷⁸
89. However, the consensus was that an alternative strategy needed to be identified.⁶⁷⁹

⁶⁷² Exhibit 56A, Brief of Evidence at p. 3563-4, 3623; Transcript for 15 May 2023 T 1424:12-17.

⁶⁷³ Exhibit 56A, Brief of Evidence at p. 3564; Transcript for 15 May 2023 T 1424:23–1425:5.

⁶⁷⁴ Exhibit 56A, Brief of Evidence at p. 3564, 3732; Transcript for 15 May 2023 T 1425:39–1426:8; Transcript for 16 May 2023 T 1503:5-20, 1523:15-20.

⁶⁷⁵ Exhibit 56A, Brief of Evidence at p. 3564, 565; Transcript for 15 May 2023 T 1423:11-20; Transcript for 16 May 2023 T 1502:31-40, T 1504:7-24.

⁶⁷⁶ Transcript for 18 May 2023 T 1616:1-8, 1633:10-11.

⁶⁷⁷ Transcript for 16 May 2023 T 1522:2-5.

⁶⁷⁸ Transcript for 18 May 2023 T 1616:22-24.

⁶⁷⁹ Transcript for 16 May 2023 T 1505:7-17.

90. The IMT ultimately decided to commence the burn around Mount Wilson and Mount Irvine on 14 December 2019, at the corner of Mount Wilson Road and Bells Line of Road, progressing in a westerly and northerly direction, as lighting up at Mount Wilson was not possible due to the damp fuels. By the time the backburn reached Mount Wilson, the IMT considered the fuels would not have dried out sufficiently to enable the backburn to progress around the north of Mount Wilson and Mount Irvine. The backburn would then be linked to previously completed backburns to the north of Bilpin.⁶⁸⁰
91. Mr Burley stated that the intention was to start the backburn at the intersection with a view to the weather conditions drying Mount Wilson to the point where they could be confident that lighting could occur later in the afternoon into Mount Wilson with the two burns to join in the middle.⁶⁸¹
92. This strategy was believed to provide several advantages including:
- a. avoiding moister fuels further north toward Mount Irvine and allowing burning to be more effective and to progress faster;
 - b. allowing progression towards Bell, Clarence, and Dargan to expedite protection of those townships;
 - c. providing protection to Mount Wilson earlier in the event of a traditional run of fire under north-westerly conditions; and
 - d. providing a “deeper” buffer between the main fire and the area bounded by Mount Wilson, Mount Irvine, Bowen Creek, Bells Line of Road, and Mount Wilson Road which had not been burnt for 25 years and represented a significant risk to maintain fire north of Bells Line of Road.⁶⁸²
93. Some local stakeholders were reportedly anxious for the backburn to be implemented before the agreed trigger was reached. Ms Raines commented that generally, if the ‘Gospers Mountain Fire crossed the 99 northern ... it was agreed that the backburning would commence - there was - a trigger point, also ... if the Bilpin backburn crossed over at Mount Tootie, that backburning would commence at Mount Irvine.’⁶⁸³
94. Further, the proposed anchor point was not at the most elevated point (Mount Wilson was at a 100 metre elevation to the intersection) and Ms Raines expressed there was a risk of the two lighting parties “pushing each other along” and advancing the fire faster than was desirable particularly when there was an uneven split resourcing-wise between one sector and another.⁶⁸⁴
95. Whilst those concerns were noted, the IMT concluded that if the backburn was anchored further north, there was a high potential that fuel moistures would prevent or hinder ignition and result in a patchy burn or insufficient depth to provide the necessary protection.⁶⁸⁵
96. Mr Carter commented that:
- ...in any situation during a fire season there was always the risk of spotting ... We negated that risk, in my view, by making sure we had local crews, lighting and areas where that risk was most present. We negated that risk by ensuring we had sufficient resources coming in as a swing shift. Having suitable amount of aircraft in place. And that was the chief risk. The chief risk that the fire would cross Mount Wilson Road and end up on the eastern side of it.*⁶⁸⁶

⁶⁸⁰ Exhibit 56A, Brief of Evidence at p. 3550; Transcript for 15 May 2023 T 1423:25-34.

⁶⁸¹ Transcript for 16 May 2023 T 1522:9-16.

⁶⁸² Exhibit 56A, Brief of Evidence at p. 3589; Transcript for 15 May 2023 T 1426:21-34.

⁶⁸³ Transcript for 18 May 2023 T 1614:24-28.

⁶⁸⁴ Exhibit 56A, Brief of Evidence at p. 167, 3514; Transcript for 18 May 2023 T 1617:21-34.

⁶⁸⁵ Exhibit 56A, Brief of Evidence at p. 167.

⁶⁸⁶ Transcript for 15 May 2023 T 1426:38-44.

97. Mr Carter surmised he'd probably categorise the strategy in the 'moderate risk category'. In the IMT's view, he stated the likelihood of the risk of spotting was low, but the consequence obviously understood to be quite high. While it's a difficult call to make whether the strategy was in a moderate or high-risk category, he felt comfortable with the decision and felt like it was a strategy that could be implemented without the risk occurring. This was because if they didn't implement the strategy, the alternative option was a defensive option. On his view, relying on aircraft to implement a slowing strategy wasn't necessarily really available due to the atmosphere being so smoke logged which meant the use of aircraft could not be guaranteed due to visibility issues.⁶⁸⁷
98. Mr Carter gave the following response when asked what tipped the scale in favour of an indirect attack through a strategic backburn as opposed to the defensive strategy:
- The opportunity to fight the fire on our terms rather than have the fire dictate terms to us and for us to have to respond when resources were uncertain, locations might have been uncertain. The ability to protect the community. Life and property was uncertain. So the ability to implement a strategy which could prevent that kind of uncontrolled fire impact always seemed like a better option than just letting a fire ... have an uncontrolled impact on us, on a community.*⁶⁸⁸
99. Mr Pullen maintained that he would recommend against a defensive strategy in every instance, unless it's a last minute thing – but if you have the time to plan, then you plan to put in some form of offensive strategy. Even in hindsight, Mr Pullen stated that he couldn't see himself 'ever reaching a different decision than the recommendation to go on the 14th' (implement the backburn). He further stated that 'A south-easterly influence along Mount Wilson Road should have enabled us to get the backburn along Mount Wilson Road sufficiently in and deep, that any change in the weather would not be a problem.'⁶⁸⁹
100. Mr Burley also stated on balance of all the factors he would still support the plan. On his view he stated, 'It was the best option that we had to protect life and property. If we'd done nothing, there's... no doubt in my mind that there was a substantial potential for the Gospers Mountain Fire to run unchecked straight into Mount Wilson, into Mount Irvine, and in Bilpin and Berambing, and Mount Tomah. We had a window of opportunity that was conducive, we had a plan that was resourced, and if the same parameters were put to me tomorrow I would support the plan again.'⁶⁹⁰

Was the decision reasonable in the circumstances?

The decision to bring forward and alter the anchor point for the backburn

101. Mr Conway noted that on 13 December 2019, the IMT determined that the backburn should be undertaken on 14 December and to commence from the intersection of the Bells Line of Road and Mount Wilson Road. This was a departure from the established strategy, which proposed backburning from the southern containment line would progress from east to west and that the triggers for undertaking the backburn in the Mount Wilson and Mount Irvine areas had not been reached.⁶⁹¹
102. He commented that the decision of the IMT was based on fire extension from the southern edge of the Fire along a line from Newnes in the west to Bilpin in the east, leaving the Mount Wilson village and those settlements along the Bells Line of Road to the west of Mount Wilson vulnerable to fire runs under deteriorating weather conditions forecast for 19 and 20 December 2019. Fire spread predictions and observed fire behaviour during the firefight indicated the potential for this to occur.⁶⁹²

⁶⁸⁷ Transcript for 15 May 2023 T 1426:50 – 1427:17.

⁶⁸⁸ Transcript for 15 May 2023 T 1427:21-27.

⁶⁸⁹ Transcript for 16 May 2023 T 1500:29-31, 1506:4-19.

⁶⁹⁰ Transcript for 17 May 2023 T 1544:30-39.

⁶⁹¹ Exhibit 56A, Brief of Evidence at p. 3732.

⁶⁹² Exhibit 56A, Brief of Evidence at p. 3732.

103. Further, the options available to the IMT to provide protection to the Mount Wilson village and those settlements along the Bells Line of Road, were limited.⁶⁹³
104. Mr Conway described a defensive strategy as an “emergency strategy” – when all else fails, that’s the strategy that will be actioned.⁶⁹⁴
105. He surmised that a defensive strategy for protection of the communities as the fire front passed was an option. However, given observed fire behaviour across the fireground to that time, and fire behaviour predictions based on forecast weather, such a strategy would have placed both firefighters and residents at significant risk in the event of a fire run under severe or extreme fire weather.⁶⁹⁵
106. Mr Conway stressed that a defensive strategy relies on having sufficient firefighting resources, and personnel who are familiar with the area and available at fire impact to successfully protect the assets identified. Given the scale of fires across NSW at the time, he opined that the IMT could not have *any* confidence that they would have access to the number of firefighters, firefighting vehicles, and aircraft needed to safely and effectively protect the people and assets that could come under threat. Mr Conway explained that in those circumstances, you don’t have any sense of potential outcomes. Relying solely on a defensive strategy in the circumstances that the IMT were facing would have been *‘incredibly problematic’*. The challenge for firefighters in those circumstances are *‘extreme, and the potential for successfully protecting life and property ... is minimal.’*⁶⁹⁶
107. It followed that, on his view, completing a backburn to reduce the fire intensity of any fire run into these areas was the *only offensive strategy considered viable*. The complexity and risk in undertaking the backburn was acknowledged by IMT members and Fire Ground Managers. Particularly, Mr Carter noted the challenges of this strategy with respect to the extensive length of burning required, the road geometry in areas creating difficult and complex burning and the heavy 25-year-old fuels in the area at the head of Bowen Creek. Mr Pullen also was cognisant of these heavy fuels.⁶⁹⁷
108. Having regard to the weather forecast issued on 13 December 2019 for the subsequent day, Mr Conway opined that it *‘did indicate a window of opportunity to undertake backburning successfully, with light east to east-northeast winds through to 6:00pm.’*⁶⁹⁸ This window was quite narrow and would certainly put pressure on the team who were undertaking the backburn. The window would have closed towards late afternoon, around 4:00pm onwards, with the change in wind direction coming more from the west rather than the south-east with an anticipated reduction in RH. Mr Conway understood that the IMT and Fire Ground Managers anticipated that a lot of the burn would have been in, and just in, sort of patrol and mop up by that stage. On his view, this was a reasonable assumption to make. There was certainly an understanding that they might not have time to finish the backburn.
109. In view of the above considerations, Mr Conway ultimately concluded that the *‘decision to proceed with the backburning as planned for the 14th of December was a high risk strategy, but the only viable offensive strategy to the IMT to protect the townships of Mount Wilson and Mount Irvine.’* In this context, Mr Conway further opined that applying indirect attack strategies in bush firefighting is in his view, always a high-risk choice.⁶⁹⁹
110. Mr Conway also commented that the planning for the backburn was generally aligned to agency guidance and good practice in prescribed burning (lighting pattern and resourcing).⁷⁰⁰

⁶⁹³ Exhibit 56A, Brief of Evidence at p. 3732.

⁶⁹⁴ Transcript for 19 May 2023 T 1647:18-22.

⁶⁹⁵ Exhibit 56A, Brief of Evidence at p. 3732.

⁶⁹⁶ Exhibit 56A, Brief of Evidence at p. 3732–3733; Transcript for 19 May 2023 T 1647:18-22.

⁶⁹⁷ Exhibit 56A, Brief of Evidence at p. 3733.

⁶⁹⁸ Exhibit 56A, Brief of Evidence at p. 3733.

⁶⁹⁹ Exhibit 56A, Brief of Evidence at p. 3733, 3735.

⁷⁰⁰ Exhibit 56A, Brief of Evidence at p. 3741.

111. In respect of the decision to alter the anchor point, Mr Conway opined that he understood why the IMT chose the intersection of Bells Line of Road and Mount Wilson Road as the anchor point to start the backburn based on the information they had available.⁷⁰¹ He further commented that it's hard to make a judgment as to whether there should have been an alternative anchor point namely: to start lighting at the Mount Wilson township near Du Faur's Lookout and then to light down to Bells Line of Road, because it was not known whether the rainfall on 12 December 2019, changed fuel moisture content. Mr Conway advised the Court:

I wasn't able to find any reference in the brief of evidence to the IMT taking fuel moisture readings, which you can do on the fireground quite simply, to give them confidence. The ... stated reasons in the statements that I read indicated that the IMT were of the view that fuel moisture content at Mount Wilson on the 14th would have been too high to get an effective burn and that would be a valid reason for not starting the burn there. The dilemma we have is that we haven't got fuel moisture content readings and there wasn't a test burn undertaken at Mount Wilson ... on that particular morning as there was at the intersection of Bells Line of Road and Mount Wilson Road. So, it's very difficult to give a definitive answer to say we should have started at Mount Wilson, it would have been fine, we would have got the sort of fire behaviour that we were looking for. We don't have the information that gives us confidence to make that claim.⁷⁰²

112. He stated that the assumptions made by the IMT in respect of not anchoring the backburn off Mount Wilson and the fuels being dry enough to sustain a burn that gave them the outcome they were looking for were reasonable in the circumstances, but they can't be validated.⁷⁰³
113. Mr Conway emphasised that while fuel moisture content is incredibly important and one of the critical things a Fire Ground Manager must consider – it's not the only thing. They must also consider topography, resource availability, observed and impending weather forecasts, potential into the future of what might happen and the consequences of not burning.⁷⁰⁴
114. When asked to assume that there had been DFMC of 9% in the location of where the backburn was being put in based on data of DFMC for 10:00am referenced by Mr Gellie in his report, Mr Conway said it would certainly give him cause for thought, to reflect on the plan and resourcing including ground capability, but as to what his final decision would be, he'd have to be standing there looking at the location to be confident to make a call.⁷⁰⁵

Proceeding with the backburn notwithstanding the triggers for undertaking the backburn in the Mount Wilson and Mount Irvine areas having not been met

115. Mr Carter gave the following explanation as to how the '99 northing gridline' was to work in practice:

Trigger points are really designed to assist fire managers to make sound decisions. So the trigger point in this instance didn't necessarily result in backburning commencing. What it did was what it was designed to do - was draw attention and focus next actions and to really- ...bring up into the scheme of things a priority of that particular part of the fire and decisions that needed to be made. You have to remember that at the time this was happening, we still had fire burning to the east, to the north and to the west... many hundreds of kilometres of fire to be thinking about at that point in time... So the trigger point was designed to say: okay, we've got this particular point in time. We now need to make a decision about what the next actions are.⁷⁰⁶

⁷⁰¹ Transcript for 19 May 2023 T 1651:2-11.

⁷⁰² Transcript for 19 May 2023 T 1651:25-40.

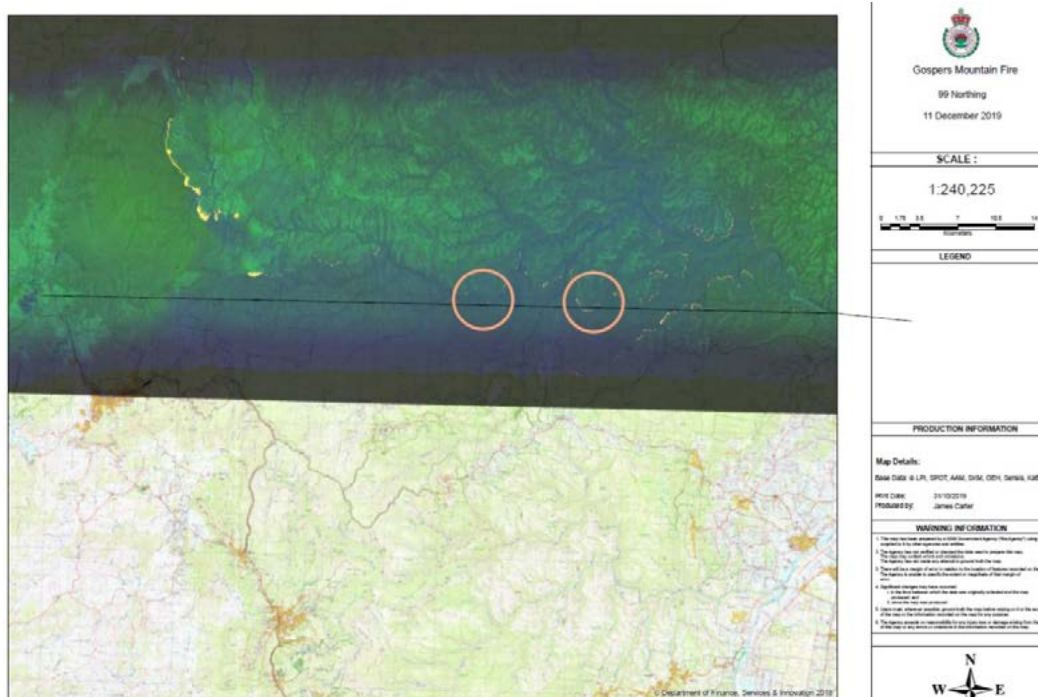
⁷⁰³ Transcript for 19 May 2023 T 1674:49 – 1675:5.

⁷⁰⁴ Transcript for 19 May 2023 T 1660:13-44.

⁷⁰⁵ Exhibit 56A, Brief of Evidence at p. 4185, 4187; Transcript for 19 May 2023 T 1661:18-23.

⁷⁰⁶ Transcript for 15 May 2023 T 1419:29-35; Transcript for 16 May 2023 T 1460:1-5.

116. Mr Carter surmised that the '99 northing' trigger point was crossed by the southern edges of the Gospers Mountain Fire on 9 or 10 December 2019, at around or about the same time as the fire trails around the townships particularly around Mount Wilson, Mount Irvine and Bell were ready. Accordingly, from 11 December, he stated they started to look at the opportunities and the windows to undertake the backburn. The only other option available was to 'sit and wait and try and understand where the fire might run into those populated areas and to undertake property protection.'⁷⁰⁷
117. Mr Carter prepared the following map of the '99 northing gridline' with a linescan taken from 11 December 2019 superimposed to illustrate that the Gospers Mountain Fire had reached and/or crossed this gridline in two locations, as denoted by the circles:⁷⁰⁸



118. Mr Conway provided the following opinion in respect of the '99 northing' trigger point:

It's one of a number of things that an Incident Management Team would consider. The 99th parallel was an appropriate trigger point, and the fire that breached it on the Newnes Plateau was certainly something that was obviously in the minds of the IMT. I think it's important for the Court to understand that those sorts of planning triggers are certainly there to guide, that the planning of the Incident Management Team is undertaking, but it's one of many considerations that you would hope the Incident Controller and the IMT were looking at. So, yes, it's a good prompt for action, but there are a number of other things that I was aware of from the brief of evidence which would have influenced this decision about undertaking that backburn at the time. The weather forecast, in particular; the extension of fire on the south-western corner of the Gospers Mountain Fire, would have been of significant concern; and also the previous experience of fire runs in that part of New South Wales would have been a prompt. So the 99th parallel is a good trigger, but it's one of a number of things that you would want the IMT to be thinking about, in making their decision.⁷⁰⁹

⁷⁰⁷ Transcript for 15 May 2023 T 1420:8-27.

⁷⁰⁸ Exhibit 56A, Brief of Evidence at p. 4144.

⁷⁰⁹ Transcript for 19 May 2023 T 1646:7-22.

119. Mr Carter stated that a linescan from 19 December 2019 (five days after the burn), showed that the main Gospers Mountain Fire had crossed Bungleboori Creek and was to imminently impact Newnes Junction. He opined that it was clear from the linescan that the Fire and the backburn met some time overnight on 19 December with a linescan at 1:21am taken on 21 December confirming that the burn and fire had met. Further, he remarked that the linescans demonstrated that had the backburn not proceeded on 14 December (which would have had flow-on delays for the burn continuing west) it would have exposed Newnes Junction to impact by the Fire.⁷¹⁰
120. Mr Conway concluded based on fire progression mapping provided by the RFS, it appeared that the southern flank of the Gospers Mountain Fire and the northern flank of the Grose Valley Fire did meet in part and progressively along a line from Clarence to Bilpin. This occurred over a period of 9 days and was driven to a significant extent by major fires runs on 19 and 21 December.⁷¹¹
121. Counsel Assisting submitted that the Court should accept the evidence of Mr Conway that the decision making of the IMT to change the Southern Containment Strategy on 13 December 2019, including the rationale underpinning same, was appropriate in the circumstances.
122. In response, the AOCG submitted:
- a. in effect, there were successive backburn containment failures relating to the Gospers Mountain Fire edges, referred to in paragraph 77 above leading up to the Grose Valley Strategic Backburn which were dealt with by Mr Gellie in his report;
 - b. had the Glow Worm Tunnel backburn operation been implemented successfully, this would have obviated the need for any backburns around Mount Wilson and Mount Irvine;⁷¹²
 - c. there is no evidence before the Court that the failure of these backburns, each of which became uncontrolled, was taken into consideration by those who decided to light the Grose Valley Strategic backburn – this failure on their view bears on the question of whether the change in the Southern Containment Strategy on 13 December 2019 was reasonable in the circumstances;
 - d. the change in the Southern Containment Strategy was caused by:
 - i. RFS concern about the threat posed by the escaped Black Fellows Hands Trail backburns that were burning intensely north east of Lithgow; and
 - ii. failure to consider or implement alternative containment options.
 - e. the change was unreasonable in the circumstances because:
 - i. there was no risk analysis or contingency plan documentation produced to the Court by the RFS, on which basis an inference can reasonably be drawn that there was no such assessment or planning undertaken in connection with the proposal to conduct the Grose Valley Strategic Backburn;
 - ii. the identified trigger of the 99th parallel was not met;
 - iii. the timing of the backburn was determined by resources availability, rather than the best conditions;
 - iv. local brigades, with the best local knowledge, were not consulted about the decision;
 - v. the anchor point for the backburn was not suitable with no fuel moisture readings and/or test burn conducted at Mount Wilson on the morning of 14 December 2019; and
 - vi. the consequences of the 14 December 2019 backburn failures documented in Mr Gellie's report were not assessed.

⁷¹⁰ Exhibit 56A, Brief of Evidence at p. 4004; Transcript for 15 May 2023 T 1448:1-6.

⁷¹¹ Exhibit 56A, Brief of Evidence at p. 4415; Transcript for 19 May 2023 T 1656:44 –1657:4.

⁷¹² Exhibit 56A, Brief of Evidence at p. 4182–4184.

CONCLUSION

I have considered the evidence of operational staff directly involved in decision-making at the relevant time and the expert evidence of Mr Conway (set out in paragraphs 82–120 above and not repeated here for the sake of brevity).

I accept the evidence of Mr Conway that the rationale for the decision of the IMT to change the Southern Containment Strategy on 13 December 2019 was appropriate in the circumstances.

In accepting the evidence of Mr Conway, I have had regard to opinion of Mr Conway as follows:

[t]hat some of the strategies that we'd applied earlier in the fire fight hadn't been successful doesn't mean that you stop... relying solely on a defensive strategy in the circumstances that the IMT were facing at that particular time in December, was just not appropriate. It would have put firefighters and residents at extraordinary risk and I think, as I've indicated, the decision the IMT took even with all the understanding they've had about the success or otherwise of the firefight up to that particular time, was still appropriate in the circumstances.

I have also had regard to Mr Gellie's report, as relevant to the scope of this Inquiry, articulated in an Issues List provided to parties, which was focussed on the planning and execution of the Grose Valley Strategic Backburn on 14 December 2019. The scope did not include consideration of every backburning operation undertaken in connection with the Gospers Mountain Fire and whether such operations were successfully implemented.

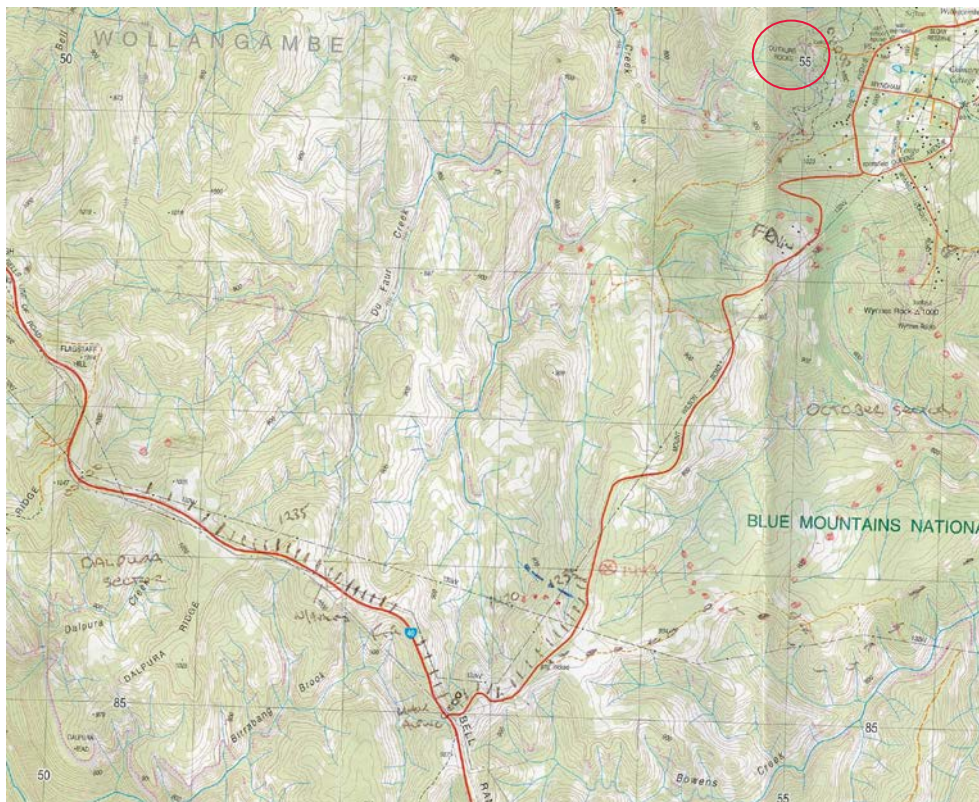
ISSUE 6

How was the Southern Containment Strategy implemented on 14 December 2019 (including timing, ignition pattern, resources and monitoring) and what led to the initial introduction of fire to the east of Mount Wilson Road?

How was the Southern Containment strategy implemented?

Resourcing

123. The strategic backbone that breached containment lines on 14 December 2019 was executed in the Bell Division. Two sectors were stood up on that day, namely, the Dalpura Sector lighting along Bells Line of Road, and the October Sector, lighting along Mount Wilson Road. These sectors are identified in the map below, and Du Fours Rocks encircled:⁷¹³



124. Key personnel specific to the Bell Division included:
- Mr James Carter RFS, Bell Division Commander. Mr Carter was posted at the intersection of the two roads in the Comms vehicle. Mr Carter had two scribes who recorded entries for him in his logbook;
 - Mr Craig Burley RFS, Bell Division Operations Officer. Mr Burley says his role was to act in that capacity between both sectors and report back to Mr Carter who would then communicate back to the Hawkesbury IMT;
 - Mr Chris Banffy NPWS, AAS. On 14 December 2019, he was deployed in Aero Logistics Aircraft FB 287 tasked by RFS;

⁷¹³ Exhibit 56A, Brief of Evidence at p. 3550; Transcript for 15 May 2023 T 1429:36-47.

- d. Ms Elizabeth Raines RFS, originally October Sector leader, leading local crews of Mount Tomah, Bell, and Mount Wilson/Mount Irvine. This amounted to one strike team comprising of five trucks.⁷¹⁴ Later in these findings, it will be explained that this sector was split into two sub-sectors by Mr Carter: namely North and South around the arrival of three swing shift strike teams after midday.⁷¹⁵ This led to Ms Raines taking charge of the October North Sector while a new strike team was allocated to the October South Sector. Ms Raines' sector went to the Mount Wilson township to create an anchor point burning to the south which would eventually meet with October South. Ms Raines was a Captain of the Mount Wilson/Mount Irvine RFS since 2008 and had been volunteering in the area for the RFS since 1999;
 - e. Mr Peter Ellison, formerly captain of the Mount Tomah RFS Brigade. On the evidence available, it appears that Mr Ellison was temporarily allocated as October South Leader and later handed over leadership to Daniel Gerzanics, Captain of The Hills RFS District who was part of the swing shift strike team; and
 - f. Mr Greg Honeysett RFS, Bell Captain, was the Dalpura Sector Leader in charge of two out of area strike teams, comprising of ten trucks.⁷¹⁶
125. A strategic reserve, or surge capacity, was established at Orchard Hills. Two aircraft were allocated to the operation, with further aircraft available should the need arise.⁷¹⁷
 126. The State Operations Overview on the morning of 14 December 2019 relevantly recorded:
 - a. 104 current bush & grass fires;
 - b. 14 section 44 declarations still in operation;
 - c. 1,284 field personnel deployed;
 - d. 338 appliances deployed; and
 - e. 103 aircraft deployed.⁷¹⁸
 127. Post-incident analysis identified that 19 crews were assigned to the Bell Division during the day shift and on swing shift, including three RFS strike teams from the Hawkesbury and Blue Mountains RFS Districts, two out of area strike teams, one FRNSW strike team and a number of bulk water carriers. As the events unfolded on 14 December 2019, resources were reprioritised from other fires and an additional two out of area strike teams, and other local crews were released and responded to the Bell Division.⁷¹⁹
 128. Eight planned aircraft were allocated to the Bell Division throughout the day and evening and a further five unplanned aircraft were available to call upon.
 129. Deputy Commissioner McKechnie described 'planned resources' as being resources that were planned prior to the shift in question and deployed. A reference to 'unplanned resources' is to resources that were not planned at the start of the shift but were deployed during the shift, normally in response to an escalating fire situation. Unplanned resources may have come from reprioritising other fires' resources as the situation evolved, namely from strategic reserves and/or from other areas with resources on standby for additional fires or escalation.⁷²⁰
 130. Mr Carter believed they '*had enough resources for the burn, given the nature of the country there. The width of the road. The ability to move appliances around each other... I was very satisfied and comfortable with the amount of resources that we had on the fireground on the day.*' In respect of aerial assets, he conceded they '*could've probably used a large aircraft a little earlier than we got it ... earlier access to a large aircraft may have been beneficial.*'⁷²¹

⁷¹⁴ Transcript for 16 May 2023 T 1525:31-34.

⁷¹⁵ A swing shift is a roster of resources that overlap day and night shifts to provide additional weight of attack at the time of day where weather conditions, and subsequent fire behaviour, are usually at their most intense: Exhibit 56A, Brief of Evidence at p. 3747; Transcript for 15 May 2023 T 1435:2-13; Transcript for 16 May 2023 T 1472:20-24.

⁷¹⁶ Transcript for 16 May 2023 T 1525:31-34.

⁷¹⁷ Exhibit 56A, Brief of Evidence at p. 583.

⁷¹⁸ Exhibit 56A, Brief of Evidence at p. 3665.

⁷¹⁹ Exhibit 56A, Brief of Evidence at p. 3647, 3690.

⁷²⁰ Exhibit 56A, Brief of Evidence at p. 3647, 3690.

⁷²¹ Transcript for 15 May 2023 T 1427:32-44.

131. Ms Raines raised concerns regarding the allocation of resources at the commencement of the burn between October Sector and Dalpura Sector.⁷²²
132. Mr Conway commented that resources were deployed throughout the day to reflect the changing needs on the fireground. He ultimately concluded that resourcing for the backburn reflected what was available at the time and was appropriate for the planned task under the forecast weather conditions.⁷²³
133. In terms of management structure, Mr Carter stated that the role of a Divisional Commander was *'very much a strategic role'* which involved looking at the firefighting operation itself, which included being in charge of the sectors on the fireground, and coordinating all the activities that have to happen during the course of that firefighting operation. This may involve dealing with media enquiries, ensuring logistical support is in place and ensuring availability of resources and appliances. Also, the role required consideration of whether additional resources were needed on the fireground or re-allocating resources elsewhere if needed. To ensure there was strong oversight of the actual operation on the ground on 14 December, a Divisional Operations Officer was appointed, namely Mr Burley. In his role, Mr Burley had the freedom to rove and observe activities and fire behaviour and weather and make calls around resources.⁷²⁴
134. Mr Conway surmised that the line of control over fireground activities was clear on 14 December, with sector commanders reporting through the Divisional Operations Lead, Mr Burley to the Divisional Commander, Mr Carter. There was only one point where the line of control and therefore, Unity of Command was unclear.⁷²⁵ This occasion will be identified later in this Section.⁷²⁶

Guidance provided in respect of executing the backburn

135. The Bells and Bilpin Division Sub Plan for 14 December 2019 detailed that the October Sector crews were to commence the backburn northward from Bells Line of Road on Mount Wilson Road and southward from Du Fours Track.⁷²⁷
136. The Dalpura Sector crews were to commence the backburn westward along Bells Line of Road.⁷²⁸
137. The crews in both sectors were to aggressively mop up to a minimum of 30 metres, noting the fuel loads to the east of Mount Wilson Road were 25 years old. There was specific guidance provided for lighting crews, emphasising a spot ignition pattern, and the importance of co-ordinating between lighting crews in the two sectors. Mr Carter explained that by using spot ignition *'you're actually reducing the overall intensity of the ignition pattern, so that you're ... introducing fire in a far more gentle low intensity way, and then those spots just gently coalesce before forming a line and moving then generally away from the road.'* He left the spacing between spots to the Sector leaders to determine in view of their local knowledge.⁷²⁹
138. Mr Conway commented that the only qualification to this guidance was in response to increased fire intensity as the weather deteriorated.⁷³⁰

Execution of the backburn

139. At 8:00am, Mr Carter delivered the operational briefing at Bilpin Memorial Hall.
140. At 8:12am, Mr Burley is recorded as having advised Karen Hodges (Gospers Mountain IC) *'...may not get all in but need to try & minimise spotting, we are not going to get all in within the timeframe approved...'*⁷³¹

⁷²² Exhibit 56A, Brief of Evidence at p. 565.

⁷²³ Exhibit 56A, Brief of Evidence at p. 3747; Transcript for 19 May 2023 T 1653:38-46.

⁷²⁴ Transcript for 15 May 2023 T 1428:27-44, T 1430:25-31.

⁷²⁵ Unity of Command is the principle of ensuring that each individual in a management structure should report to only one supervisor and knows who they are reporting to: Exhibit 56A, Brief of Evidence at p. 3742.

⁷²⁶ Exhibit 56A, Brief of Evidence at p. 3742.

⁷²⁷ Exhibit 56A, Brief of Evidence at p. 3647.

⁷²⁸ Exhibit 56A, Brief of Evidence at p. 3647.

⁷²⁹ Transcript for 15 May 2023 T 1431:38-46.

⁷³⁰ Exhibit 56A, Brief of Evidence at p. 3647, 3739.

⁷³¹ Exhibit 56A, Brief of Evidence at p. 375.

141. At around 9:48am, a test burn was undertaken in advance of the backburn, which went well. Mr Carter and Mr Burley stated that the flame height as a result of the test was under half a metre indicating that conditions were suitable for burning at that particular point in time.⁷³² Mr Carter stated that the practical application of Fine Fuel Moisture Content was exhibited in the fire behaviour observed. They observed fire behaviour that was extremely conducive to proceeding with the burn and achieving the objectives that had been set.⁷³³
142. At 9:48am, Mr Carter provided a SITREP to Hawkesbury IMT advising crews were in position and confirmed he had obtained approval from Ms Hodges to proceed with the backburn. In Mr Carter's logbook the following is recorded for 9:51am: '*Started burn IC approved to start burn. Flame lit ½ M to 1 M – going well.*'⁷³⁴
143. At 10:05am, Mr Banffy advised '*Setting up buoy wall – at Mt Wilson.*'⁷³⁵
144. At 10:55am, Mr Banffy further advised '*...No AI for approx. 2 hrs 2 machines @ Mt Wilson.*'⁷³⁶
145. At 10:56am, Mr Honeysett advised, '*Progressing well Jumping A Team past B team Will use F+R to mop up ½ M FH.*'⁷³⁷
146. At 11:00am, Ms Raines advised, '*Don't want to be outflanked by Dalpura.*'⁷³⁸
147. At 11:02am, Dalpura Sector was asked to slow lighting to allow October Sector to remain in an appropriate relative position with corresponding entry being: '*Slowing down. Need Oct S to get more depth.*'⁷³⁹ Mr Carter remarked that the intensity of the burn going in on Mount Wilson Road wasn't as intense as what it was on Bells Line of Road, so progress was much slower in October Sector to try and get some depth on Mount Wilson Road and to ensure it was an effective burn.⁷⁴⁰
148. At 11:09am, Chris Banffy is recorded as having said to Mr Carter '*Get troops going up Mt Wilson Rd – get more depth! When wind changes later [sic], could. Bells Line of Rd depth could come up gully later*'. Mr Carter interpreted this as a piece of intelligence allowing resource allocation and operational activity to be adjusted on the fireground.⁷⁴¹
149. Ms Raines is recorded as having advised Mr Carter that they were '*going as fast as possible – a few slow patches at the moment*' suggestive that October Sector were experiencing slow patches due to the more complex geometry of Mount Wilson Road.⁷⁴²
150. The following entry is recorded in Mr Carter's logbook for 11:35am in respect of the SITREP Mr Carter provided to FireCom: '*...Dalpura Sector 30-50 m Depth Flame height ½ mtr slowing Dalpura Sector Down so will be in line with October Sector. Western end is quite hot & using 2 aircraft to cool this down...*'⁷⁴³
151. Mr Carter commented that his preference was to have some depth on Mount Wilson Road before they introduced too much fire directly to the west of that road. The fire behaviour in Dalpura Sector was certainly more intense than on Mount Wilson Road, but what was clear was that most of that, and reports from Mr Banffy was that the initial ignition was quite intense after which it would settle down and move away from the road in a less intense fashion. He was okay with that, but he didn't want to have so much fire in the western part of that sector because if, for some reason, they needed to cease operations on Mount Wilson Road, they would end up with a significant amount of fire to the west of that road which would give the Fire the potential to have an uphill run. Accordingly, at approximately 11:30am, he requested Dalpura Sector to slow down.⁷⁴⁴

⁷³² Transcript for 15 May 2023 T 1432:34-47; Transcript for 16 May 2023 T 1526:5-8.

⁷³³ Transcript for 16 May 2023 T 1464:11-25.

⁷³⁴ Exhibit 56A, Brief of Evidence at Tab 46A, T09-48-26; p. 4010.

⁷³⁵ Exhibit 56A, Brief of Evidence at p. 4010.

⁷³⁶ Exhibit 56A, Brief of Evidence at p. 4010.

⁷³⁷ Exhibit 56A, Brief of Evidence at p. 4010.

⁷³⁸ Exhibit 56A, Brief of Evidence at p. 4011; Transcript for 18 May 2023 T 1620:41-45.

⁷³⁹ Exhibit 56A, Brief of Evidence at p. 4011.

⁷⁴⁰ Transcript for 15 May 2023 T 1434:-28-31.

⁷⁴¹ Transcript for 16 May 2023 T 1452:43-45.

⁷⁴² Exhibit 56A, Brief of Evidence at p. 4011; Transcript for 18 May 2023 T 1620:12-15.

⁷⁴³ Exhibit 56A, Brief of Evidence at p. 4011.

⁷⁴⁴ Transcript for 15 May 2023 T 1433:42 – 1434:9, T 1436:41-44.

152. At 11:39am, Mr Banffy is recorded as having advised, '*Progress up Mt W – good Right pace Burn gong [sic] well Spotting.*'⁷⁴⁵
153. At 11:49am, Mr Carter advised FireCom that the Hawkesbury bulk water carrier was at the fireground and requested two additional carriers to attend the fireground.⁷⁴⁶
154. At 11:59am, Ms Raines is recorded as having reported, '*Almost to High Voltage line crossing Mt Wilson Rd Fire quite volatile Settles down.*'⁷⁴⁷
155. At 12:00pm, Mr Banffy advised, '*2 Helitak + 1 F/bird at disposal. Staff to move back from buoy wall. Adit unit free sent Sth + West.*'⁷⁴⁸
156. At 12:17pm, Mr Banffy advised '*All aircraft in place 296 helitak patrolling both back burns. Continue BLOR → west. Heading back to Katoomba airfield for fuel – back about 1300.*'⁷⁴⁹
157. At 12:19pm, Mr Honeysett reported '*A ahead of B Couple of units knocking down trees. Need couple of units to check where been.*'⁷⁵⁰
158. At 12:20pm, Mr Banffy reported '*Htak 296 monitor TG44 – returning to Katoomba.*'⁷⁵¹
159. At 12:29pm, Ms Raines reported '*...Line burning nicely.*'⁷⁵² Mr Carter also advised FireCom, '*...we have pulled up a little bit on the Bells Line of Rd ... just so they can get depth on the Mt Wilson Rd locked in a bit more, but everything is going well.*'⁷⁵³
160. Mr Carter stated that as at 12:35pm, the Dalpura Sector's and October Sector's lighting progress was approximately 1.6 kilometres and 1.25 kilometres respectively with a comparative ratio being 1.76 : 1.⁷⁵⁴
161. Also, around this time the swing shift strike team were enroute to the site,⁷⁵⁵ and Ms Raines had a discussion with Mr Carter which led to the splitting of the October Sector in line with her request to take a strike team north onto Mount Wilson to start another anchor point around Du Fours Lookout to bring the edge south and down off the hill to meeting up with October South heading north.⁷⁵⁶
162. At 12:49pm, Helitak 296 is reported as having advised, '*Mt Wilson Rd burn looking good.*'⁷⁵⁷
163. At 12:56pm, Mr Banffy is recorded as having advised, '*Back on scene.*'⁷⁵⁸
164. Mr Carter commented that at about 1:00pm, was the beginning of the departure from the forecast weather conditions. The wind had started to back around to the south-west. So, by 2:00pm, they were in fire weather which was not really what they would've like to have had. There was a corresponding increase in fire activity as that weather changed including increased flame heights, rates of spread and potential for spotting and everything started to look more active.⁷⁵⁹ Mr Burley agreed that the weather started to take a turn for the worst at around 1:00pm to 1:30pm; the RH started to deplete, and the wind started to shift to the southwest as the afternoon progressed on.⁷⁶⁰
165. At approximately 1:24pm, the Dalpura Sector re-commenced lighting.⁷⁶¹

⁷⁴⁵ Exhibit 56A, Brief of Evidence at p. 4011.

⁷⁴⁶ Exhibit 56A, Brief of Evidence at Tab 46A, T11-49-17, T11-49-54, T11-50-25, T11-57-23, T11-58-31, T11-58-51; p. 4011.

⁷⁴⁷ Exhibit 56A, Brief of Evidence at p. 4011.

⁷⁴⁸ Exhibit 56A, Brief of Evidence at p. 4011.

⁷⁴⁹ Exhibit 56A, Brief of Evidence at p. 4012.

⁷⁵⁰ Exhibit 56A, Brief of Evidence at p. 4012.

⁷⁵¹ Exhibit 56A, Brief of Evidence at p. 4012.

⁷⁵² Exhibit 56A, Brief of Evidence at p. 4012.

⁷⁵³ Exhibit 56A, Brief of Evidence at Tab 46A, T12-29-25, T12-30-19, T12-31-02.

⁷⁵⁴ Exhibit 56A, Brief of Evidence at p. 3998.

⁷⁵⁵ Exhibit 56A, Brief of Evidence at p. 4012.

⁷⁵⁶ Exhibit 56A, Brief of Evidence at p. 564.

⁷⁵⁷ Exhibit 56A, Brief of Evidence at p. 4012.

⁷⁵⁸ Exhibit 56A, Brief of Evidence at p. 4012.

⁷⁵⁹ Transcript for 15 May 2023 T 1437:12-27.

⁷⁶⁰ Transcript for 16 May 2023 T 1528:1-20.

⁷⁶¹ Exhibit 56A, Brief of Evidence at p. 4012.

166. Mr Carter stated that at 1:30pm, the Dalpura Sector and October Sector's lighting progress was approximately 2.2 kilometres and 1.75 kilometres respectively with a comparative ratio being 1.8 : 1.⁷⁶²
167. Around this time, all strike teams on site were tasked, and the October Sector split into the two sectors, an agreed decision between Mr Carter and Ms Raines,⁷⁶³ and the swing shift teams were deployed. Ms Raines stated that she left Mr Ellison in charge of October South Sector.⁷⁶⁴ Mr Carter struggled to recall that Mr Ellison took charge of the October South Sector, but stated it was possible he was made the Sector Leader for a short time until Mr Gerzanics turned up. Mr Ellison stated that following a period of about an hour, he passed control over to Mr Gerzanics. Mr Gerzanics stated he was briefed by Ms Raines and made no reference to the role of Mr Ellison.⁷⁶⁵
168. Mr Burley recalled that Mr Ellison was nominated October South Sector for a short period of time before The Hills Strike Team took over.⁷⁶⁶
169. Mr Conway commented that:
- ...this situation is not uncommon in an escalating incident. The volume of information flowing among fire ground managers increases with fire behaviour, and the number of decision[s] that must be made always becomes significant. There is no suggestion that this period of uncertainty in management of October South Sector contributed in any way to the outcome on the day. It does serve to highlight one of the many challenges that fire ground managers must contend with in exercising their role.*⁷⁶⁷
170. Mr Carter stated that he briefed the crews coming into the October South Sector to keep the lighting of the burn on Mount Wilson Road ahead of the Fire coming up from the Bells Line of Road ignition.⁷⁶⁸
171. At 1:49pm, Mr Carter advised Mr Honeysett, 'Don't be too much rush – need to lock in Mt Vic rd.'⁷⁶⁹
172. At 1:59pm, October South Sector Leader is recorded as having reported: 'Very active fire in middle crowning. But on edges very small.'⁷⁷⁰ The following entry in Mr Carter's logbook is undated, from Mr Banffy advising 'Will have 3 machines operating was very high. But has now subsided. Should not cross Mt Wilson Rd'.⁷⁷¹

Spotting to the east of Mount Wilson Road, October Sector

173. At 2:03pm, the following entry is recorded in respect of October North: 'Nothing heard – Oct Nth LDR not to go ahead with fire on ground. Not to comm lighting, strategy to stay ahead of active fire on Mt Wilson Rd.'⁷⁷²
174. At 2:08pm, the following entry is recorded, 'Paused lighting of Bells Line of Rd Grid Ref 500 864 Have ceased all lighting of fire due to Fire behaviour.'⁷⁷³
175. At 2:17pm, Mr Carter provided the following sitrep to the Hawkesbury IMT:
- Temperature 27 °C, relative humidity 23%, winds from south-west, 3-8 km... In the Dalpura Sector we have a very active fire in the middle crowning but on the edges its very small. All fire lighting has ceased along Bells Line of Rd and Mt Wilson Rd... due to fire behaviour... mopping up around the edges on it as well. The strategy is to keep ahead of it ... we also have 3 choppers being active in assisting as well.*⁷⁷⁴

⁷⁶² Exhibit 56A, Brief of Evidence at p. 3998.

⁷⁶³ Transcript for 15 May 2023 T 1438:14.

⁷⁶⁴ Exhibit 56A, Brief of Evidence at p. 4012, 568; Transcript for 18 May 2023 T 1626:1.

⁷⁶⁵ Transcript for 15 May 2023 T 1438:8-11; Exhibit 56A, Brief of Evidence at p. 235, 3626.

⁷⁶⁶ Transcript for 16 May 2023 T 1529:40-43.

⁷⁶⁷ Exhibit 56A, Brief of Evidence at p. 3743; Transcript for 19 May 2023 T 1655:12-16.

⁷⁶⁸ Exhibit 56A, Brief of Evidence at p. 3745.

⁷⁶⁹ Exhibit 56A, Brief of Evidence at p. 4012.

⁷⁷⁰ Exhibit 56A, Brief of Evidence at p. 4012.

⁷⁷¹ Exhibit 56A, Brief of Evidence at p. 4013.

⁷⁷² Exhibit 56A, Brief of Evidence at p. 4013; Transcript of 15 May 2023 T 1439:32-37.

⁷⁷³ Exhibit 56A, Brief of Evidence at p. 4013; Transcript of 15 May 2023 T 1439:32-37.

⁷⁷⁴ Exhibit 56A, Brief of Evidence at Tab 46A, T14-17-10, T14-17-31, T14-17-57, T14-18-20, T14-19-03.

176. Mr Conway stated that in this communication, Mr Carter suggested that:
- ... the burns had begun to run ahead of the lighting crews, potentially influenced by both the run ahead of the lighting crews ... potentially influenced by both the topography and deteriorating weather conditions. He describes a ridge line running north south and parallel to Mt Wilson Road that influenced fire behaviour and suggested the fire wrapped around in front of the lighting crews. His instruction to the lighting crews was to only light from Mount Wilson Road to keep in front of the burn running parallel to the road, and address any spotting across Mount Wilson Road ...*⁷⁷⁵
177. Mr Gerzanics stated that as the Fire spread across the gully to the west of Mount Wilson Road, lighting crews struggled to keep up. The fire appeared to be coming across from Bells Line of Road faster than they could light in the October Sector.⁷⁷⁶ Mr Carter explained that the increase in fire behaviour at the time was a consequence of the burn ignited on Bells Line of Road burning along a ridgeline parallel to Mount Wilson Road and then uphill through a gully to the west of Mount Wilson Road under the influence of a south-westerly wind, with the crews at that location endeavouring to keep the burn on Mount Wilson Road ahead of this fire run.⁷⁷⁷
178. Mr Conway surmised that stopping the lighting on Bells Line of Road was absolutely the right thing to do and it was an appropriate decision at the time to try to keep ahead of the fire front given the behaviour they were dealing with at the time.⁷⁷⁸
179. At approximately 2:16pm, Mr Banffy caused the helicopter in which he was performing the role of AAS to land. A discussion followed between himself, Mr Carter and Mr Burley.
180. At 2:20pm, a request for a gel run from a LAT was put in to the IMT.
181. At 2:21pm, Mr Banffy advised, *'Start build up steam on Mt W road. Crews staying ahead ... SW Gusting 4-15.'*⁷⁷⁹
182. At about 2:23pm, Mr Banffy took off again in his helicopter.
183. At 2:25pm, Mr Burley advised *'Crews on prop protect Wollondilly No LAT or VLAT...'*⁷⁸⁰ Mr Carter explained that there was some difficulty getting a LAT on the fireground, as it was currently working on property protection in the Wollondilly area, so they couldn't get access to the LAT straightaway. But the request was in.⁷⁸¹
184. At around 2:40pm, a member of the Glenorie 1 Team in the October South Sector reported to Mr Gerzanics the first spot fire, which they were able to contain.⁷⁸² It appears minutes later, at 2:42pm, a further spot fire was reported in that Sector, approximately 2 kilometres down Mount Wilson Road, to the east of that road near Box Hill 1 Team, who, with the assistance of Annangrove 7 Team, went with hoses to try and contain the Fire. However, the ground was inclined slightly for about 10 to 15 metres east of the road and then dropped sharply making it too dangerous for the crews to go any further in.⁷⁸³
185. At 2:42pm, the following entry is recorded in Mr Carter's logbook from Mr Burley: *'536 860 – Spot over ... Strike team can't get to it. Need air attack. 3 mediums are attacking.'*⁷⁸⁴
186. At 2:46pm, Mr Burley advised *'Multiple spots – some crew can get to – some they can't.'*⁷⁸⁵

⁷⁷⁵ Exhibit 56A, Brief of Evidence at p. 3745; Transcript for 15 May 2023 T 1437:34–1438:5.

⁷⁷⁶ Exhibit 56A, Brief of Evidence at p. 3627-8, 3630.

⁷⁷⁷ Exhibit 56A, Brief of Evidence at p. 3568-9, 3571.

⁷⁷⁸ Transcript for 19 May 2023 T 1653:27-32.

⁷⁷⁹ Exhibit 56A, Brief of Evidence at p. 4013.

⁷⁸⁰ Exhibit 56A, Brief of Evidence at p. 4013.

⁷⁸¹ Transcript of 15 May 2023 T 1440:16-21.

⁷⁸² Exhibit 56A, Brief of Evidence at p. 3628; Transcript for 17 May 2023 T 1609:28-29.

⁷⁸³ Exhibit 56A, Brief of Evidence at p. 3628; Transcript for 17 May 2023 T 1609:32-49.

⁷⁸⁴ Exhibit 56A, Brief of Evidence at p. 4013.

⁷⁸⁵ Exhibit 56A, Brief of Evidence at p. 4014.

187. Mr Conway stressed that while aerial resources are a critically valuable tool to firefighters, they do not suppress wildfires – they never have and probably never will. They're a tool which are used in conjunction with work on the ground to secure a fire edge and prevent it from spreading.⁷⁸⁶
188. By about 2:47pm, Mr Gerzanics stated that the spot fire had grown to about 60 metres and was continuing to spread rapidly.
189. At 2:48pm, Mr Burley advised, *'Following spot over – attempting to do what can be done. Unable to take extra crews – too congested.'*⁷⁸⁷
190. By 2:50pm, Mr Gerzanics stated that he received reports of multiple spots. A decision was made for crews to leave in whatever direction their trucks were facing. Within minutes of this occurring, the Fire jumped Mount Wilson Road.⁷⁸⁸
191. At 2:51pm, Mr Burley reported, *'Spots well established. Pulling crews out – Some teams → Mt Wilson. Some teams returning to Control. Hills St Team – to Mt Wilson or back to Control.'*⁷⁸⁹
192. At 2:54pm, Mr Banffy advised, *'Well + truly entrenched. 2 other Helitaks coming. Don't think can hold now'* and Mr Burley reported, *'GEL drop coming. Just refuelling now.'*⁷⁹⁰ Mr Carter explained that the LAT was refuelling at that time, and they would be the next deployment for that aircraft.⁷⁹¹
193. At 2:56pm, Mr Banffy indicated, *'Advising GEL drop approved. Will have 4 med & 1 firebird Smoke so thick – can only send 1 heli at a time.'*⁷⁹² These aircraft were later joined by a LAT, however, Mr Carter stated that the powerlines, combined with poor visibility, made effective gel drops very difficult to achieve.⁷⁹³
194. A fire spread prediction map for the extended outlook for 3:00pm on 14 December 2019 to 10:00pm on 15 December 2019 identified that assets may be impacted in Mount Wilson that day and the following day at Mount Tomah if the spot fire was not suppressed.⁷⁹⁴
195. At 3:06pm, Mr Banffy stated, *'Not good – running at speed. Doubt can do anything with it. About 1k east of Mt Wilson Rd. Growing – running along Ridge Line to Mt Wilson. Get crews at Mt Wilson into property protection'* and further added at 3:19pm *'IS SAFE TO BRING ST TO MT WILSON – CAN'T SEE HOLDING IN BLACK holding for blacking out Zero visibility.'*⁷⁹⁵
196. At around 3:12pm, the Mount Wilson/Mount Irvine Brigade activated their community engagement program, including emails and phone calls to residents and door knocking to Mount Wilson and Mount Irvine residents not contactable. At the time, they would have had contact details for around 300 residents living within those communities.⁷⁹⁶

Property protection

197. At 3:25pm, Mr Carter recommended a W&A message be broadcast for the Fire to the east of Mount Wilson Road. Some five minutes later, the Blue Mountains IMT advised the Hawkesbury IMT that no additional resources were available to assist in responding to the Fire.⁷⁹⁷
198. At 3:46pm, Mr Carter advised the Hawkesbury IMT that the majority of the swing shift strike teams, and the FRNSW strike team, had been deployed to undertake property protection in the Mount Wilson area, with the first properties alongside the western side of Mount Wilson Road to be potentially impacted by way of direct attack within 45 minutes.⁷⁹⁸

⁷⁸⁶ Transcript for 19 May 2023 T 1654:45–1655:5.

⁷⁸⁷ Exhibit 56A, Brief of Evidence at p. 4014.

⁷⁸⁸ Exhibit 56A, Brief of Evidence at p. 3628.

⁷⁸⁹ Exhibit 56A, Brief of Evidence at p. 4014.

⁷⁹⁰ Exhibit 56A, Brief of Evidence at p. 4014.

⁷⁹¹ Transcript for 15 May 2023 T 1444:28-30.

⁷⁹² Exhibit 56A, Brief of Evidence at p. 4014.

⁷⁹³ Exhibit 56A, Brief of Evidence at p. 3569.

⁷⁹⁴ Exhibit 55A Brief of Evidence at p. 1603.

⁷⁹⁵ Exhibit 56A, Brief of Evidence at p. 4014.

⁷⁹⁶ Transcript for 18 May 2023 T 1627:21–1628:39.

⁷⁹⁷ Exhibit 56A, Brief of Evidence at p. 199, 384.

⁷⁹⁸ Exhibit 56A, Brief of Evidence at p. 199, 404, Tab 46A, T15-46-42, T15-47-30.

199. At 3:49pm, Mr Carter recommended that an EW be issued which was approved by Ms Hodges. At this time, the Public Information Officer was looking for information relevant to the W&A message.⁷⁹⁹
200. By 4:02pm, Mr Carter reported that there was a heavy pyrocumulus cloud developing over the top of the fireground.⁸⁰⁰
201. At 4:06pm, SITREP '411' established EW 5, the first of five levels of EW, was issued in respect of Mountain Lagoon and Bilpin, rather than Mount Wilson and Mount Irvine. This was corrected in a SITREP issued at 4:39pm which identified Mount Wilson as the area under threat.⁸⁰¹
202. At 4:16pm, the first emergency alert campaign for the Mount Wilson area, comprising SMS and voice messages, commenced which advised residents to 'Shelter as Fire Approaches'.⁸⁰²
203. An MFU was posted by the RFS at 4:19pm indicating 'fire is moving in a north-easterly direction towards Mt Wilson'.⁸⁰³
204. Mr Conway commented that there were some:
- ...51 minutes between the time that the Division Commander indicated that he needed messaging to the Community, which was a Watch and Act, and when the Emergency Alert campaign began... that period of time between the IMT becoming aware that things had deteriorated on the fireground, and when the major fire update occurred, and when the Emergency Alert update occurred; in my mind is a little long... I would anticipate that you should be able to get those messages out a little earlier than that'.⁸⁰⁴*
205. He agreed that the community engagement program actioned by the Mount Wilson/Mount Irvine Brigade at around 3:12pm, does mitigate the risk of people not knowing about approaching fire and was commendable. However, emergency managers understand, as an industry generally, that when you're communicating with communities under threat, they're looking for multiple sources of information. Accordingly, we need to make sure that the rest of those involved in responding are providing that source of validation for the information that's been provided.⁸⁰⁵
206. As the afternoon progressed, crews assembled at Mount Wilson to defend the township from the approaching fire. The fire impacted properties along the end of Wynnes Rock Road.⁸⁰⁶

Conflicting evidence between Mr Banffy, Mr Carter, and Mr Burley

207. There were minor differences in the timing of a meeting in the accounts of Mr Banffy, Mr Carter, and Mr Burley.
208. Mr Banffy gave evidence that at around 2:00pm (probably around 2:16pm when regard is had to the flight log),⁸⁰⁷ he caused the helicopter in which he was performing the role of AAS to land in order to convey his concerns about control of the backburn.⁸⁰⁸
209. Mr Banffy said he caused the aircraft to land on a hill to the south of Bells Line of Road, within walking distance to where Mr Carter was performing his role as Division Commander at the intersection of Mount Wilson Road.⁸⁰⁹
210. Mr Banffy recalled conveying his concerns to both Mr Carter and Mr Burley during this short interaction and was of the impression that all were 'on the same page'.⁸¹⁰

⁷⁹⁹ Exhibit 56A, Brief of Evidence at p. 200.

⁸⁰⁰ Exhibit 56A, Brief of Evidence at p. 585, 201.

⁸⁰¹ Exhibit 56A, Brief of Evidence at p. 3749, 318, 313.

⁸⁰² Exhibit 56A, Brief of Evidence at Tab 42, Item 6.

⁸⁰³ Exhibit 56A, Brief of Evidence at p. 3750; Exhibit 55A, Brief of Evidence at Tab 41, Entry 5688.

⁸⁰⁴ Transcript for 19 May 2023 T 1655:22 – 1656:22; Transcript for 18 May 2023 T 1627:21 – 1627:28.

⁸⁰⁵ Transcript for 19 May 2023 T 1655:22 – 1656:22; Transcript for 18 May 2023 T 1627:21 – 1627:28.

⁸⁰⁶ Exhibit 56A, Brief of Evidence at p. 209.

⁸⁰⁷ Transcript for 17 May 2023 T 1584 – 1585.

⁸⁰⁸ Transcript for 17 May 2023 T 1582 – 1583.

⁸⁰⁹ Transcript for 17 May 2023 T 1583.

⁸¹⁰ Transcript for 17 May 2023 T 1584.

211. Mr Burley gave evidence that he recalled Mr Banffy landing the aircraft near the intersection; recalled that they had a face-to-face meeting; and recalled that they were *'on the same page'*.⁸¹¹
212. However, Mr Burley placed the meeting earlier, at 12:30pm, when the fire behaviour was not as concerning, and he did not recall Mr Banffy expressing any *'overt' concerns, but conceded he possibly did*.⁸¹²
213. In his oral evidence, Mr Carter agreed he had a face-to-face meeting with Mr Banffy, and Mr Banffy caused the helicopter in which he was performing the role as AAS to land near the intersection of Mount Wilson Road.⁸¹³
214. Mr Carter recalled that Mr Banffy, Mr Burley, and himself were in agreement with respect to the observations conveyed by Mr Banffy during the interaction, and Mr Banffy didn't tell Mr Carter anything he didn't already know during the interaction.⁸¹⁴
215. In reconciling the chronology of this interaction, the NPWS provided the Court a flight log for Mr Banffy's aircraft on the day of the backburn. This showed that Mr Banffy landed his aircraft at a location described as *'unknown' at 2:16pm, then took off again at 2:23pm*.⁸¹⁵ A corresponding map identified the helicopter apparently landing on Bells Line of Road near Mount Wilson.⁸¹⁶
216. In oral evidence, Mr Banffy confirmed these records supported the probability that it was at this time when he had the interaction with Mr Carter and Mr Burley.⁸¹⁷

Forecast and observed weather conditions

217. The following table annexed to Mr Carter's second supplementary statement outlines the weather forecast for the locations and ground observations, and observations from the Mount Boyce AWS. Mr Carter stated that this AWS is at a similar elevation to the burn location and approximately 10 kilometres to the south-southwest.⁸¹⁸

	Forecast				Ground Observations				Mt Boyce Observations			
	Temp	RH	WD	WS	Temp	RH	WD	WS*	Temp	RH	WD	WS
09:00	15	65%	W	4					16	46	W	11
10:00	19	50%	S	4	18.5	38.4%	Var	0 - 2	18	37	W	13
11:00	22	40%	SSE	8	23	31.5%	Var	3.5 - 6	22	33	W	8
12:00	24	33%	SE	9					24	28	W	13
13:00	26	29%	ESF	9	27	23%	SW	2 - 8	25	23	WSW	18
14:00	27	29%	ESE	8	29	15%	SW	4 - 15	26	17	WSW	26
15:00	28	29%	E	9	28	15%	SW	5 - 15	26	16	WSW	28
16:00	28	31%	ENE	9					27	16	WSW	30
17:00	27	30%	NW	15					27	19	WSW	28
18:00	24	29%	SW	16	25	50%	SE	light	24	47	SSE	9

* Wind speed at ground level and affected by topography – visible observations at 10m substantially higher

The table above outlines the difference between the forecast and observed conditions. A max FDI of 15 was forecast, however conditions at Mt Boyce reached a max FDI of 32. The conditions observed at the fire ground were very similar to Mt Boyce in all respects except wind speed which is due to the height (AGL) of the field observations (2m AGL) and local topography.

⁸¹¹ Transcript for 17 May 2023 T 1537.

⁸¹² Transcript for 17 May 2023 T 1539 - 1541; 1549 - 1550.

⁸¹³ Transcript for 17 May 2023 T 1440-1441.

⁸¹⁴ Transcript for 17 May 2023 T 1441-1442.

⁸¹⁵ Exhibit 56A, Brief of Evidence at p. 3889.

⁸¹⁶ Exhibit 56A, Brief of Evidence at p. 3890.

⁸¹⁷ Transcript for 17 May 2023 T 1585.

⁸¹⁸ Exhibit 56A, Brief of Evidence at p. 3593.

218. Mr Carter commented that:

...the gridded forecast for the site of the burn showed the winds to be light, with RH between 29 and 65% for the key part of the day. Wind would change at 17:00 to north-west, however that direction would not have caused any issues. The weather observed on 14 December followed these grids until the weather deteriorated at approximately 13:00 when it deteriorated dramatically.⁸¹⁹

219. Mr Carter also remarked that the weather was probably at its peak departure from the forecast just prior to the spot over. RH was about 15% which was significantly lower than forecast, and the wind direction was from the south-west and at ground level gusting up to 15 kilometres per hour, which in terms of equivalence for forecast is more like 30 – 40 kilometres per hour, as observations are taken at ground level and forecasts are generated at a 10 metre wind height.⁸²⁰

Expert evidence

220. Mr Conway concluded that:

- a. the backburn was implemented in accordance with the IAP and the Bell/Bilpin Division Sub-Plan;⁸²¹
- b. based on the forecast weather, there was barely sufficient time to complete the burn before the conditions deteriorated, however, the IMT were aware of this constraint, where it was suggested at 8:12am that getting all the burn in was unlikely. With the observed weather conditions generating more intense fire behaviour, this became impossible;⁸²²
- c. the decision to anchor the backburn at the corner of Bells Line of Road and Mount Wilson Road resulted in up-hill runs from the burn ignited on Bells Line of Road. This was a known risk noted by both IMT members and Fire Ground Managers, and was addressed through a conservative lighting pattern, fireground resourcing, in particular the rostering of a swing shift;⁸²³
- d. resources were deployed throughout the day to reflect the changing needs on the fireground. Resourcing for the backburn reflected what was available at the time and was appropriate for the planned task under the forecast weather conditions;⁸²⁴
- e. the lighting pattern adopted for the backburn was appropriate and consistent with established guidance. Further, as the weather conditions deteriorated and fire intensity and forward rate of spread increased, the lighting pattern was adjusted in an attempt to keep the burn on Mount Wilson Road ahead of fire spreading from Bells Line of Road;⁸²⁵
- f. the timing of the backburn during the day, in a relatively narrow window of suitable weather, and the decision to burn upslope was a conscious one, and reflects the constraints of topography, fire behaviour and deteriorating weather forecasts the IMT was grappling with;⁸²⁶
- g. there was an appropriate fireground management structure in place for the Bell Division. There was some uncertainty during the transfer of command of the October South Sector during the early afternoon, which reflected the dynamic nature of the operation at the time. There was a period in the afternoon between 2:00pm and 3:00pm where fire activity increased in response to changing weather and subsequently put pressure on Fire Ground Managers, impacting on oversight of fireground management structures. Despite concerns raised by Mr Banffy, it is clear that weather and fire behaviour were closely monitored, and actions were taken by Fire Ground Managers in response to changing conditions;⁸²⁷

⁸¹⁹ Exhibit 56A, Brief of Evidence at p. 3564.

⁸²⁰ Transcript for 15 May 2023 T 1443:27-34.

⁸²¹ Exhibit 56A, Brief of Evidence at p. 3746.

⁸²² Exhibit 56A, Brief of Evidence at p. 3740.

⁸²³ Exhibit 56A, Brief of Evidence at p. 3741.

⁸²⁴ Exhibit 56A, Brief of Evidence at p. 3747; Transcript for 19 May 2023 T 1653:38-46.

⁸²⁵ Exhibit 56A, Brief of Evidence at p. 3739–3740.

⁸²⁶ Exhibit 56A, Brief of Evidence at p. 3741.

⁸²⁷ Exhibit 56A, Brief of Evidence at p. 3745–3746.

- h. once the control line was breached the backburn stopped immediately. An attempt at direct attack was made but due to heavy fuels, access was not possible, nor would it have been safe for firefighters to undertake direct attack given fuel loads, topography and observed fire behaviour;⁸²⁸
- i. the application of a defensive strategy to protect Mount Wilson village was the only option available to the IMT and Fire Ground Managers on the afternoon of 14 December once the Fire had spotted across Mount Wilson Road and was executed in a timely way. All resources available to the Fire Ground Managers were deployed to implement this strategy; and⁸²⁹
- j. the warnings and advice provided to communities affected by the fire extension to the east of Mount Wilson Road were relevant and tailored to the needs of the affected community. There was a brief delay in providing initial advice and warnings after the spot overs on Mount Wilson Road were identified. The focus of IMT members in resourcing the defensive strategy for Mount Wilson may explain this delay, but the delay is still of note. Warnings were in place approximately one hour before the Fire impacted Mount Wilson.⁸³⁰

221. Mr Conway was taken to the submission of the AOCG to the NSW Bushfire Coronial Inquiry and, in particular, some information in respect of warnings and advice within that document, conveyed to the public on 14 and 15 December 2019 after the spotting on 14 December. Mr Conway commented that some of the information he was taken to did not reflect what was happening at the time. Mr Conway noted that he could not comment on what other material might have been out there which was reflective of the situation at the time.⁸³¹

What led to the initial introduction of fire to the east of Mount Wilson Road?

222. Using endorsed fire behaviour models, Mr Carter undertook a reconstruction of this backburn based on observed weather conditions, Mr Burley's, and his own observations. He surmised that this reconstruction demonstrated that the backburn from Dalpura Sector was not the cause of fire spotting across Mount Wilson Road.⁸³²

223. Mr Carter theorised that a short time prior to the first spot over being reported, the backburn had progressed north under the influence of south-westerly winds (not forecast) along a ridge 350 metres west of, and parallel to Mount Wilson Road and a convective column was starting to form, indicating an increase in fire behaviour. Based on reports, the burn on that ridge burnt along the ridge ahead of the backburn on Mount Wilson Road, down slope to the northeast, and then with high intensity uphill toward Mount Wilson Road, spotting over the road in that process.⁸³³ Mr Carter described this as a '*terrain driven effect*'.⁸³⁴

224. Mr Conway reviewed Mr Carter's reconstruction in detail and concurred that the spot fires were most likely a result of fire runs from the first section of the burn along Mount Wilson Road immediately north of the high voltage transmission lines.⁸³⁵

225. Counsel Assisting submitted that the Court should accept the evidence of Mr Conway that the execution of the Grose Valley Mount Wilson Strategic Backburn was appropriate in the circumstances.

⁸²⁸ Exhibit 56A, Brief of Evidence at p. 3748.

⁸²⁹ Exhibit 56A, Brief of Evidence at p. 3748.

⁸³⁰ Exhibit 56A, Brief of Evidence at p. 3751.

⁸³¹ Transcript for 19 May 2023 T 1669:13–1672:50.

⁸³² Exhibit 56A, Brief of Evidence at p. 4001, 4050, 3571.

⁸³³ Exhibit 56A, Brief of Evidence at p. 4001, 4054.

⁸³⁴ Transcript for 15 May 2023 T 1443:2-11.

⁸³⁵ Exhibit 56A, Brief of Evidence at p. 4413.

226. In summary, the AOCG submitted:
- a. there was insufficient time or resources to conduct the backburn;
 - b. there were not enough resources available to control the backburn and put out the spot overs;
 - c. the weather and fuel conditions were not suitable for a controllable backburn;
 - d. fuel moisture content readings were not obtained by the IMT or the Divisional Commander prior or during the backburn on 14 December 2019;
 - e. the FFDI rating in relation to the backburn was very high, strongly suggesting the backburn was not suitable or appropriate (this matter will be addressed later in my findings, by reference to the work of the University of Wollongong, partnered with the RFS to respond to Recommendation 48 of the NSW Bushfire Inquiry, where they found in their research they could not confidently predict FFDI thresholds that might lead to low or high risk of backburn escape); and
 - f. the emergency warnings and public information provided to the affected communities on 14 and 15 December 2019 were not timely or appropriate and were misleading as to the threat posed by the escaped backburn.

CONCLUSION

I accept the evidence set out in paragraphs 213–219 (which have not been repeated here for the sake of brevity) about how the Southern Containment Strategy was implemented on 14 December 2019, including with respect to issues of timing, ignition pattern, resources, and monitoring.

I have considered case study 6 (Mount Wilson Backburn) in Mr Gellie’s report, including his fire situation analysis. I accept the submission of Counsel Assisting that Mr Gellie’s report does not address what Mr Conway has said in his report about the appropriateness (or not) of the Grose Valley Strategic Backburn.

I accept the expert evidence of Mr Conway that the execution of the Grose Valley Strategic Backburn was appropriate in the circumstances having regard to the conclusions set out paragraphs 220–221 above (which have not been repeated here for the sake of brevity).

I also accept the evidence of Mr Conway that the spot fires were most likely a result of fire runs from the first section of the burn along Mount Wilson Road immediately north of the high voltage transmission lines.

Mr Conway was taken a part of the Submission of the AOCG to the NSW Bushfire Coronial Inquiry about warnings and advice conveyed to the public on 14 and 15 December 2019 (after the spotting on 14 December). Mr Conway commented that some of the information he was taken to did not reflect what was happening operationally at the time. Mr Conway noted that he could not reflect on what other material might have been available which was reflective of the situation at the time. I accept the position stated by Mr Conway.

As previously stated, the scope of this Inquiry was articulated in an Issues List. The Issues List did not extend to consideration about the appropriateness of emergency warnings and public information provided in connection with the Grose Valley, Strategic Backburn. Relevantly, these issues had already considered by the Court through a separate general inquiry into the Kangawalla, Diehard Fire which was the identified representative case study for further analysis on the topic of communications and warnings (the Findings for this Inquiry have been detailed earlier in Part 10, Section 3).

Therefore, the submissions of the AOCG as to the appropriateness of warnings and advice conveyed to the public on 14 and 15 December 2019 are outside the scope of this Inquiry, and I make no findings on these issues.

Currowan Strategic Backburn

227. The Currowan Fire is believed to have commenced following a lightning strike in remote bushland within the Currowan State Forest on the evening of 25 November 2019. However, it did not become visible until the afternoon of 26 November.
228. As part of its response to the Fire, the RFS IMT implemented an 'Eastern Containment Strategy'.
229. Despite the strategy, the Currowan Fire burned for approximately 11 weeks, until it was declared 'Out' on 8 February 2020. It damaged an area of approximately 315,000 hectares, and three people tragically died as a result: Laurence Andrew, John Butler, and Michael Campbell.
230. Mr Geoffrey Conway AFSM was engaged by those assisting to provide two expert reports in respect of the Currowan Fire.
231. The Court also received into evidence affidavits from Currowan Fire affected owners.
232. The following witnesses gave oral evidence between 19 and 25 May 2023:
 - a. Mr Peter McKechnie, RFS Deputy Commissioner, Field Operations;
 - b. Charles Alexander Magnuson, RFS Fire Brigade Captain, Bawley Point;
 - c. Mark Williams, Director, Incident Management Solutions (at the time of the Currowan Fire, Mr Williams was the RFS District Manager, Shoalhaven District and IC/section 44 appointee for fires burning within the Shoalhaven District);
 - d. David Christopher Palmer, RFS Inspector, Operational Response Coordination & Infrastructure, Shoalhaven District; and
 - e. Mr Geoff Conway ASFM, Court-appointed expert.

ISSUE 7

What containment strategies were considered to control the easterly spread of the Currowan Fire in the period up to 29 December 2019 and how did such strategies fit within the wider context of responding to other fire edges for the Currowan cluster of fires, along with other fires burning within the State?

Alternative containment strategies

233. The Currowan Fire was well established by the time it emerged into terrain where direct attack might hope to have some measure of success. Fire weather conditions and fire behaviour meant direct attack would not be effective or safely possible in the early stages of the Fire.⁸³⁶ This was an observation repeated in very many of the fires the Court has investigated across the 2019/2020 season.
234. The use of close containment options using small breaks was not favourable due to severe fuel moisture deficits, associated fire activity and timing and resource limitations. Similarly, the use of wet gullies and rainforest areas was not considered viable due to these areas being too dry.⁸³⁷
235. RFS Strategic documents demonstrate that a number of alternative containment strategies were considered in response to the Currowan Fire. The primary strategy named '*Alternative 1 - Primary Strategy - Monitor and Confine*' was to complete control lines to the east and west flanks of the Fire and to herd the Fire north towards Braidwood Road in order to protect populated communities on the coast.⁸³⁸ '*Alternative 2 - Alternative Strategy - Monitor and Advance*' was to complete alternative control lines on east west and south flanks of the Fire should the primary strategy fail in any location. '*Alternative 3 - Contingency Strategy - Protection*' was to engage the Fire with a combination of direct line construction and larger scale firing operations to protect communities to the east, west and south of the Fire, and limit additional movement north.⁸³⁹

⁸³⁶ Exhibit 19A, Brief of Evidence at p. 731.

⁸³⁷ Exhibit 19A, Brief of Evidence at p. 731.

⁸³⁸ Exhibit 19A, Brief of Evidence at p. 3758.

⁸³⁹ Exhibit 19A, Brief of Evidence at p. 3759.

Eastern Containment Strategy

236. The eastern containment line (or more accurately a series of lines) was intended to act as a barrier to prevent fire impact upon the populated coastal communities to the east of the Princes Highway. That is, once the Fire progressed from the west of Clyde River, the Princes Highway was considered the “*next major stopping point*” for its progression towards the east.⁸⁴⁰
237. There was also a need to ensure the Fire did not cross or impact the Princes Highway from an access perspective, as it was the main road linking many settlements along the coast.⁸⁴¹
238. The IAP did not however ignore assets to the west. It specifically referred to the protection of the farming and rural lifestyle properties to the west of the Princes Highway up to the base of the escarpment in the Yatte Yattah district.⁸⁴²
239. The strategy involved utilising existing, or constructing, containment lines and then backburning from the containment lines to reduce the fuel load in an aim to create a ‘break’ that the Fire did not cross.⁸⁴³ Containment lines included existing roads, driveways, trails and watercourses, as well as constructed ‘lines’ of 4 to 6 meters width where vegetation was removed.⁸⁴⁴
240. Containment lines were constructed at various points throughout the area, to be ‘tied together’ to ultimately create a single extended containment line. While portions of the containment lines may have been used for individual fires in the past, the Currowan Fire was the first time the 108 kilometres Eastern Containment Strategy was employed.⁸⁴⁵ Mr Williams, the section 44 IC for the Currowan Fire, told the Court that a containment line of similar length was successfully employed in the Blue Mountains area during the 2001/2002 fires.⁸⁴⁶

Timeline

241. The strategy was first mentioned in Mark Williams, IC’s section 44 chronology on 7 December 2019.⁸⁴⁷
242. Reports indicate that containment line construction and backburning operations were occurring “*on most days*” throughout December 2019, and it became a natural progression to expand upon those to establish an eastern containment line.⁸⁴⁸ Initially heavy plant commenced by constructing and improving containment lines between Nowra Hill and Milton.⁸⁴⁹
243. Construction of the containment line and backburning operations off the line were undertaken in multiple locations at the same time.⁸⁵⁰ Containment operations located in the south progressed the lines towards the north, and at the same time containment lines were constructed in the north and progressed south.⁸⁵¹ Mr Williams explained that there were “*identified trigger points as to which sections would be constructed in a priority order*”.⁸⁵² Those trigger points remained fluid and dynamic as the Fire progressed.⁸⁵³
244. The events of 21 December 2019 added urgency to the need to complete the eastern containment line. Despite the merging of the Currowan and Tianjara Fires and the significant fire progression on 21 December 2019, the predominant amount of fire remained to the west of the Princes Highway, which according to Mr Williams meant that the Eastern Containment Line remained a “*valid and viable*” strategy to limit the Fire’s impact on eastern communities.⁸⁵⁴

⁸⁴⁰ Exhibit 19A, Brief of Evidence at p. 3759.

⁸⁴¹ Exhibit 19A, Brief of Evidence at p. 3980.

⁸⁴² Exhibit 19A, Brief of Evidence at p. 3759.

⁸⁴³ Exhibit 19A, Brief of Evidence at p. 3982.

⁸⁴⁴ Exhibit 19A, Brief of Evidence at p. 3982; Transcript for 23 May 2023, T 1776:5-10.

⁸⁴⁵ Transcript for 23 May 2023, T 1776:48-50; Transcript for 22 May 2023, T 1724:21-25.

⁸⁴⁶ Transcript for 23 May 2023, T 1777:1-6.

⁸⁴⁷ Exhibit 19A, Brief of Evidence at p. 739.

⁸⁴⁸ Exhibit 19A, Brief of Evidence at p. 3924; Transcript for 22 May 2023, T 1723:11-16.

⁸⁴⁹ Exhibit 19A, Brief of Evidence at p. 2560.

⁸⁵⁰ Transcript for 23 May 2023, T 1772:36-37.

⁸⁵¹ Transcript for 22 May 2023, T 1726:6-13.

⁸⁵² Transcript for 23 May 2023, T 1775:34-35.

⁸⁵³ Transcript for 23 May 2023, T 1775:36-37.

⁸⁵⁴ Transcript for 23 May 2023, T 1782:15-22.

245. Deputy Commissioner McKechnie, described the Eastern Containment Line as a core element of a strategy to attempt to protect communities from the impact of the Currowan Fire before the weather worsened, as was forecast for 31 December 2019.⁸⁵⁵

CONCLUSION

A number of possible containment strategies were considered to control the easterly spread of the Currowan Fire in the period up to 29 December 2019. The Eastern Containment Line was considered the most appropriate and was intended to act as a barrier to prevent fire impact upon, in particular, the populated coastal communities to the east of the Princes Highway. There was also a need to ensure the Fire did not cross or impact the Princes Highway from an access perspective, as it was the main road linking many settlements along the coast.

ISSUE 8

Should the Eastern Containment Line Strategy have been varied in light of predicted weather conditions for 30-31 December 2019 and the resources available to execute the strategy?

Ethos

246. It is apparent from the evidence within contemporaneous documents and witness statements that the RFS considered the containment line could offer “some” protection in light of the forecasted severe weather conditions of 31 December 2019.⁸⁵⁶
247. It is also apparent that some RFS personnel were motivated to take positive action and to be seen to take positive action in response to the Fire, describing that “*doing nothing was not an option*”⁸⁵⁷ and completing the backburn was “*the only viable strategy available*”.⁸⁵⁸ Mr Williams confirmed that the IMT felt some pressure on 30 December 2019 to complete the containment lines in the Yatte Yattah Sector before the weather was predicted to deteriorate in the early morning of 31 December 2019.⁸⁵⁹
248. Mr Williams spoke of the impetus to “*close the gates*” along the length of the containment line. This meant ensuring that, so far as possible, the containment line was continuous between the anchor points in Nowra Hill to the north and Milton to the south. Tied to this was the hope that backburning of good depth could be completed along the containment line.⁸⁶⁰ Mr Williams told the Court that having “*open gates*” between parts of the containment line was in effect having a containment line “*of no more than a few metres*”.⁸⁶¹ Mr Williams said:
- Given the amount of wildfire in the area and the nature of the fire behaviour and predicted weather, these were likely to not provide any real chance of stopping the progress of the fire. Therefore, the need to close the gates and create as wide a fuel reduced/removal area as possible was the only real effective measure in the arsenal.*
249. Even so, based upon hard experience gained in response to the fires burning in the northern part of the state earlier in the season, the RFS were aware that conditions on the ground might yet overwhelm attempts to contain the Currowan Fire to the west of the Princes Highway.

⁸⁵⁵ Exhibit 19A, Brief of Evidence at p. 3791.

⁸⁵⁶ Exhibit 19A, Brief of Evidence at p. 3798.

⁸⁵⁷ Exhibit 19A, Brief of Evidence at p. 3798.

⁸⁵⁸ Exhibit 19A, Brief of Evidence at p. 3984.

⁸⁵⁹ Exhibit 19A, Brief of Evidence at ps. 3984, 3968.

⁸⁶⁰ Exhibit 19A, Brief of Evidence at p. 3981–3982.

⁸⁶¹ Exhibit 19A, Brief of Evidence at p. 3982.

Should the strategy have been varied?

250. In respect of the question of whether the IMT should have varied its strategy in light of the predicted weather conditions and/or resources available to execute the strategy, the Court's appointed expert, Mr Conway took note of the IAP for 30 December 2019. This included a Fire Weather Discussion prepared by Fire Behaviour Analysts at 6:00pm the previous day, which documented the deteriorating weather forecast for 30 December and its potential impact on fire behaviour.⁸⁶² Containment operations located in the south progressed the lines towards the north, and at the same time containment lines were constructed in the north and progressed south.⁸⁶³
251. In his oral evidence, Mr Williams was taken to the IAP for the operational period 8:00am 30 December 2019 to 8:00am 31 December 2019.⁸⁶⁴ That IAP was accompanied by a document headed 'Fire Weather Discussion'. Mr Williams confirmed that it was likely that this document formed part of the IAP.⁸⁶⁵ Mr Williams could not state whether he would have read the specific Fire Weather Discussion document when he was considering the risks and benefits of continuing with the eastern containment strategy across 30 and 31 December 2019, but he expects he would have been made aware of the circumstances via the FBA and other members of the IMT involved with planning and operations.⁸⁶⁶
252. Under the IAP for 30-31 December 2019,⁸⁶⁷ the 'Mission' for the Currowan Fire was broadly described as:
- build strategic containments at locations with highest chance of success for tactical burning using assigned resources to reduce threat to communities before weather worsens within the Eastern Division.*
253. Specifically, under the heading 'Execution', the tasks for the East Division were relevantly described as:
- mop up and patrol south from Turpentine Road to Porters Creek Road; continue containment recon and establish any remaining containment then finished backburn off paddocks/containment at vegetated interface between Porters Creek Road to Gooloo Creek and Porters Creek Road and Pointer Road; patrol and actively mop up to depth of 30 metres.*
254. The Fire Weather Discussion was prepared following a forecast issued on 29 December 2019 at 1800 hrs. The weather situation was relevantly described therein as:⁸⁶⁸
- hot and dry air from Central Australia is resulting in heatwave conditions and elevated fire dangers today and tomorrow. Winds will begin to increase Monday [30th] evening and humidity recovery into Tuesday [31st] will be poor leading to increased fire danger in the early hours. Tuesday, strongest winds could be after sunrise and increases in temperature, wind speeds and lower humidities as front passes.*
255. The document also warned of a convergence of winds in the afternoon on 30 December 2019 with the potential to increase fire behaviour.⁸⁶⁹
256. In his oral evidence, Mr Conway said he was "a little perturbed" by an apparent anomaly in the IC's log entered on the afternoon of 30 December 2019, which read: "fire behaviour Tuesday [31 December] not much different to today [30 December 2019]".⁸⁷⁰
257. This entry within the IC's log was incorrect. The Fire Weather Discussion prepared 29 December 2019 made clear that weather conditions on Tuesday 31 December were expected to lead to increased fire behaviour.

⁸⁶² Exhibit 19A, Brief of Evidence at p. 3695.

⁸⁶³ Transcript for 22 May 2023, T 1726:6-13.

⁸⁶⁴ Exhibit 19A, Brief of Evidence from p. 3029; Transcript for 23 May 2023, T 1796:33-35.

⁸⁶⁵ Transcript for 23 May 2023, T 1796:43-36.

⁸⁶⁶ Transcript for 23 May 2023, T 1797:6-13.

⁸⁶⁷ Exhibit 19A, Brief of Evidence at p. 3029.

⁸⁶⁸ Exhibit 19A, Brief of Evidence at p. 3033.

⁸⁶⁹ Exhibit 19A, Brief of Evidence at p. 3033.

⁸⁷⁰ Transcript for 25 May 2023, T 1849:14-26.

258. In contrast to the account recorded in the IC's log, Mr Williams confirmed in his statement to the Court that 31 December 2019 was a "*predicted extreme fire weather day*". His statement further spoke to the urgency of continuing work on the eastern containment line including at Porters Creek Road on 30 December 2019 ahead of the anticipated adverse fire weather the next day.⁸⁷¹
259. Mr Williams was asked about this in his oral evidence and confirmed that the IMT knew the weather on 31 December was "*deteriorating and certainly it was to the effect that it did push us to ensure that we had that backburning done well and truly before that weather system came in that bad*".⁸⁷²
260. In his statement, Mr Williams identified the particular focus of backburning operations on 30 December 2019 was to close off '*open gates*', that is, as he clarified in oral evidence, "*open areas which had not yet been backburnt from [the] hard containment line which had been constructed*".⁸⁷³
261. Closing the open gates would increase the prospect of the containment line successfully holding an approaching fire.⁸⁷⁴
262. Mr Conway was asked to comment upon the appropriateness of this approach. He confirmed that seeking to '*close the gates*' was a valid strategy, but added that in successfully implementing this option, an IMT needed to have "*a few things running in [their] favour*", namely, time to implement the backburn so as to achieve sufficient depth to halt the advancing fire, and to have available adequate resources to safely implement and control the backburn.⁸⁷⁵
263. In his report, Mr Conway ultimately expressed some criticism of the IMT's plan, concluding:⁸⁷⁶
- Given the weather forecast and level of resourcing in place for the night shift on the 30th December, the IMT and fireground managers ... should have taken steps to mitigate the risk this posed by seeking further resources, or limiting the amount of fire introduced into the landscape.*
264. Mr Conway affirmed this opinion in his oral evidence.⁸⁷⁷ In expanding on this conclusion in his oral evidence, Mr Conway recognised that the decision to implement the backburn with weather conditions and resource availability as known on the day of 30 December 2019 was a "*tough*" call for the IC to make, but it was one he suspected many ICs had to make throughout that particular fire season. Mr Conway acknowledged Mr Williams' view expressed in his statement that the alternative would be to essentially "*do nothing*" and let the Fire break containment at the '*open gates*'. However, Mr Conway detailed at some length in his oral evidence the viability of well-planned defensive strategies and encouraged greater latitude for ICs to make these types of brave decisions in the future.⁸⁷⁸
265. More broadly, Mr Conway agreed in Court that the Eastern Containment Strategy was a feasible containment strategy to implement early in the Fire and added that it was a "*reasonable*" strategy that was "*worth pursuing*", noting in the early stages of the Currowan Fire, there was a window of opportune weather conditions to potentially contain the Fire (before it broke containment near Yadboro on 6-7 December 2019).⁸⁷⁹
266. Moving deeper into December, Mr Conway said there were "*not really*" any other strategic options available to the IMT other than attempting to establish the 108 kilometres eastern containment line, noting the topography, fuel type and fuel load in the area was "*very, very challenging*" as far as viable foundations for control lines running east to west were concerned.⁸⁸⁰
267. In other words, it was impractical for the Incident Management Plan to halt the Fire progressing north along the escarpment as December progressed due to circumstances of the natural environment, so the next best options included keeping the Fire from running east towards population centres.

⁸⁷¹ Exhibit 19A, Brief of Evidence at ps. 3981-3982.

⁸⁷² Transcript for 23 May 2023, T 1798:28-33.

⁸⁷³ Transcript for 23 May 2023, T 1798:44-47.

⁸⁷⁴ Exhibit 19A, Brief of Evidence at p. 3982; Transcript for 23 May 2023, T 1786:44-47.

⁸⁷⁵ Transcript for 25 May 2023, T 1854:36-50; 1855:1-7.

⁸⁷⁶ Exhibit 19A, Brief of Evidence at p. 3700.

⁸⁷⁷ Transcript for 25 May 2023, T 1855:15-28.

⁸⁷⁸ Transcript for 25 May 2023, T 1856:28-32.

⁸⁷⁹ Transcript for 25 May 2023, T 1847:27-31.

⁸⁸⁰ Transcript for 25 May 2023, T 1847:38-40.

268. Mr Conway noted the RFS SOPs relevant to backburning then in place (Fire Ground SOP 18 – 1999), particularly provided:⁸⁸¹

All backburning must be strictly supervised. Officers in charge must ensure:

- *Weather and fuel conditions are suitable for a controllable backburn.*
- *Adequate time and resources are available for the backburning operation (e.g.: tankers, firefighters, look-outs, communications, etc).*
- *Backburning is commenced from suitable, safe “anchor” point/s.*
- *Firefighters light-up on the correct side of the firebreak.*
- *Spot overs can be quickly extinguished.*
- *Firebreaks are sufficiently wide to be effective.*
- *Wind direction and strength and relative humidity are monitored for change.*
- *If firefighters can no longer see or communicate with one another, they are to cease lighting-up until they can.*

269. Mr Conway also noted that backburning is a high-risk strategy. Citing Dr Neil Burrows (CALM 1986) Mr Conway observed:⁸⁸²

... there is always the possibility that:

- *The backburn will not be deep enough and the main fire will throw over the backburn;*
- *The length of the backburn necessary to cut off the headfire may be such that there are insufficient crews and equipment to control or look after the backburn; and*
- *The backburn and fire head may join resulting in extreme fire behaviour and massive, long distance spotting behind the backburn, thus aggravating control and endangering firefighters.*

270. Mr Conway concluded in his report that given the fire behaviour described by the IC, the observed and forecasted weather for 30-31 December 2019 and resource limitations adverted to in the section 44 report, all of the concerns highlighted in the SOP and Burrows paper applied to the situation confronting decision-makers on 30 December 2019.⁸⁸³

271. Mr Conway added that there was no information in either the statements provided by the IMT members or the section 44 report that described the risk assessment process applied to the implementation of the Eastern Containment Strategy on 30 December 2019 or risk mitigation actions applied. He expected the latter would be detailed in the IAP.⁸⁸⁴

272. Mr Conway concluded that in the absence of viable mitigation actions, given the number of available resources to control the backburns and undertake patrol, and the forecasted weather for 30-31 December 2019, the IMT should have given consideration to limiting the amount of fire introduced to the landscape.⁸⁸⁵

⁸⁸¹ Exhibit 19A, Brief of Evidence at p. 3695–3696.

⁸⁸² Exhibit 19A, Brief of Evidence at p. 3696.

⁸⁸³ Exhibit 19A, Brief of Evidence at p. 3696.

⁸⁸⁴ Exhibit 19A, Brief of Evidence at p. 3696.

⁸⁸⁵ Exhibit 19A, Brief of Evidence at p. 3696.

273. Since Mr Conway prepared his initial expert report, further RFS statements and documents concerning the planning and implementation of the Eastern Containment Strategy were made available. In his oral evidence, Mr Conway confirmed that the provision of these documents essentially allayed the concerns he had expressed in his initial report as to the want of evidence of risk assessment or risk mitigation planning saying:⁸⁸⁶

the information in those documents was what I was originally hoping to see when the first brief of evidence was provided ... The material in those documents, particularly the strategic documents, was the sort of analysis and thinking that I was hoping to see when I originally looked at the brief of evidence and I think it reflects good practice in strategic planning in this particular circumstance. The particular observation I would make is the work that the strategic planners and the planning function have done in using the PACE model of planning ... So that was quite useful and certainly filled in a number of gaps in my understanding of the rationale behind the work that the IMT were doing ... they were applying the strategic thinking that they'd used initially in relation to how they might contain the fire. So those were the gaps that I saw early on and they had been addressed in the subsequent documentation.

CONCLUSION

Mr Conway was of the view that the Eastern Containment Strategy was a feasible containment strategy to implement early in the Fire. Further, as December progressed, due to the topography, fuel type and fuel load in the area, he stated that there were “*not really*” any other strategic options other than to continue the construction of the eastern containment line.

Notwithstanding the above, prior to additional documentation being provided concerning RFS planning and implementation of the Eastern Containment Strategy, Mr Conway raised concerns in respect of the lack of risk assessment or risk mitigation planning in the context of the forecasted extreme weather for 30-31 December 2019. He was of the view that given the forecasted weather for the evening of 30 December 2019 and the morning of 31 December 2019, the IMT should have given consideration to limiting the amount of fire introduced to the landscape.

After Mr Conway was provided with RFS statements and documentation evidencing the risk assessment and mitigation planning, he provided the opinion that the planning “*reflected good practice*” and evidenced “*strategic thinking.... In relation to how they might contain the fire*”.

The evidence indicates that the continuation of the Eastern Containment Strategy between 30 and 31 December 2019 was appropriate in the circumstances.

⁸⁸⁶ Transcript for 25 May 2023, T 1858:17-33.

ISSUE 9

How was the Eastern Containment Line Strategy implemented on 30-31 December 2019 in the vicinity of Porters Creek Road, Yatte Yattah (including timing, ignition pattern, resources and monitoring) and what was the result?

Resourcing

274. While the IAP for 30-31 December 2019 provided a list of allocated resources, in his evidence, Deputy Commissioner McKechnie confirmed IAPs are not necessarily reliable in terms of recording the actual resources that were available during the time covered by the IAP. The Court would note that it is entirely understandable that, as Deputy Commissioner McKechnie said, these plans sometimes need to change in response to dynamic fire conditions.⁸⁸⁷
275. A document titled ‘Currowan Resourcing’ was prepared as part of Deputy Commissioner McKechnie’s evidence to assist the Court in determining what resources were in fact available on 30-31 December 2019.⁸⁸⁸
276. According to that document, during the day shift on 30 December (8:00am-8:00pm), the East Division had six RFS appliances (each crewed by a team of two to six personnel), a single NPWS Category 9 tanker (with a five person crew) and further support crews. During the swing shift (6:00pm-1:00am), there were three RFS crews (Basin View, Conjola and Kioloa), one NPWS crew, three FRNSW tankers and other FRNSW support vehicles. During the night shift (11:59pm-8:00am), there were two RFS crews (Bawley Point and Cudmirrah), three FRNSW tankers and other support vehicles and one NPWS tanker. Mr Ashton, RFS Divisional Commander for the East Division in late December 2019, told the Court that while there were FRNSW appliances rostered on the night shift on 30-31 December 2019, these appliances did not assist with the backburning efforts around Porters Creek Road.⁸⁸⁹ Mr Magnuson also confirmed that FRNSW strike teams would not be ‘split up’ even if they contained multiple appliances.⁸⁹⁰ Mr Magnuson explained that one FRNSW strike team may be made up of five tankers that could respond to only one call (and not five separate calls).⁸⁹¹
277. Ultimately, some of the crews tasked to the Yatte Yattah sector across the evening of 30 December 2019 were pulled back due to dangerous conditions, namely, the risk of trees falling on firefighters in the fireground.⁸⁹² This would have had the effect of further limiting the number of crews actively patrolling the backburn during these times. The evidence from almost every firefighter witness during the Stage 2 Currowan inquiry was that falling trees in these circumstances posed a significant risk to firefighter safety.

Execution of the strategy

278. These findings will now turn to witness accounts of how the backburn was actually executed on 30 December 2019.
279. Deputy Captain Ross Cunningham of Bawley Point RFS provided a statement to the inquiry. He said he understood his was the only RFS crew on patrol during the night shift on 30-31 December 2019.⁸⁹³ He indicated that due to the presence of dangerous trees, his crew did not travel across the whole of the assigned area (including up to Porters Dam up on the escarpment) due to dangerous trees.⁸⁹⁴ That is consistent with the evidence from several witnesses who gave evidence in the inquiry, all of whom confirming crews were withdrawn from parts of the fire line due to dangerous trees.

⁸⁸⁷ Transcript for 19 May 2023, T 1684:15-20.

⁸⁸⁸ Exhibit 19A, Brief of Evidence at p 3890.

⁸⁸⁹ Transcript for 23 May 2023, T 1815:36-39.

⁸⁹⁰ Transcript for 22 May 2023, T 1758.

⁸⁹¹ Transcript for 22 May 2023, T 1758.

⁸⁹² Transcript for 23 May 2023, T 1799.

⁸⁹³ Exhibit 19A, Brief of Evidence at p. 3341.

⁸⁹⁴ Exhibit 19A, Brief of Evidence at p. 3341.

280. Paul Colebrook of 59 Currowar Lane provided a statement to the Inquiry. On 30 December 2019, he went to Geoff Evans' property at 83 Porters Creek Road, where he saw the NPWS arrive with a dozer, utes and a number of water tankers. Mr Colebrook said he saw NPWS lighting a backburn through the Evans property towards the McCrossin property at 148 Porters Creek Road. Mr Colebrook said he left the Evans property while the backburn was being lit and returned home.⁸⁹⁵
281. Peter Field of 41 Currowar Lane provided a statement to the Inquiry. On the evening of 30 December 2019, he attended a dinner at the Stewart family property at 34A Currowar Lane with other community members. He said he became aware that the NPWS had started a burn at the Evans property on Porters Creek Road. After dinner, around 10:00pm, a group of residents drove through the Stewart property to assess the progress of the backburn. Mr Field said he saw a single RFS crew on Porters Creek Road outside the Stewart property. He said he could see a significant fire burning on the boundary of the Evans property with the State Forest.⁸⁹⁶
282. Ian Stewart of 34A Currowar Lane provided two statements to the Inquiry. He took a series of photographs on 30 December 2019, in particular three photographs⁸⁹⁷ taken around 10:30pm (an hour later than as captioned in the photos) that show fire in the vicinity of Porter Creek Road residents' property boundaries and the McDonald State Forest at that time (one of these is below).⁸⁹⁸



283. Mr Williams provided his perspective on these photos during the Inquiry. Mr Williams said that it was difficult to determine where the photographs were taken from in relation to the backburn and that if the photographer had stepped into burnt bushland, being somewhere near the edge of the backburn, then the photos indicated a significant progression of the Fire and a fair amount of depth had been achieved into the bushland some distance away.⁸⁹⁹ The completely black foreground of the photographs indicated to Mr Williams that that area was fairly cool and without much fire activity.⁹⁰⁰ Alternatively, if the Fire depicted in the photographs was the edge of the backburn as it had just been lit, then Mr Williams advised that it would require mopping up and blacking out particularly where tree bark was alight.⁹⁰¹

⁸⁹⁵ Exhibit 19A, Brief of Evidence at ps. 3478-3479.

⁸⁹⁶ Exhibit 19A, Brief of Evidence at p. 3483.

⁸⁹⁷ Exhibit 19A, Brief of Evidence at ps. 3378-3380.

⁸⁹⁸ Exhibit 19A, Brief of Evidence at ps. 3388-3389.

⁸⁹⁹ Transcript for 23 May 2023, T 1801:18-27.

⁹⁰⁰ Transcript for 23 May 2023, T 1801:3-8.

⁹⁰¹ Transcript for 23 May 2023, T 1780:41-44.

284. Clive Turner was the Captain of the Conjola brigade on the swing shift (6:00pm-1:00am) on 30 December 2019 and was tasked to patrol the backburn around Porters Creek Road. Mr Turner recalled that his crew did the best they could to patrol the burn and ensure there were no runs, but that due to the size of the burn it was too dangerous to access the middle of the burn and they were only able to patrol the eastern perimeter.⁹⁰² Mr Turner said that when his crew left the area at the end of their shift, the backburn was still alight but had reduced in height towards the edge of the burn where they were patrolling.⁹⁰³
285. Martin Lee was also on the swing shift with Mr Turner in the Porters Creek Road area on 30 December 2019. Mr Lee recorded that as he travelled along Porters Creek Road on 30 December 2019, everyone on the truck had been surprised by the large glow cast by the Fire as it appeared to be “a large fire for a backburn (from an RFS perspective)”.⁹⁰⁴ Mr Lee observed the height of the backburn was into the treetops and it was obvious to him that it had not been controlled “as the RFS would have [usually] controlled it”.⁹⁰⁵ Mr Turner also confirmed that when the swing shift finished at 1:00am, the backburn was still burning and Mr Turner believed at that time that it was uncontrollable with the assets on hand.⁹⁰⁶
286. Mr Conway was taken to Mr Stewart’s photos of the Fire at 10:30pm in the course of his expert evidence. Mr Conway said they showed the backburn at that location was still active, and extensive blacking out over a number of shifts would be required.⁹⁰⁷
287. Mr Conway concluded in his report that:⁹⁰⁸
- a. there were minimal crews on the night shift of 30-31 December;
 - b. those crews that were there were unable to access all parts of the fireground due to dangerous trees;
 - c. those crews that undertook the backburning operation did not appear to have stayed on the fireground for the balance of the night shift; and
 - d. the blacking out and patrol undertaken by crews on the night shift and the swing shift on 30-31 December was not consistent with RFS guidance and accepted fire practice, apparently due to a lack of resources for the scale of the task, limited access to the fireline due to falling trees, and gaps in monitoring of the fireground, by fireground managers overseeing the night shift operations.
288. Early on the morning of 31 December 2019, Mr Williams was redeployed to the Clyde Mountain Fire in the Batemans Bay area, managed out of the Moruya FCC. This deployment was called as a matter of urgency because of concerns that the Clyde Mountain Fire would threaten the larger population area around Batemans Bay.
289. As a result, DIC Chris Palmer remained at Milton showground and unexpectedly assumed primary management for the Currowan Fire. Mr Williams offered “sporadic, limited input ... via phone” to Mr Palmer during the day, and at a later point Superintendent Greg Wardle later came in to assist Mr Palmer. This may have happened at around 2:00pm.⁹⁰⁹
290. During the day, a large number of strike teams were sent from Sydney to Batemans Bay in response to the Clyde Mountain Fire. Initially, the conditions caused by the Currowan Fire meant the crews couldn’t pass beyond the broader Conjola area, and were redeployed to fight the Currowan Fire before the road cleared and they could continue to Batemans Bay.⁹¹⁰

⁹⁰² Exhibit 19A, Brief of Evidence at p. 3325.

⁹⁰³ Exhibit 19A, Brief of Evidence at p. 3325.

⁹⁰⁴ Exhibit 19A, Brief of Evidence at p. 3327.

⁹⁰⁵ Exhibit 19A, Brief of Evidence at p. 3327.

⁹⁰⁶ Exhibit 19A, Brief of Evidence at p. 3327.

⁹⁰⁷ Exhibit 19A, Brief of Evidence at p. 3701.

⁹⁰⁸ Exhibit 19A, Brief of Evidence at p. 3702.

⁹⁰⁹ Transcript for 22 May 2023, T 1740:27-33.

⁹¹⁰ Transcript for 22 May 2023, T 1741:4-11.

Result

291. In terms of the conclusions set out within the RFS Factual Investigation, Mr Conway agreed in his report that the conclusions drawn by the RFS Predictive Services team based on the simulations run with Phoenix RapidFire were valid in that the final outcome on the day of 31 December 2019 was not substantially influenced by the backburns undertaken on the evening of 30 December.⁹¹¹
292. In other words, the assessment indicated that the outcome on 31 December 2019 would have occurred regardless of the backburning operation.⁹¹²
293. Mr Conway noted the linescan taken at 9:50 am on 31 December showed the main firefront making a major run to the east southeast which would certainly have generated spotting off the top of the escarpment.⁹¹³
294. While the witness statements indicated that there may have been spotting from the backburns, this suggested to Mr Conway that some properties may have been affected by fire earlier in the day than they might otherwise have been if the backburns had not been undertaken.⁹¹⁴
295. Mr Conway concluded that the progression of the fire front from the top of the escarpment, and the potential for spot fires in those weather conditions were such that the backburns lit on the evening of 30 December 2019 did generate spotting on the morning of 31 December but were overrun by the main fire as the day progressed.⁹¹⁵
296. In his oral evidence, Mr Conway remarked upon the unique topography of the escarpment to the west of Yatte Yattah, which elevates dramatically compared with the plateau to its east.
297. One of the consequences of this topography is the variation of fire behaviour between the top of the escarpment and the lower, coastal plateau where Yatte Yattah sits, in addition to the presence of gullies running eastward down the escarpment, which have the potential to generate turbulent wind.
298. Both of these phenomena (relative height difference and wind turbulence) have the potential to increase spotting distance, or the distance travelled by burning material being carried through the air in strong winds.⁹¹⁶
299. In oral evidence, Mr Conway said it was not possible to be “*definitive*” as to whether the Fire that first impacted upon properties on Porters Creek Road and Currowar Lane on 31 December 2019 were from the strategic backburn, the Currowan Fire or a combination of the two.
300. However, he was confident that there was a very intense run of fire off the top of the escarpment towards the north and west of Pointer Mountain and the Yatte Yattah area which eventually generated significant spotting and the development of fire on the coastal plain.
301. He said: “*I don’t think there’s any question in my mind that the main Currowan fire was very much the cause of that developing fire on the coastal plain⁹¹⁷ and the one thing I can confidently make an observation about is that it was the fire run off the top of the escarpment that ultimately generated the outcomes of the day*”.⁹¹⁸

⁹¹¹ Exhibit 19A, Brief of Evidence at p. 3704.

⁹¹² Exhibit 19A, Brief of Evidence at p. 3703.

⁹¹³ Exhibit 19A, Brief of Evidence at p. 3704.

⁹¹⁴ Exhibit 19A, Brief of Evidence at p. 3704.

⁹¹⁵ Exhibit 19A, Brief of Evidence at p. 3704.

⁹¹⁶ Transcript for 25 May 2023, T 1853:26-35.

⁹¹⁷ Transcript for 25 May 2023, T 1860:41-43.

⁹¹⁸ Transcript for 25 May 2023, T 1866:20-23.

CONCLUSION

Timing and ignition pattern

The Eastern Containment Strategy was first mentioned in the IC's section 44 chronology on 7 December 2019.

Containment line construction and backburning operations were occurring on most days throughout December 2019.

By 30 December 2019, the eastern containment line was largely completed, however there remained a number of areas that had not yet had the backburn implemented. The strategy on 30 December 2019 was to attempt to "close the gates" including at Porters Creek Road ahead of predicted adverse weather on 31 December 2019. Backburning was inevitably completed on 30 December 2019, with crews patrolling and mopping up on 31 December 2019.

Resourcing

According to a document titled 'Currowan Resourcing' prepared by RFS Deputy Commissioner McKechnie, during the day shift on 30 December (8:00am-8:00pm), the East Division had:

- a. Six RFS appliances (each crewed by a team of two to six personnel);
- b. One NPWS Category 9 tanker (with a five person crew); and
- c. Further support crews.

During the swift shift (6:00pm-1:00am) on 31 December 2019, there were:

- a. Three RFS Crews (Basin View, Conjola and Kioloa);
- b. One NPWS crew;
- c. Three FRNSW tankers; and
- d. Other FRNSW support vehicles.

Some of the crews tasked to the Yatte Tattah sector across the evening of 30 December 2019 were pulled back due to dangerous conditions (falling trees).

Monitoring

The line of control over fireground activities included sector commanders reporting through the Divisional Operations Lead to the Division Commander.

Result

Simulations run with Phoenix RapidFire indicated that the outcome of 31 December 2019 would have occurred irrespective of whether any backburning took place. Mr Conway agreed with this assessment based on the simulation. However, in oral evidence he said that it was not possible to be "definitive" as to whether the Fire that first impacted upon properties on Porters Creek Road and Currowan Lane on 31 December 2019 were from the strategic backburn, the Currowan Fire or a combination of the two.

Responding to recommendations from the NSW Bushfire Inquiry

ISSUE 10

What if any response has there been to the following recommendations from the NSW Bushfire Inquiry:

Recommendation 47: That, in order to enhance firefighting strategies in severe conditions, the NSW RFS implement the following in respect to backburning:

- a. *Establish protocols for each category (tactical and strategic) within their operational and training doctrine. These protocols should include lessons learnt from the 2019/2020 season;*
- b. *Modify 'ICON' to implement the capability to record all backburns, including whether or not they break containment lines;*
- c. *When fire conditions are approaching Severe or above, an independent review must be undertaken at State Operations Level before strategic backburns are implemented; and*
- d. *Where there is significant concern within a community regarding a backburn, the NSW RFS should undertake a community engagement session with affected residents to discuss the backburn, including any investigation and relevant findings.*

Recommendation 48: That Government commission further research on the potential risks and benefits of backburning during severe, extreme and catastrophic conditions and/or in particular terrain, and that the NSW RFS use this research to inform future backburning protocols and training.

302. Dealing with part a) of Recommendation 47: that the RFS establish protocols for each category (tactical and strategic) within their operational and training doctrine.
303. The Operations Directorate of the RFS, in consultation with key RFS IMT personnel involved in the 2019/2020 bushfire season prepared 'OP 1.2.20 - Operational Protocol for Backburning'. The protocol specifically states that it addresses part a) and c) of Recommendation 47.⁹¹⁹
304. The Protocol provides the following definitions of strategic and tactical backburns (**emphasis added**):

Strategic Backburning

*Strategic Backburning is used as one of the primary means to halt the main fire or to secure the spread of parts of a fire. It is proactive, generally conducted over a larger area than Tactical Backburning, and may involve implementing burns of hundreds of metres up to kilometres in length and depth. Strategic Backburning is planned and informed by a range of personnel including fireground commanders, members with local knowledge, and Fire Behaviour Analysts, and is usually part of the plan in the IAP. It is carefully co-ordinated, suitably resourced and **must only be conducted with approval from the Incident Controller**. Strategic backburns usually increase the effective area that is involved in fire.*

Tactical Backburning

*Tactical Backburning is used to protect specific assets or for other small-scale purposes. It is conducted at a small scale, often within limits of the OIC's visibility. **It is conducted at the discretion of field commanders and/or Brigade and Group officers**, often reactively, and is not usually contained in the IAP. It must not interfere with other firefighting operations and is generally conducted under orders from the officer in charge of the area which it will affect. Tactical backburns do not usually influence the overall fire path or progression of the fire.⁹²⁰*

⁹¹⁹ Exhibit 56A, Brief of Evidence at p. 3407.

⁹²⁰ Exhibit 56A, Brief of Evidence at p. 3408-3409.

305. The Protocol goes on to say:
- It is extremely important that all members understand the difference between these types of backburns. A backburn that cannot be easily controlled by the appliances present, and that will notably contribute to growth of the overall fire area, should always be considered strategic, not tactical.*⁹²¹
306. Turning to part b) of Recommendation 47: *that the RFS modify 'ICON' to implement the capability to record all backburns, including whether or not they break containment lines.*
307. In the Quarterly Progress Report of the NSW Bushfire Inquiry for January to March 2022, the RFS notes that *'backburning can be recorded in ICON intel module'*.
308. In his oral evidence, Deputy Commissioner McKechnie confirmed that post-2019/2020, the RFS updated ICON to require that a record of any backburns – strategic or tactical – is included within an incident record before it can be closed off.⁹²² He expected all but perhaps the most fleeting and trivial of tactical backburns would be recorded under this new system, and all strategic backburns would almost certainly be included, as the person entering the data would likely be a member of the IMT.⁹²³
309. Importantly, this functionality has the consequence that one can now hypothetically go back and look at the number of tactical backburns that have taken place in a particular fire district over a given period.⁹²⁴
310. Turning to part c) of Recommendation 47: *when fire conditions are approaching Severe or above, an independent review must be undertaken at State Operations Level before strategic backburns are implemented.*
311. This is also dealt with in the RFS OP 1.2.20 – Operational Protocol for Backburning, which now provides that when a strategic backburn is being considered, and the Fire Behaviour Index in the 36 hours from the time of the burn exceeds or is forecast to exceed 50, the IC must contact the Major Incident Co-ordination Desk or State Duty Operations Officer to request an independent review be convened by officers approved by the SOC.⁹²⁵
312. Following the provision of the required information, the independent review is convened by the SOC, who consults suitable officers (such as FBAs) and ultimately advises the IC if the strategic backburn plan is supported or not.⁹²⁶
313. Turning to part d) of Recommendation 47: *where there is significant concern within a community regarding a backburn, the NSW RFS should undertake a community engagement session with affected residents to discuss the backburn, including any investigation and relevant findings.*
314. Deputy Commissioner McKechnie confirmed that the letter of appointment for ICs since the 2019/2020 bushfire season now requires the IC to consider the need for community consultation at the end of a section 44 declaration, regardless of whether the backburn was successfully implemented or not.⁹²⁷
315. Deputy Commissioner McKechnie added that since 2019/2020, the RFS has embedded psychologists within the RFS to enable the provision of care for RFS volunteers and staff, but also to assist in advice and planning if needed for events such as community consultations.⁹²⁸
316. Now addressing Recommendation 48: *That Government commission further research on the potential risks and benefits of backburning during severe, extreme and catastrophic conditions and/or in particular terrain, and that the NSW RFS use this research to inform future backburning protocols and training.*

⁹²¹ Exhibit 56A, Brief of Evidence at p. 3409.

⁹²² Transcript for 19 May 2023 T 1693.

⁹²³ Transcript for 19 May 2023 T 1693-1694.

⁹²⁴ Transcript for 19 May 2023 T 1693.

⁹²⁵ Exhibit 56A, Brief of Evidence at p. 3410.

⁹²⁶ Exhibit 56A, Brief of Evidence at p. 3411–3412.

⁹²⁷ Transcript for 19 May 2023 T 1694.

⁹²⁸ Transcript for 19 May 2023 T 1697.

317. In the Quarterly Progress Report of the NSW Bushfire Inquiry for January to March 2022, the RFS noted: ‘NSW RFS and DPE to continue support for the University of Wollongong’s NSW Bush Fire Risk Management Research Hub and include back burning into the research program.’⁹²⁹
318. In this regard the University of Wollongong provided a draft report to the RFS that evaluated backburning undertaken in response to seven fires during the 2019/2020 fire season. Neither the Grose Valley, Mount Wilson nor the Currowan strategic backburns were subject to this analysis but the report is of significant relevance to the Court’s Inquiry because of the stated objectives of the study.
319. The University of Wollongong study had as its objectives:⁹³⁰
- a. to understand and document the available data to categorise backburns as strategic or tactical and analyse their fates;
 - b. to explore methods for quantitative analysis of backburn data;
 - c. to document how many backburns occurred during the 2019/2020 bushfire season and what their fate was; and
 - d. to understand the weather conditions under which backburns tend to be successful or unsuccessful according to their stated objective.
320. RFS analysts selected seven bushfires from the 2019/2020 season that represented the range of sizes and conditions experienced during the season.⁹³¹ Although the draft report drew from a relatively small sample size, it nonetheless included a number of potentially relevant findings including:⁹³²
- a. the IAPs do not routinely incorporate reference to strategic backburns despite the fact they are commonly
 - b. strategic and tactical backburns was rarely made within the documentation.
321. Approximately half the backburns analysed by the University of Wollongong as having occurred in response to the seven fires that were investigated were on the final fire perimeter. This suggested those backburns actually contained a fire that otherwise would have spread further.⁹³³
322. About a quarter of backburns were beyond the final fire perimeter, meaning the Fire never reached them. The authors of the report were careful to suggest fire agencies should aim to reduce this figure because of the delicate trade-off between implementing a backburn which proves not to be useful against the risk of major impact if it is not implemented.⁹³⁴
323. About a quarter of backburns considered in the University of Wollongong study were overrun by fire. The authors advised it is hard to judge whether this is a reasonable outcome because tactical backburns are expected to be overrun. The authors noted there is a trade-off between implementing a backburn which has a high risk of being overrun, against the great benefit if the backburn is in fact successful in suppressing the Fire.⁹³⁵
324. The authors also noted the lack of documentation defining burns as either strategic or tactical hampered the interpretation of these results. This echoes the findings of the NSW Bushfire Inquiry.⁹³⁶
325. The report identified that backburns which did not stop fires (that is, they merely slowed or had no effect on the Fire) tended to occur in conditions with a higher FFDI rating than that which existed for backburns which did stop fires. However, there was a wide range of FFDI values across the backburns studied, meaning the authors could not confidently predict FFDI thresholds that might lead to low or high risk of escape.⁹³⁷

⁹²⁹ Exhibit 61, Brief of Evidence at p. 730.

⁹³⁰ Exhibit 56A, Brief of Evidence at p. 3712.

⁹³¹ Exhibit 56A, Brief of Evidence at p. 3712.

⁹³² Exhibit 56A, Brief of Evidence at p. 3726.

⁹³³ Exhibit 56A, Brief of Evidence at p. 3727.

⁹³⁴ Exhibit 56A, Brief of Evidence at p. 3727.

⁹³⁵ Exhibit 56A, Brief of Evidence at p. 3727.

⁹³⁶ Exhibit 56A, Brief of Evidence at p. 3727.

⁹³⁷ Exhibit 56A, Brief of Evidence at p. 3727.

326. The authors attributed the variation in FFDI values within each backburn result type to the many possible reasons which might impact upon success or failure of a specific backburn: that is, the FFDI was not the only variable. Matters such as fuel load and topography would be of obvious relevance in this respect.⁹³⁸
327. The University of Wollongong study therefore recommended further research into this area, including extending their examination to more fires in view of the current sample being small and perhaps not representative of the entire 2019/2020 season.⁹³⁹
328. In his oral evidence, Deputy Commissioner McKechnie added that a new natural hazards research centre is in the process of being set up in NSW, led by the University of Western Sydney and other universities, and it is the RFS' intention to engage through that medium with further research around backburning once the necessary procurement procedures are completed.⁹⁴⁰

Other matters

ISSUE 11

Whether it is otherwise necessary or desirable for the Coroner to make recommendations pursuant to section 82 of the Coroners Act 2009 in relation to any matter connected with these fire inquiries.

329. Counsel Assisting submitted that in view of the evidence of progress on Recommendations 47 and 48 received by the Court, that it is not necessary to make any Recommendations.
330. The AOCG submitted that the following recommendations ought to be made:
1. *That NSW Rural Fire Service OP 1.2.20 Operational Protocol for Backburning be strengthened as follows:*
 - a. *Specific Risk analysis, consequence analysis and contingency planning to be completed as part of operational planning prior to a strategic backburn operation including:*
 - i. *Development & implementation of standardised risk assessment, consequence analysis and contingency planning processes to be completed prior to a strategic backburn operation.*
 - ii. *Use of appropriately validated fire prediction tools and localised fire knowledge and expertise in validating the fire risk assessments above.*
 - b. *That there be mandatory public reporting of identified threats posed by planned backburning including:*
 - i. *Publication of risk analysis and consequence analysis prior to the backburn commencing, if practicable in the circumstances. If not, this to be done as soon as possible.*
 - ii. *Publication of risk and threat assessment if backburn escapes.*
 - iii. *Location of backburn to be clearly identified, including planned limits of backburn on a map for public dissemination.*
 - iv. *Identification of backburn as a separate fire, with naming distinction, to ensure clear and informative public communication.*
 - v. *Where threats are identified through risk analysis the NSWPF must be notified before the operation begins as an issue of public safety.*
 - c. *Calls for emergency warnings from fireground managers are escalated directly to State Operations*

⁹³⁸ Exhibit 56A, Brief of Evidence at p. 3727.

⁹³⁹ Exhibit 56A, Brief of Evidence at p. 3727.

⁹⁴⁰ Transcript for 19 May 2023 T 1695.

- d. *Mandatory documenting, minuting and record keeping of planning meetings relating to strategic backburning operations*
 - e. *Local NPWS staff and RFS brigades from regions identified at risk from a backburning operation must be involved in the planning, consulted and advised of a strategic backburn operation prior to the operation beginning.*
 - f. *Given the Operational Protocol states that strategic backburns are rarely initiated at short notice in the field¹¹², the RFS conduct mandatory community consultation prior to the commencement of a strategic backburn.*
 - g. *That the Rural Fire Service conduct scientific fuel moisture content readings with appropriately calibrated fuel moisture meters:*
 - i. *Prior to the commencement of strategic backburn operations*
 - ii. *Routinely during the operation along with standard Situation Report weather observations along with temperature, relative humidity, wind direction and wind speed.*
 - iii. *That fuel moisture content readings and test burns are conducted prior to all backburn operations.*
 - h. *Fuel Moisture Content calculations based on forecast conditions be used:*
 - i. *That safe minimum and maximum Fuel Moisture Content limit be identified for each backburn operation.*
 - ii. *The Rural Fire Service develop and make public a set of protocols that define the minimum and maximum weather and fuel conditions that strategic backburning must be conducted within.*
 - iii. *Where a strategic backburn is planned and does not meet these conditions, a review at State Operations must be undertaken and documented.*
2. *Backburning protocols must be enforced with disciplinary action mandated for personnel who are found to have breached protocols.*
- When a backburning operation is identified as escaping containment, a mandatory post-incident review should take place with the following aims:*
- a. *Assess whether the relevant employees of the RFS or NPWS were in compliance with operating procedures and backburning protocols.*
 - b. *Incorporate feedback from affected communities into the review*
 - c. *That disciplinary action be mandated when personnel are identified as breaching protocols*
 - d. *Publish the findings of the review for public comment.*
3. *The NSW Government implement an independent Inspector General of Emergency Services to promote continuous improvement and best practice.*
 4. *That the NSW Government commission an independent study to establish the social and economic costs of backburning operations across the state.*
 5. *That the NSW Government formally apologise to residents, firefighters and communities that are adversely impacted by escaped backburns.*
 6. *That the NSW Government establish a compensation scheme for residents and communities impacted by the escaped Mount Wilson backburn and other backburns across the state.*

331. Counsel Assisting submitted it would not be appropriate for the Court to make the above recommendations for the following reasons:
- a. the proposed changes to RFS policies and procedures were not put to Deputy Commissioner McKechnie or any other suitable witness during the evidence for this Inquiry so the Court has no evidence as to the utility or practicality of recommending such measures.
 - b. those recommendations largely canvass matters which fall outside the scope of this particular Inquiry and the Issues List.
 - c. in particular, the proposed recommendations directed to the NSW RFS and the NSW Government at large do not have any evidentiary foundation with the underlying premises having not been the subject of evidence, including by being put to relevant witnesses during oral evidence. There is, therefore, no evidence before the Court which would allow the recommendations proposed by the AOCG to be made.
 - d. further, several recommendations are directed towards the 'NSW Government', which was not represented at the inquiry by a capable Department and was similarly not called upon during the hearing to make answer to the utility, practicality, or appropriateness of any such recommendations.

CONCLUSION

I have considered the proposed recommendations put forward by the experts on behalf of the AOCG, and the submissions of the AOCG set out above in paragraph 330 above, together with the submission of Counsel Assisting.

I find that no recommendations are warranted in the circumstances for the reasons stated above in paragraph 331 above and in view of the evidence of progress on Recommendations 47 and 48 of the NSW Bushfire Inquiry (detailed in paragraphs 302–328 above and not repeated here for brevity).

332. I wish to express my sincere gratitude to those who have aided and provided information to the Court to assist with the general inquiry that considered the topic of Backburning Operations – Planning and Execution.
333. I also wish to express my appreciation to the affected owners who willingly and openly shared their invaluable, personal experiences of the fires, and acknowledge the trauma still being felt by many affected individuals and communities.

Part 11

Appendices

11

Appendix 1: Legal Team Assisting the State Coroner

NAME	CHAMBERS/OFFICE
Counsel Assisting	
Adam Casselden SC	Greenway Chambers, Sydney
Donna Ward SC	Frederick Jordan Chambers, Sydney
Matthew Harker	Greenway Chambers, Sydney
Tracey Stevens	Maurice Byers Chambers, Sydney
Jonathan Wilcox	Sir Owen Dixon Chambers, Sydney
Solicitor Assisting	
Lincoln Chee	Department of Communities and Justice, Sydney
Legal Team Assisting	
Elizabeth Favalaro	Department of Communities and Justice, Sydney
Trinity Higgs	Department of Communities and Justice, Sydney
Alexander Jobe	Department of Communities and Justice, Sydney
Mena Katawazi	Department of Communities and Justice, Sydney
Claire Dunn	Department of Communities and Justice, Sydney
Geeti Faramarzi	Department of Communities and Justice, Sydney
Rebecca Hubbard	Department of Communities and Justice, Sydney
Danae Lekakis	Department of Communities and Justice, Sydney
Connie Livanos	Department of Communities and Justice, Sydney
Valentina Markovina	Department of Communities and Justice, Sydney
Elizabeth May	Department of Communities and Justice, Sydney
Ryan Schmidt	Department of Communities and Justice, Sydney
Lara Vaccaro	Department of Communities and Justice, Sydney
Eden Cortes	Department of Communities and Justice, Sydney
Lilyanne Jones	Department of Communities and Justice, Sydney
Caroline Li	Department of Communities and Justice, Sydney
Tanith Nair	Department of Communities and Justice, Sydney

Appendix 2: Inquiry Support Officers

NAME	DEPARTMENT/ORGANISATION
Administrative Officers	
Chloe Johnson	Office of the State Coroner, Sydney
Donna Schriever	Office of the State Coroner, Sydney
Habib Tohme	Office of the State Coroner, Sydney
Eva Tuautu	Office of the State Coroner, Sydney
Media Liaison	
Albert Martinez	Department of Communities and Justice, Sydney
Coronial Information And Support	
Coronial Information and Support Team	Office of the State Coroner, Sydney
Registry Support And Court Officers	
Ann Lambino	Office of the State Coroner, Sydney
Ernest Harrington	Office of the State Coroner, Sydney
Ann Noller	Office of the State Coroner, Sydney
Shaun Flint	Office of the State Coroner, Sydney
Marie-Louise Swaney	Office of the State Coroner, Sydney
IT Support Staff	
Robert Dubois	Department of Communities and Justice, Sydney
Alan Dodd	Department of Communities and Justice, Sydney
Erick Reboredo	Department of Communities and Justice, Sydney

Appendix 3: Legal Representatives for Interested Parties and Other Affected Persons

COUNSEL/ SOLICITOR	LEGAL REPRESENTATIVE	CHAMBERS/FIRM/ OFFICE	INTERESTED PARTIES/ AFFECTED PERSONS
Counsel	Stephen Free SC	Eleven Wentworth, Sydney	NSW Rural Fire Service Fire and Rescue NSW (Kian Road, South Arm Fire only) Forestry Corporation of NSW
	Nicholas Newton	11th Floor St James Hall, Sydney	
	Sarah Woodland	11th Floor St James Hall, Sydney	
Solicitors	Helen Allison Jordan Power	Crown Solicitor's Office (NSW)	
Counsel	Jennifer Single SC	12 Wentworth Selborne Chambers Sydney	National Parks and Wildlife Service
	Amelia Avery-Williams	12 Wentworth Selborne Chambers, Sydney	
Solicitor	Leighton Hawkes	McCabes Lawyers, Sydney	
Counsel	Simon Glascott	9 Windeyer Chambers, Sydney	Bega Valley Shire Council
Solicitor	Fiona McGinley	Mills Oakley, Sydney	
Counsel	Phillip Thomas	9 Selborne Chambers, Sydney	Brett Wheway, Affected Landowner
Solicitor	Nicholas Andrew	Barry Nilsson Lawyers, Sydney	
Solicitor	Peerce McManus	Legal Aid NSW	Shane Clarke
Solicitors	Dr Ashley Tsacalos	Clayton Utz, Sydney	Megan McPaul, wife of Samuel McPaul
	Julia Cantarella		Jessica Hayes, partner of Geoffrey Keaton
	Lycia Hayes		Melissa O'Dwyer, wife of Andrew O'Dwyer
Solicitor	Christopher Slan	Shine Lawyers, Sydney	Noreen Hudson, wife of Paul Hudson
			Bowdie McBeth, wife of Ian McBeth

COUNSEL/ SOLICITOR	LEGAL REPRESENTATIVE	CHAMBERS/FIRM/ OFFICE	INTERESTED PARTIES/ AFFECTED PERSONS
Counsel	Chris McDermott	Aickin Chambers, Melbourne	Australian Transport Safety Bureau
Solicitors	Patrick Hornby Ming Li	Australian Transport Safety Bureau, Sydney	
Counsel	Greg O'Mahoney	New Chambers, Sydney	Coulson Aviation
Solicitors	Andrew Dunn Mark Mackrell	Norton White, Sydney	
Counsel	Hernan Pintos-Lopez	Greenway Chambers, Sydney	Essential Energy
Solicitors	Catherine Wilkinson Renee Compain-Helsloot	Sparke Helmore Lawyers, Newcastle	
Counsel	Alexandra Rose	Black Chambers, Sydney	NSW Police
Solicitor	Rebecca Atherton	NSW Police, Sydney	
Solicitor	Steven Bolt	Bolt Findlay, Sydney	Six affected landowners in relation to Myall Creek Road, Bora Ridge Fire
Solicitors	Kizzy Bagga Emily Ransom	Hall and Wilcox, Sydney	Insurance Australia Group Limited (IAG)
Counsel	Tim Tobin SC	Owen Dixon Chambers West, Melbourne	36 affected landowners in relation to Palmers Oakly, Upper Turon Fire
	Daniel Nguyen	Castan Chambers, Melbourne	
	William Mellor	Nexus Chambers, Adelaide	
Solicitor	Kathryn Emeny	Maddens Lawyers, Victoria	
Counsel	Adam Searle	State Chambers, Sydney	Jochen Spencer and Kooryn Sheaves, spokespersons for affected landowners in relation to Grose Valley, Mount Wilson Fire
	Liam James	Level 22 Chambers, Sydney	
Solicitor	Roderick Storie	Roderick Storie Solicitors, Windsor	

Appendix 4: Police Coronial Investigation Team

NO.	INQUIRY/INQUEST	NAME	SQUAD/LOCAL AREA COMMAND
1.	Badja Forest, Forest Road Fire Inquiry Deua National Park (Coondella) Fire Inquiry	Detective Senior Constable Glenn Bradley	Fraud Unit, State Crime Command
2.	Inquest into the death of Colin Harold Burns		
3.	Inquests into the deaths of Robert John Salway and Patrick James Salway		
4.	Inquest into the death of Michael Stanley Clarke		
5.	Inquest into the death of Ross Alphonsus Rixon		
6.	Inquest into the Richard John Steele		
7.	Inquest into the death of John Robert Smith		
8.	Werri Berri Fire Inquiry		
9.	Green Valley, Talmalmo Fire Inquiry	Detective Senior Constable Paul Blanch	Arson Unit, State Crime Command
10.	Inquest into the death of Samuel Ian McPaul	Detective Sergeant Dane Kremers Detective Acting Inspector Hassan El-Khansa	
11.	Dunns Road, Ellerslie Range Fire Inquiry East Ournie Creek, Ellerslie Range Fire Inquiry	Detective Senior Constable Peter Alexander	Arson Unit, State Crime Command
12.	Inquest into the death of David Andrew Harrison		
13.	Adaminaby Complex Fire Inquiry	Detective Senior Constable Ben Waldron	Arson Unit, State Crime Command
14.	Border (Rockton) Fire Inquiry	Detective Senior Constable Glenn Bradley	Fraud Unit, State Crime Command
15.	Currowan Cluster of Fires: <ul style="list-style-type: none"> • Currowan, Clyde Ridge Road Fire Inquiry • Tianjara, Braidwood Road Fire Inquiry • Morton Fire Inquiry • Clyde Mountain Fire Inquiry • Charley's Forest (Monga National Park) Fire Inquiry 	Detective Senior Constable Natalie Burston	Financial Crimes Squad, Arson Unit, State Crime Command

NO.	INQUIRY/INQUEST	NAME	SQUAD/LOCAL AREA COMMAND
16.	Inquest into the death of Laurence Alan Andrew	Detective Senior Constable Simone Hackett	Arson Unit, State Crime Command
17.	Inquest into the death of John Ronald Butler	Detective Senior Constable Natalie Burston	
18.	Inquest into the death of Michael Campbell		
19.	Clyde Mountain Fire Inquiry	Detective Senior Constable Geoffrey Horn	Arson Unit, State Crime Command
20.	North Black Range, Palerang Fire Inquiry	Detective Senior Constable Ben Waldron	Arson Unit, State Crime Command
21.	Long Gully Road, Drake Fire Inquiry	Detective Senior Constable Timothy Atkins	Inverell Police
22.	Inquest into the deaths of Robert Frederick Lindsay and Gwendoline Mair Hyde	Detective Senior Constable Steven Hoffman	Casino Police
23.	Busbys Flat, Rappville Fire Inquiry		
24.	Gulf Road, Torrington Fire Inquiry	Detective Senior Constable Nicole Ramsay	Glen Innes Police
25.	Washpool State Forest, Coombadjha Fire Inquiry	Detective Senior Constable Travis Ware	Coffs-Clarence Police
26.	Kangawalla, Diehard Fire Inquiry	Detective Sergeant Damian Loone	New England Police
27.	Inquest into the death of Vivien Christine Chaplain	Detective Sergeant Timothy Atkins	Inverell Police
28.	Inquest into the death of George Nole		
29.	Bees Nest (Guy Fawkes National Park) Fire Inquiry	Detective Sergeant Matthew Crotty	Armidale Police
30.	Liberation Trail (Chaelundi) Fire Inquiry	Detective Senior Constable Vivienne Thomas	Coffs-Clarence Police
31.	Kian Road, South Arm Fire Inquiry	Detective Senior Constable Brian Priest	Macksville Police
32.	Inquest into the death of Christopher Savva	Senior Constable Justin Simpson	Macksville Police
33.	Mount Mackenzie Road, Tenterfield Fire Inquiry	Detective Senior Constable Nicole Ramsay	Glenn Innes Police
34.	Carrai Creek Fire Inquiry Carrai East (Jacobs Spur, Willawarrin) Fire Inquiry	Detective Senior Constable Simon Cass Detective Senior Constable Brian Priest Detective Senior Constable Mark Symons	Kempsey Police Armidale Police

NO.	INQUIRY/INQUEST	NAME	SQUAD/LOCAL AREA COMMAND
35.	Stockyard Flat, Yarrowitch Fire Inquiry	Senior Constable Michael McDonnell	Walcha Police
36.	Inquest into the death of Russell Bratby		
37.	Inquest into the death of Barry Parsons	Detective Senior Constable Simon Cass Detective Senior Constable Brian Priest	Kempsey Police
38.	Myall Creek Road, Bora Ridge Fire Inquiry	Detective Senior Constable Emma Hogan	Ballina Police
39.	Rumba Complex Dingo Tops Road (Tapin Tops National Park) Fire Inquiry	Detective Chief Inspector Rodney Blackman	Taree Police
40.	Bills Crossing, Crowdy Bay Fire Inquiry	Detective Sergeant David Frith	
41.	Inquest into the death of Julie Fletcher		
42.	Failford Road, Darawank Fire Inquiry		
43.	Hillville Fire Inquiry		
44.	Green Wattle Creek (Lake Burragorang) Fire Inquiry	Detective Sergeant Daniel Clements	Camden Police
45.	Ruined Castle, Kedumba Valley Fire Inquiry	Detective Senior Constable Nicole Dunn	Blue Mountains Police
46.	Inquest into the death of Geoffrey Wesley Keaton	Leading Senior Constable Bryan Wilson	Metropolitan Crash Investigation Unit, Hawkesbury Local Area Command
47.	Inquest into the death of Andrew Joel O'Dwyer		
48.	Gospers Mountain (Wollemi National Park) Fire Inquiry	Detective Sergeant Joshua Holgate	Mudgee Police
49.	Grose Valley, Mount Wilson Fire Inquiry	Detective Sergeant Laura Harvey	Hawkesbury Police Area Command, Windsor
50.	Little L Complex, Laguna Fire Inquiry	Plain Clothes Senior Constable Katie Platt	Hunter Valley Police
51.	Palmers Oaky, Upper Turon Fire Inquiry	Detective Sergeant Glenn Griffith	Bathurst Police
52.	Good Good, Peak View Fire Inquiry	Detective Senior Constable Ben Waldron	Arson Unit, State Crime Command

NO.	INQUIRY/INQUEST	NAME	SQUAD/LOCAL AREA COMMAND
53.	Creewah Cluster of Fires: <ul style="list-style-type: none"> • Creewah Road, Glen Allen Fire Inquiry • Postmans Trail, Tantawangalo Fire Inquiry • Big Jack Mountain Road, Cathcart Fire Inquiry 	Detective Chief Inspector Richard Puffett Detective Senior Constable Robert Bruce (Creewah Road) Detective Senior Constable Evan Gray (Postmans Trail & Big Jack Mountain)	Arson Unit, State Crime Command Monaro Police Bega Police
54.	Inquest into the death of Rick Allen DeMorgan Jr	Detective Senior Constable Justin Taylor	Arson Unit, State Crime Command
55.	Inquest into the death of Paul Hudson		
56.	Inquest into the death of Ian McBeth		

Appendix 5: Witness List

NO.	NAME	PROCEEDINGS	STAGE	DATE WITNESS CALLED
1.	Detective Senior Constable Glenn Bradley, Officer in Charge	Badja Forest, Forest Road Fire Inquiry Deua National Park (Coondella) Fire Inquiry	1	6 September 2021
2.	Ian Cook, RFS Fire Investigator	Badja Forest, Forest Road Fire Inquiry Deua National Park (Coondella) Fire Inquiry	1	6 September 2021
3.	Darin Howell, RFS Fire Investigator	Badja Forest, Forest Road Fire Inquiry Deua National Park (Coondella) Fire Inquiry	1	6 September 2021
4.	Detective Senior Sergeant Gregory Moon, FETS	Badja Forest, Forest Road Fire Inquiry Deua National Park (Coondella) Fire Inquiry	1	7 September 2021
5.	Ewan Thomson, RFS Volunteer	Inquest into the death of Colin Harold Burns	1	7 September 2021
6.	Deborah Dance, Resident	Inquest into the death of Colin Harold Burns	1	7 September 2021
7.	Peter Anderson, Resident	Inquests into the deaths of Robert John Salway and Patrick James Salway	1	7 September 2021
8.	Robert Eder, Resident	Inquest into the death of Michael Stanley Clarke	1	8 September 2021
9.	James Neil, Resident	Inquest into the death of Ross Alphonsus Rixon	1	8 September 2021
10.	Ernst Berger, Resident	Inquest into the death of Richard John Steele	1	9 September 2021
11.	Kurt Rogan, Resident	Inquest into the death of John Robert Smith	1	9 September 2021
12.	Detective Senior Constable Glenn Bradley, Officer in Charge	Werri Berri Fire Inquiry	1	13 September 2021
13.	Jake Roarty, RFS Helicopter Pilot	Werri Berri Fire Inquiry	1	13 September 2021

NO.	NAME	PROCEEDINGS	STAGE	DATE WITNESS CALLED
14.	John Inskip, RFS Captain of the Bemboka Brigade	Werri Berri Fire Inquiry	1	13 September 2021
15.	Detective Senior Sergeant Gregory Moon, FETS	Werri Berri Fire Inquiry	1	13 September 2021
16.	Darin Howell, RFS Fire Investigator	Werri Berri Fire Inquiry	1	13 September 2021
17.	Detective Acting Inspector Hassan El-Khansa, NSWPF	Green Valley, Talmalmo Fire Inquiry	1	14 September 2021
18.	Detective Sergeant Dane Kremers, NSWPF	Green Valley, Talmalmo Fire Inquiry	1	14 September 2021
19.	Angus Bullough, RFS Fire Investigator	Green Valley, Talmalmo Fire Inquiry	1	14 September 2021
20.	Mark Reeves, RFS Volunteer	Green Valley, Talmalmo Fire Inquiry	1	15 September 2021
21.	Matthew Hicks, RFS Group Captain	Inquest into the death of Samuel Ian McPaul	1	15 September 2021
22.	Rodney O'Keefe, RFS Volunteer	Inquest into the death of Samuel McPaul	1	15 September 2021
23.	Andrew Godde, RFS Captain of the North West Culcairn Brigade	Inquest into the death of Samuel Ian McPaul	1	15 September 2021
24.	Senior Constable Mark Lester, FETS	Inquest into the death of Samuel Ian McPaul	1	15 September 2021
25.	Sergeant Derick Fenton, FETS	Inquest into the death of Samuel Ian McPaul	1	16 September 2021
26.	Mark Sculthorpe, Consultant Motor Vehicle Crash Reconstructionist and Forensic Investigator	Inquest into the death of Samuel Ian McPaul	1	16 September 2021
27.	Kenneth Edwards, RFS Safety Supervisor	Inquest into the death of Samuel Ian McPaul	1	16 September 2021
28.	Mika Peace, Senior Research Scientist, Bureau of Meteorology	Inquest into the death of Samuel Ian McPaul	1	16 September 2021
29.	Detective Senior Constable Peter Alexander, Officer in Charge	Dunns Road, Ellerslie Range Fire Inquiry East Ournie Creek, Ellerslie Range Fire Inquiry	1	20 September 2021

NO.	NAME	PROCEEDINGS	STAGE	DATE WITNESS CALLED
30.	Detective Sergeant Sean Clarke, FETS	Dunns Road, Ellerslie Range Fire Inquiry East Ournie Creek, Ellerslie Range Fire Inquiry	1	20 September 2021
31.	Scott Conlan, RFS Fire Investigator	Dunns Road, Ellerslie Range Fire Inquiry East Ournie Creek, Ellerslie Range Fire Inquiry	1	21 September 2021
32.	Geoffrey Purcell, Resident	Inquest into the death of David Andrew Harrison	1	21 September 2021
33.	Detective Senior Constable Ben Waldron, Officer in Charge	Adaminaby Complex Fire Inquiry	1	22 September 2021
34.	Mark Hollands, Senior Crime Scene Officer, FETS	Adaminaby Complex Fire Inquiry	1	22 September 2021
35.	Mike Fratturo, RFS Fire Investigator	Adaminaby Complex Fire Inquiry	1	22 September 2021
36.	Warren Menzies, Resident	Adaminaby Complex Fire Inquiry	1	22 September 2021
37.	Leslie Vearing, Senior Investigator and Fire Investigation Coordinator, Victorian Department of Environment, Land, Water and Planning	Border (Rockton) Fire Inquiry	1	23 September 2021
38.	Detective Senior Constable Glenn Bradley, Officer in Charge	Border (Rockton) Fire Inquiry	1	23 September 2021

NO.	NAME	PROCEEDINGS	STAGE	DATE WITNESS CALLED
39.	Detective Senior Constable Natalie Burston, Officer in Charge	<p>Currowan Cluster of Fires:</p> <ul style="list-style-type: none"> • Currowan, Clyde Ridge Road Fire Inquiry • Tianjara, Braidwood Road Fire Inquiry • Morton Fire Inquiry • Clyde Mountain Fire Inquiry • Charley's Forest (Monga National Park) Fire Inquiry <p>Inquest into the death of Laurence Alan Andrew</p> <p>Inquest into the death of John Ronald Butler</p> <p>Inquest into the death of Michael Campbell</p>	1	27 September 2021
40.	Senior Constable Rani Hulme, FETS	<p>Currowan, Clyde Ridge Road Fire Inquiry</p> <p>Tianjara, Braidwood Road Fire Inquiry</p>	1	28 September 2021
41.	Steven May, RFS Fire Investigator	<p>Currowan, Clyde Ridge Road Fire Inquiry</p> <p>Tianjara, Braidwood Road Fire Inquiry</p>	1	28 September 2021
42.	Mark Fullagar, RFS Fire Investigator	Morton Fire Inquiry	1	28 September 2021
43.	Detective Senior Constable Geoffrey Horn, Officer in Charge	Charley's Forest (Monga National Park) Fire Inquiry	1	29 September 2021
44.	Darin Howell, RFS Fire Investigator	<p>Clyde Mountain Fire Inquiry</p> <p>Charley's Forest (Monga National Park) Fire Inquiry</p> <p>Inquest into the death of Laurence Alan Andrew</p> <p>Inquest into the death of John Ronald Butler</p> <p>Inquest into the death of Michael Campbell</p>	1	29 September 2021

NO.	NAME	PROCEEDINGS	STAGE	DATE WITNESS CALLED
45.	Detective Sergeant Matthew Gibb, FETS	Clyde Mountain Fire Inquiry Charley's Forest (Monga National Park) Fire Inquiry Inquest into the death of Laurence Alan Andrew Inquest into the death of John Ronald Butler Inquest into the death of Michael Campbell	1	29 September 2021
46.	Detective Senior Constable Ben Waldron, Officer in Charge	North Black Range, Palerang Fire Inquiry	1	30 September 2021
47.	Mark Hollands, Senior Crime Scene Investigator, FETS	North Black Range, Palerang Fire Inquiry	1	30 September 2021
48.	Steven May, RFS Fire Investigator	North Black Range, Palerang Fire Inquiry	1	30 September 2021
49.	Steven May, RFS Fire Investigator	Long Gully Road, Drake Fire Inquiry	1	1 March 2022
50.	Geoffrey Conway AFSM, Principal Consultant, Crossbow Consulting Services, Court-appointed Expert	Long Gully Road, Drake Fire Inquiry	1	1 March 2022
51.	Detective Sergeant Steven Hoffman, Officer in Charge	Inquest into the deaths of Robert Frederick Lindsay and Gwendoline Mair Hyde	1	1 March 2022
52.	Ashleigh Hogan, Helicopter Pilot, Microflite Helicopters	Inquest into the deaths of Robert Frederick Lindsay and Gwendoline Mair Hyde	1	1 March 2022
53.	Robert Morgan, Resident	Inquest into the deaths of Robert Frederick Lindsay and Gwendoline Mair Hyde	1	1 March 2022
54.	Detective Sergeant Steven Hoffman, Officer in Charge	Busbys Flat, Rappville Fire Inquiry	1	2 March 2022
55.	Detective Senior Constable Nicole Ramsay, Officer in Charge	Gulf Road, Torrington Fire Inquiry	1	2 March 2022
56.	Detective Senior Constable Travis Ware, Officer in Charge	Washpool State Forest, Coombadjha Fire Inquiry	1	4 March 2022

NO.	NAME	PROCEEDINGS	STAGE	DATE WITNESS CALLED
57.	Mark Fullagar, RFS Fire Investigator	Washpool State Forest, Coombadjha Fire Inquiry	1	4 March 2022
58.	Richard Woods AFSM, Wildfire Investigation Consultant, Court-appointed Expert	Washpool State Forest, Coombadjha Fire Inquiry	1	4 March 2022
59.	Detective Sergeant Damian Loone, Officer in Charge	Kangawalla, Diehard Fire Inquiry	1	7 March 2022
60.	Daniel Busch, RFS Fire Investigator	Kangawalla, Diehard Fire Inquiry	1	7 March 2022
61.	Detective Senior Constable Andrew Chetham, FETS	Kangawalla, Diehard Fire Inquiry	1	7 March 2022
62.	Dylan McKean, Resident	Kangawalla, Diehard Fire Inquiry	1	7 March 2022
63.	Michael Borgia, RFS Volunteer	Inquest into the death of Vivien Christine Chaplain	1	8 March 2022
64.	Jesse Kirkman, RFS Volunteer	Inquest into the death of Vivien Christine Chaplain	1	8 March 2022
65.	Matthew Smith, Resident	Inquest into the death of Vivien Christine Chaplain	1	8 March 2022
66.	Allan Bacon, Resident	Inquest into the death of George Nole	1	8 March 2022
67.	Philip Hine, Resident	Inquest into the death of George Nole	1	8 March 2022
68.	Detective Acting Inspector Matthew Crotty, Officer in Charge	Bees Nest (Guy Fawkes National Park) Fire Inquiry	1	9 March 2022
69.	Mark Fullagar, RFS Fire Investigator	Bees Nest (Guy Fawkes National Park) Fire Inquiry	1	9 March 2022
70.	Mark Fullagar, RFS Fire Investigator	Liberation Trail (Chaelundi) Fire Inquiry	1	9 March 2022
71.	Senior Sergeant Scott Gane, Crime Scene Officer, FETS	Liberation Trail (Chaelundi) Fire Inquiry	1	9 March 2022
72.	Detective Senior Constable Brian Priest, Officer in Charge	Kian Road, South Arm Fire Inquiry	1	10 March 2022
73.	Senior Sergeant Scott Gane, Crime Scene Officer, FETS	Kian Road, South Arm Fire Inquiry	1	10 March 2022

NO.	NAME	PROCEEDINGS	STAGE	DATE WITNESS CALLED
74.	Senior Constable Justin Simpson, Officer in Charge	Inquest into the death of Christopher Savva	1	10 March 2022
75.	Alfred Tesser, Resident	Inquest into the death of Christopher Savva	1	10 March 2022
76.	Anton Pflugler, Resident	Inquest into the death of Christopher Savva	1	10 March 2022
77.	Adjunct Associate Professor Trevor Blackburn, Consulting Engineer, Electrical Engineering & Telecommunications, UNSW, Court-appointed Expert	Mount Mackenzie Road, Tenterfield Fire Inquiry	1	11 March 2022
78.	Detective Senior Constable Andrew Chetham, Crime Scene Officer, FETS	Mount Mackenzie Road, Tenterfield Fire Inquiry	1	11 March 2022
79.	Steven May, RFS Fire Investigator	Mount Mackenzie Road, Tenterfield Fire Inquiry	1	11 March 2022
80.	Janelle Edwards, Resident	Mount Mackenzie Road, Tenterfield Fire Inquiry	1	11 March 2022
81.	Detective Senior Constable Mark Symons, Officer in Charge	Carrai Creek Fire Inquiry	1	14 March 2022
82.	David Duff, Resident	Carrai East (Jacobs Spur, Willawarrin) Fire Inquiry	1	14 March 2022
83.	Darryl Aldridge, FRNSW Firefighter	Kian Road, South Arm Fire Inquiry	1	14 March 2022
84.	Luke Rushton, FRNSW Firefighter	Kian Road, South Arm Fire Inquiry	1	14 March 2022
85.	Senior Constable Michael McDonnell, Officer in Charge	Stockyard Flat, Yarrowitch Fire Inquiry Inquest into the death of Russell Bratby	1	16 March 2022
86.	Inspector Michelle Hepburn, FETS	Stockyard Flat, Yarrowitch Fire Inquiry Inquest into the death of Russell Bratby	1	16 March 2022
87.	Peter Arthur, RFS Fire Investigator	Busbys Flat, Rappville Fire Inquiry	1	16 March 2022
88.	Detective Senior Constable Brian Priest, Officer in Charge	Inquest into the death of Barry Parsons	1	17 March 2022

NO.	NAME	PROCEEDINGS	STAGE	DATE WITNESS CALLED
89.	Luke Harman, Resident	Inquest into the death of Barry Parsons	1	17 March 2022
90.	Mark Mulheron, RFS Fire Investigator	Myall Creek Road, Bora Ridge Fire Inquiry	1	17 March 2022
91.	Marco Brunato, Resident	Myall Creek Road, Bora Ridge Fire Inquiry	1	17 March 2022
92.	Richard Woods AFSM, Wildfire Investigation Consultant, Court-appointed Expert	Myall Creek Road, Bora Ridge Fire Inquiry	1	17 March 2022
93.	Detective Chief Inspector Rodney Blackman, Officer in Charge	Rumba Complex Dingo Tops Road (Tapin Tops National Park) Fire	1	21 March 2022
94.	Richard Woods AFSM, Wildfire Investigation Consultant, Court-appointed Expert	Rumba Complex Dingo Tops Road (Tapin Tops National Park) Fire Inquiry	1	21 March 2022
95.	Mark Fullagar, RFS Fire Investigator	Bills Crossing, Crowdy Bay Fire Inquiry	1	21 March 2022
96.	Senior Constable Warwick Holborow, FETS	Inquest into the death of Julie Fletcher	1	22 March 2022
97.	Michael Cleland, RFS Captain of the Harrington Brigade	Inquest into the death of Julie Fletcher	1	22 March 2022
98.	Paul de Mar, Bushfire Risk Management Consultant, Court-appointed Expert	Failford Road, Darawank Fire Inquiry	1	23 March 2022
99.	Glenn Hargrave, Senior Program Supervisor, Vegetation Operations North-Eastern Region, Essential Energy	Failford Road, Darawank Fire Inquiry	1	23 March 2022
100.	Adjunct Associate Professor Trevor Blackburn, Consulting Engineer, Electrical Engineering & Telecommunications, UNSW, Court-appointed Expert	Failford Road, Darawank Fire Inquiry	1	23 March 2022
101.	Detective (Technical) Sergeant Shane Guymmer, FETS	Hillville Fire Inquiry	1	24 March 2022
102.	Mark Fullagar, RFS Fire Investigator	Hillville Fire Inquiry	1	24 March 2022

NO.	NAME	PROCEEDINGS	STAGE	DATE WITNESS CALLED
103.	Peggy Kinchin, Resident	Hillville Fire Inquiry	1	24 March 2022
104.	Detective Sergeant Daniel Clements, Officer in Charge	Green Wattle Creek (Lake Burragorang) Fire Inquiry	1	9 May 2022
105.	Detective Senior Constable Thomas Dodd, NSWPF	Green Wattle Creek (Lake Burragorang) Fire Inquiry	1	9 May 2022
106.	Andrew Sweeney, RFS Fire Investigator	Green Wattle Creek (Lake Burragorang) Fire Inquiry	1	9 May 2022
107.	Detective Senior Constable Nicole Dunn, Officer in Charge	Ruined Castle, Kedumba Valley Fire Inquiry	1	10 May 2022
108.	Darin Howell, RFS Fire Investigator	Ruined Castle, Kedumba Valley Fire Inquiry	1	10 May 2022
109.	Leigh Nolan, NPWS Team Leader, Greater Sydney Branch	Ruined Castle, Kedumba Valley Fire Inquiry	1	10 May 2022
110.	Nigel Holland, NPWS Senior Field Officer, Blackheath	Ruined Castle, Kedumba Valley Fire Inquiry	1	10 May 2022
111.	Leading Senior Constable Bryan Wilson, Officer in Charge	Inquest into the death of Geoffrey Wesley Keaton Inquest into the death of Andrew Joel O'Dwyer	1	11 May 2022
112.	Senior Constable Jeffrey Head, Engineering Investigation Section NSWPF	Inquest into the death of Geoffrey Wesley Keaton Inquest into the death of Andrew Joel O'Dwyer	1	11 May 2022
113.	Adam Hurst, RFS Volunteer, Deputy Captain, and Strike Team Leader, Cumberland District	Inquest into the death of Geoffrey Wesley Keaton Inquest into the death of Andrew Joel O'Dwyer	1	11 May 2022
114.	Carlos Quinteros, RFS Volunteer, Horsley Park Brigade	Inquest into the death of Geoffrey Wesley Keaton Inquest into the death of Andrew Joel O'Dwyer	1	11 May 2022
115.	Andrew Gregory, RFS Senior Deputy Captain, Castlereagh Brigade	Inquest into the death of Geoffrey Wesley Keaton Inquest into the death of Andrew Joel O'Dwyer	1	12 May 2022
116.	Detective Sergeant Joshua Holgate, Officer in Charge	Gospers Mountain (Wollemi National Park) Fire Inquiry	1	15 June 2022

NO.	NAME	PROCEEDINGS	STAGE	DATE WITNESS CALLED
117.	Peter Jones, RFS Fire Investigator	Gospers Mountain (Wollemi National Park) Fire Inquiry	1	15 June 2022
118.	Andrew Benson, NPWS Senior Field Officer, Mudgee	Gospers Mountain (Wollemi National Park) Fire Inquiry	1	16 June 2022
119.	Detective Sergeant Laura Harvey, Officer in Charge	Grose Valley, Mount Wilson Fire Inquiry	1	16 June 2022
120.	Darin Howell, RFS Fire Investigator	Grose Valley, Mount Wilson Fire Inquiry	1	16 June 2022
121.	Rebekah Lo, Account Manager, MetraWeather	Gospers Mountain (Wollemi National Park) Fire Inquiry	1	17 June 2022
122.	Detective Sergeant Neil Welschinger, FETS	Grose Valley, Mount Wilson Fire Inquiry	1	17 June 2022
123.	Matthew O'Donnell, RFS Capability Manager, Hunter Area Command	Gospers Mountain (Wollemi National Park) Fire Inquiry	1	17 June 2022
124.	Plain Clothes Senior Constable Katie Platt, Officer in Charge	Little L Complex, Laguna Fire Inquiry	1	20 June 2022
125.	Paul Sandilands, NPWS Project Officer, Bulga	Little L Complex, Laguna Fire Inquiry	1	20 June 2022
126.	Senior Constable Jost Preis, Spatial & Analytical Capability-Mapping Operations, State Intelligence Command, NSWPF	Little L Complex, Laguna Fire Inquiry	1	20 June 2022
127.	Detective Sergeant Glenn Griffith, Officer in Charge	Palmers Oaky, Upper Turon Fire Inquiry	1	21 June 2022
128.	Shane Bryant, RFS Fire Investigator	Palmers Oaky, Upper Turon Fire Inquiry	1	21 June 2022
129.	Spencer Morgan, Apprentice FLOORER	Palmers Oaky, Upper Turon Fire Inquiry	1	22 June 2022
130.	Mark Turner, Contractor	Palmers Oaky, Upper Turon Fire Inquiry	1	22 June 2022
131.	Jamie Edwards, Contractor	Palmers Oaky, Upper Turon Fire Inquiry	1	22 June 2022
132.	Charbel Tannous, Property Owner	Palmers Oaky, Upper Turon Fire Inquiry	1	22 June 2022
133.	James Ferguson, RFS Volunteer, Palmers Oaky Brigade	Palmers Oaky, Upper Turon Fire Inquiry	1	23 June 2022

NO.	NAME	PROCEEDINGS	STAGE	DATE WITNESS CALLED
134.	Michael Grabham, RFS Captain, Wattle Flat Sofala Brigade	Palmers Oaky, Upper Turon Fire Inquiry	1	23 June 2022
135.	Detective Senior Constable Ben Waldron, Officer in Charge	Good Good, Peak View Fire Inquiry	1	27 June 2022
136.	Detective (Technical) Inspector Sacha Debnam, FETS	Good Good, Peak View Fire Inquiry	1	27 June 2022
137.	John Smith, RFS Fire Investigator	Good Good, Peak View Fire Inquiry	1	27 June 2022
138.	Detective Senior Constable Robert Bruce, Officer in Charge	Creewah Road, Glen Allen Fire Inquiry	1	29 June 2022
139.	Senior Constable Evan Gray, Officer in Charge	Postmans Trail, Tantawangalo Fire Inquiry Big Jack Mountain, Cathcart Fire Inquiry	1	29 June 2022
140.	Michael Rein Peet, RFS Fire Investigator	Creewah Cluster of Fires	1	29 June 2022
141.	Mark Daley, Vegetation Manager, Essential Energy	Creewah Cluster of Fires	1	29 June 2022
142.	Detective Chief Inspector Richard Puffett, Arson Unit, State Crime Command	Case Study into investigation of fires by NSWPF and RFS	2	19 September 2022
143.	Detective Sergeant Laura Harvey, Officer in Charge	Case Study into investigation of fires by NSWPF and RFS	2	20 September 2022
144.	Ben Millington, RFS Assistant Commissioner, State Operations	Case Study into investigation of fires by NSWPF and RFS	2	20 September 2022
145.	Mark Fullagar, RFS Fire Investigator and Training Coordinator, Fire Investigation and Compliance Unit	Case Study into investigation of fires by NSWPF and RFS	2	20 September 2022
146.	Richard (Kym) Jermey, RFS Captain, Wyaliba Brigade	Case Study into Communications and Warnings	2	21 September 2022
147.	Brett Miller, RFS Deputy Captain, Wyaliba Brigade	Case Study into Communications and Warnings	2	21 September 2022

NO.	NAME	PROCEEDINGS	STAGE	DATE WITNESS CALLED
148.	Alex Stewart, Communications Operator, Volunteer Rescue Association	Case Study into Communications and Warnings	2	21 September 2022
149.	John Harper, Communications Operator, Volunteer Rescue Association	Case Study into Communications and Warnings	2	21 September 2022
150.	Carol Sparks, Resident	Case Study into Communications and Warnings	2	21 September 2022
151.	Angela Burford, RFS Public Liaison Officer	Case Study into Communications and Warnings	2	21 September 2022
152.	Mark Williams, RFS Incident Controller, Glen Innes Fire Control Centre	Case Study into Communications and Warnings	2	23 September 2022
153.	Anthony Clark, RFS Director, Communications and Engagement	Case Study into Communications and Warnings	2	23 September 2022
154.	Peter McKechnie, RFS Deputy Commissioner, Field Operations	Case Study into Communications and Warnings	2	23 September 2022
155.	Paul de Mar, Bushfire Risk Management Consultant, Court-appointed Expert	Case Study into Bushfire Risk Classification	2	28 September 2022
156.	Professor Jason Sharples, Bushfire Dynamics, UNSW, Court-appointed Expert	Case Study into Bushfire Risk Classification	2	28 September 2022
157.	Ian Fitzpatrick, Manager, Network Risk Strategy, Asset Management Group, Essential Energy	Case Study into Bushfire Risk Classification	2	28 September 2022
158.	Laura Henwood, Senior Transport Safety Investigator, ATSB	Inquest into the death of Rick Allen DeMorgan Jr Inquest into the death of Paul Hudson Inquest into the death of Ian McBeth	1	20 March 2023
159.	Sam Crothers, State Duty Aviation Officer, State Air Desk	Inquest into the death of Rick Allen DeMorgan Jr Inquest into the death of Paul Hudson Inquest into the death of Ian McBeth	1	20 & 21 March 2023

NO.	NAME	PROCEEDINGS	STAGE	DATE WITNESS CALLED
160.	Shawn Dugan, Air Tanker Pilot, Coulson Aviation	Inquest into the death of Rick Allen DeMorgan Jr Inquest into the death of Paul Hudson Inquest into the death of Ian McBeth	1	21 March 2023
161.	Michael Davison, Air Base Manager, Richmond RAAF	Inquest into the death of Rick Allen DeMorgan Jr Inquest into the death of Paul Hudson Inquest into the death of Ian McBeth	1	21 March 2023
162.	Cherie Smith, Air Base Manager, Richmond RAAF	Inquest into the death of Rick Allen DeMorgan Jr Inquest into the death of Paul Hudson Inquest into the death of Ian McBeth	1	21 March 2023
163.	Robert (Bob) Justo Coward, Pilot, CAL FIRE	Inquest into the death of Rick Allen DeMorgan Jr Inquest into the death of Paul Hudson Inquest into the death of Ian McBeth	1	22 March 2023
164.	Kevan Harder, Aviation Radio Operator, Cooma Fire Control Centre	Inquest into the death of Rick Allen DeMorgan Jr Inquest into the death of Paul Hudson Inquest into the death of Ian McBeth	1	22 March 2023
165.	Timothy McGuffog, State Fire Manager, NSW Forestry Corporation	Inquest into the death of Rick Allen DeMorgan Jr Inquest into the death of Paul Hudson Inquest into the death of Ian McBeth	1	22 March 2023
166.	Allister Polkinghorne, Pilot Consultant, Court-appointed Expert	Inquest into the death of Rick Allen DeMorgan Jr Inquest into the death of Paul Hudson Inquest into the death of Ian McBeth	1	23 March 2023
167.	John Gallaher, Director of Flight Operations, Coulson Aviation	Inquest into the death of Rick Allen DeMorgan Jr Inquest into the death of Paul Hudson Inquest into the death of Ian McBeth	1	27 March 2023

NO.	NAME	PROCEEDINGS	STAGE	DATE WITNESS CALLED
168.	Peter McKechnie, RFS Deputy Commissioner, Field Operations	Inquest into the death of Rick Allen DeMorgan Jr Inquest into the death of Paul Hudson Inquest into the death of Ian McBeth	1	27 March 2023
169.	Emeritus Professor Raphael Grzebieta, Transport and Road Safety Research Unit, UNSW, Court-appointed Expert	Case Study into Vehicle Design and Safety	2	29 March 2023
170.	Dr Shane Richardson, Forensic Engineer, Managing Director and Owner, Delta-V Experts, engaged by RFS	Case Study into Vehicle Design and Safety	2	29 March 2023
171.	Associate Professor David Logan, Senior Researcher, MUARC engaged by RFS	Case Study into Vehicle Design and Safety	2	29 March 2023
172.	Kyle Stewart, RFS Deputy Commissioner, Preparedness and Capability Directorate	Case Study into Vehicle Design and Safety	2	29 March 2023
173.	David Philp, FRNSW Fire Behaviour Analyst	Case Study into Fire Prediction Modelling	2	4 April 2023
174.	Derek Gibb, FRNSW Fire Behaviour Analyst	Case Study into Fire Prediction Modelling	2	4 April 2023
175.	Dr Jonathan Marsden-Smedley, Bushfire and Weed Management Consultant, Court-appointed Expert	Case Study into Fire Prediction Modelling	2	4 April 2023
176.	David Field, RFS Acting Manager, Predictive Services Unit	Case Study into Fire Prediction Modelling	2	4 April 2023
177.	Laurence McCoy, RFS Acting Director, Community Risk	Case Study into Fire Prediction Modelling	2	4 April 2023
178.	Dr Simon Heemstra, Director, National Projects and Innovation, AFAC	Case Study into Fire Prediction Modelling	2	4 April 2023
179.	James Carter, RFS Bell Division Commander	Case Study into Backburning Operations –Planning & Execution	2	15 & 16 May 2023
180.	Kenneth Pullen, RFS Assistant Planning Officer, Hawkesbury IMT	Case Study into Backburning Operations –Planning & Execution	2	16 May 2023

NO.	NAME	PROCEEDINGS	STAGE	DATE WITNESS CALLED
181.	Craig Burley, RFS Bell Division Operations Officer	Case Study into Backburning Operations –Planning & Execution	2	16 & 17 May 2023
182.	Christopher Banffy, NPWS Air Attack Supervisor, Hawkesbury IMT	Case Study into Backburning Operations –Planning & Execution	2	17 May 2023
183.	Daniel Gerzanics, RFS October South Sector Leader of the Bell Division	Case Study into Backburning Operations –Planning & Execution	2	17 May 2023
184.	Elizabeth Raines, RFS October North Sector Leader of the Bell Division	Case Study into Backburning Operations –Planning & Execution	2	18 May 2023
185.	Geoffrey Conway AFSM, Principal Consultant, Crossbow Consulting Services, Court-appointed expert	Case Study into Backburning Operations –Planning & Execution	2	19 May 2023
186.	Peter McKechnie, RFS Deputy Commissioner, Field Operations	Case Study into Backburning Operations –Planning & Execution	2	19 May 2023
187.	Chris Palmer, RFS Deputy Incident Controller for the Currowan Fire	Case Study into Backburning Operations –Planning & Execution	2	22 May 2023
188.	Charles Magnuson, RFS Divisional East Commander, Bawley Point Brigade	Case Study into Backburning Operations –Planning & Execution	2	22 May 2023
189.	Mark Williams, RFS District Manager, Shoalhaven District	Case Study into Backburning Operations –Planning & Execution	2	23 May 2023
190.	Ronald John Ashton, RFS Group Captain, Shoalhaven District	Case Study into Backburning Operations –Planning & Execution	2	23 May 2023
191.	Geoffrey Conway AFSM, Principal Consultant, Crossbow Consulting Services, Court-appointed Expert	Case Study into Backburning Operations –Planning & Execution	2	25 May 2023

Appendix 6: Exhibits

EXHIBIT NUMBER	DESCRIPTION
1	General Brief of Evidence–Far Southern Region
2	Brief of Evidence–Badja Forest, Forest Road Fire and Deua National Park (Coondella) Fire Inquiries
3	Brief of Evidence–Inquest into the death of Colin Harold Burns
4	Brief of Evidence–Inquest into the death of Michael Stanley Clarke
5	Brief of Evidence–Inquest into the death of Ross Alphonsus Rixon
6	Brief of Evidence–Inquest into the death of Patrick James Salway
7	Brief of Evidence–Inquest into the death of Robert John Salway
8	Brief of Evidence–Inquest into the death of Richard John Steele
9	Brief of Evidence–Inquest into the death of John Robert Smith
10A	Brief of Evidence–Werri Berri Fire Inquiry
11A	Brief of Evidence–Green Valley, Talmalmo Fire Inquiry
12	Brief of Evidence–Inquest into the death of Samuel Ian McPaul
13A	Brief of Evidence–Dunns Road, Ellerslie Range Fire and East Ournie Creek, Ellerslie Range Fire Inquiries
14	Brief of Evidence–Inquest into the death of David Andrew Harrison
15A	Brief of Evidence–Adaminaby Complex Fire Inquiry
16A	Brief of Evidence–Border (Rockton) Fire Inquiry
17	Photographs and Videos for the Far Southern Region
18	General Brief of Evidence–Mid Southern Region
19A	Brief of Evidence–Currowan Cluster of Fires: Currowan, Clyde Ridge Road Fire Inquiry Tianjara, Braidwood Road Fire Inquiry Morton Fire Inquiry Clyde Mountain Fire Inquiry Charley’s Forest (Monga National Park) Fire Inquiry
20	Brief of Evidence–Inquest into the death of Laurence Alan Andrew
21	Brief of Evidence–Inquest into the death of John Ronald Butler
22	Brief of Evidence–Inquest into the death of Michael Campbell
23A	Brief of Evidence–North Black Range, Palerang Fire Inquiry

EXHIBIT NUMBER	DESCRIPTION
24	Photographs and Videos for the Mid Southern Region
25	General Brief of Evidence–Northern Region
26A	Brief of Evidence–Long Gully Road, Drake Fire Inquiry
27	Brief of Evidence–Inquest into the death of Robert Frederick Lindsay
28	Brief of Evidence–Inquest into the death of Gwendoline Mair Hyde
29A	Brief of Evidence–Busbys Flat, Rappville Fire Inquiry
30A	Brief of Evidence–Gulf Road, Torrington Fire Inquiry
31A	Brief of Evidence–Washpool State Forest, Coombadjha Fire Inquiry
32A	Brief of Evidence–Kangawalla, Diehard Fire Inquiry
33	Brief of Evidence–Inquest into the death of Vivien Christine Chaplain
34	Brief of Evidence–Inquest into the death of George Nole
35A	Brief of Evidence–Bees Nest (Guy Fawkes National Park) Fire Inquiry
36A	Brief of Evidence–Liberation Trail fire (Chaelundi) Fire Inquiry
37A	Brief of Evidence–Kian Road (South Arm) Fire Inquiry
38	Brief of Evidence–Inquest into the death of Christopher Savva
39A	Brief of Evidence–Mount Mackenzie Road, Tenterfield Fire Inquiry
40A	Brief of Evidence–Carrai Creek Fire Inquiry
41A	Brief of Evidence–Carrai East (Jacobs Spur, Willawarrin) Fire Inquiry
42A	Brief of Evidence–Stockyard Flat, Yarrowitch Fire Inquiry
43	Brief of Evidence–Inquest into the death of Russell Bratby
44	Brief of Evidence–Inquest into the death of Barry Parsons
45A	Brief of Evidence–Myall Creek Road, Bora Ridge Fire Inquiry
46A	Brief of Evidence–Rumba Complex, Dingo Tops Road (Tapin Tops National Park) Fire Inquiry
47A	Brief of Evidence–Bills Crossing, Crowdy Bay Fire Inquiry
48	Brief of Evidence–Inquest into the death of Julie Fletcher
49A	Brief of Evidence–Failford Road, Darawank Fire Inquiry
50A	Brief of Evidence–Hillville Fire Inquiry
51A	General Brief of Evidence–Central Metro Region

EXHIBIT NUMBER	DESCRIPTION
52A	Brief of Evidence – Green Wattle Creek (Lake Burragorang) Fire Inquiry
53A	Brief of Evidence – Ruined Castle, Kedumba Valley Fire Inquiry
54	Brief of Evidence – Inquests into the deaths of Geoffrey Wesley Keaton and Andrew Joel O’Dwyer
55A	Brief of Evidence – Gaspers Mountain (Wollemi National Park) Fire Inquiry
56A	Brief of Evidence – Grose Valley, Mount Wilson Fire Inquiry
57A	Brief of Evidence – Little L Complex, Laguna Fire Inquiry
58A	Brief of Evidence – Palmers Oaky, Upper Turon Fire Inquiry
58B	Photograph annotated by Jamie Edwards (taken from Tab 40, page 957)
58C	ASIC Report – Kwik Flo Pty Ltd
59A	Brief of Evidence – Good Good, Peak View Fire Inquiry
60A	Brief of Evidence – Creewah Cluster of Fires: Creewah Road, Glen Allen Fire Inquiry Postmans Trail, Tantawangalo Fire Inquiry Big Jack Mountain Road, Cathcart Fire Inquiry
61	General Brief of Evidence – Stage 2
62	State Coroner’s Bulletin No 21 signed 1 September 2022 – Stage 2 Investigations of Fires (Police)
63	Statement of Ben Millington, Assistant Commissioner and Director of State Operations, RFS (undated) – Stage 2 Investigations of Fires (RFS)
64	Operational Logs for Mr David Philp, Fire Behaviour Analyst within Glen Innes Fire Control Centre on 8 November 2019 p.024 entry, 15:18 hrs – Stage 2 Communications and Emergency Warnings – Kangawalla, Diehard Fire
65	NSW State Coroner’s Bulletin No 22 signed 11 October 2022 – Stage 2 Investigations of Fires (Police)
66	Brief of Evidence – Inquests into the deaths of Rick Allen DeMorgan Jnr, Paul Hudson and Ian McBeth
67	PowerPoint presentation of Laura Henwood, Investigator, Australian Transport Safety Bureau
68	Updated Police Standard Operating Procedures – published November 2022
69	Updated Police Handbook Chapter ‘Fires’ – endorsed 15 December 2022
70	Correspondence from DCJ Legal to Roderick Storie for the Grose Valley Affected Owners Community Group dated 25 July 2023

Appendix 7: Inquiry Statistics

INVESTIGATION	
Approximate total number of pages of evidence reviewed by Assisting Team during investigation (<i>excluding electronic evidence</i>)	More than 600,000
Court Attendances	
First sitting day	25 August 2021
Total number of hearing days (<i>excluding directions hearings</i>)	78
Number of directions hearings	10
Number of days that legal argument was heard and judgement delivered on issue of scope	2
Number of witnesses of fact who gave evidence	176
Number of expert witnesses who gave evidence	12
Number of interested parties granted leave to appear	59
Number of legal representatives for interested parties or witnesses at the hearing	38
Brief Of Evidence And Exhibits	
Number of statements in all briefs of evidence tendered	785
Approximate total number of pages comprising all briefs of evidence tendered (<i>excluding electronic evidence</i>)	44,559
Transcript	
Total number of pages of transcript across duration of inquiry	3322

Appendix 8: Public Submissions

NO.	DATE OF SUBMISSION	NAME OF SUBMITTING PARTY	FIRE/INQUEST
1.	21 May 2020	Brett Wheway, Affected resident	Badja Forest, Forest Road Fire
2.	28 August 2020	Brian Davies, Community resident	Planning processes
3.	20 September 2020	Roger Wood, Affected resident	Myall Creek Road, Bora Ridge Fire
4.	22 October 2020	Tony Chu, Community resident	Planning processes
5.	3 November 2020	Independent Bushfire Group (IBG), Interest group	<p>The following documents were provided to the NSW Police in the Ruined Castle (Kedumba Valley) Fire:</p> <ul style="list-style-type: none"> • IBG submission to NSW Independent Inquiry (15/6/2020) • IBG Main Report to Emergency Leaders for Climate Action (ELCA) (29/3/20) • IBG Summary Report to ELCA (3/8/20) • Submission to Coroner (3/11/20)
6.	15 November 2020	Brian Davies, Community resident	Planning processes
7.	14 January 2021	Martin and Marion Tebbutt, Affected residents	Grose Valley, Mount Wilson Fire
8.	18 January 2021	Roger Wood, Affected resident	Myall Creek Road, Bora Ridge Fire
9.	2 February 2021	Brian Davies, Community resident	Planning processes
10.	1 March 2021	Brian Davies, Community resident	Planning processes
11.	22 March 2021	Ian Brown on behalf of the Independent Bushfire Group, Interest group	General and Blue Mountains area fires and including an IBG Report titled 'Reducing the costs and impacts of bushfires' (29/7/20)
12.	29 March 2021	Ian Brown on behalf of the Independent Bushfire Group, Interest group	Including the IBG Summary Report to ELCA dated 3 August 2020 (<i>also referenced in Submission 5 above</i>)
13.	29 March 2021	Tony Chu, Community resident	Planning processes
14.	14 April 2021	Roger Wood, Affected resident	Myall Creek Road, Bora Ridge Fire
15.	28 May 2021	John Hawkins, Firefighter	Green Valley, Talmalmo Fire
16.	17 June 2021	Anonymous, Affected resident	<ul style="list-style-type: none"> • Dunns Road, Ellerslie Range Fire • East Ournie Creek, Ellerslie Range Fire

NO.	DATE OF SUBMISSION	NAME OF SUBMITTING PARTY	FIRE/INQUEST
17.	18 June 2021	Samantha Smithett, Firefighter	Carrai East (Jacobs Spur) Fire
18.	19 June 2021	Brendan Cowled, Veterinary Epidemiologist	Currowan Cluster of Fires
19.	24 June 2021	Andrew MacDougall, Affected resident	Dunns Road, Ellerslie Range Fire
20.	28 June 2021	Brett Wheway, Affected resident	Badja Forest, Forest Road Fire
21.	28 June 2021	Gail Trapp and Geoff Fearon, Affected residents	Currowan Cluster of Fires
22.	28 June 2021	John O'Donnell, Forester/Fire Manager	All/General
23.	30 June 2021	Phillipa Hollenkamp, Affected resident	Currowan Cluster of Fires
24.	3 July 2021	Andy Carnahan, Affected resident	Currowan Cluster of Fires
25.	4 July 2021	Anonymous, Community resident	Currowan Cluster of Fires
26.	8 July 2021	Robert Whymark, Affected resident	Werri Berri Fire
27.	8 July 2021	Anonymous, Affected resident	Badja Forest, Forest Road Fire
28.	11 July 2021	Anne Elizabeth Lacey, Affected resident	Badja Forest, Forest Road Fire
29.	13 July 2021	Anonymous, Affected resident	Clear Range Fire (<i>not the subject of this Inquiry</i>)
30.	16 July 2021	Robert Snedden, Community resident	Morton Fire
31.	19 July 2021	Christine McGrath, Community resident	North Black Range Fire
32.	22 July 2021	Keith Dance, Community resident	Badja Forest, Forest Road Fire
33.	23 July 2021	Clarissa Watson, Community resident	Currowan Cluster of Fires
34.	23 July 2021	Bega Valley Shire Council, Affected communities	<ul style="list-style-type: none"> • Badja Forest, Forest Road Fire • Border (Rockton) Fire • Werri Berri Fire
35.	24 July 2021	Warren and Helen Salway, Affected residents and family of Robert and Patrick Salway	Badja Forest, Forest Road Fire
36.	26 July 2021	John Finkernagel, Affected resident	Currowan Cluster of Fires

NO.	DATE OF SUBMISSION	NAME OF SUBMITTING PARTY	FIRE/INQUEST
37.	28 July 2021	John-Paul Romano, Firefighter	Currowan Cluster of Fires
38.	30 July 2021	Ian Stewart, Affected resident	Currowan Cluster of Fires
39.	30 July 2021	Malcolm Hay, Community resident	<ul style="list-style-type: none"> Gospers Mountain (Wollemi National Park) Fire Grose Valley, Mount Wilson Fire
40.	30 July 2021	Martine Jordan, family of Richard Steele	<ul style="list-style-type: none"> Badja Forest, Forest Road Fire Inquest into the death of Richard Steele
41.	30 July 2021	Michaela Samman, Affected resident	Werri Berri Fire
42.	30 July 2021	Paul Scherek, Affected resident	Werri Berri Fire
43.	30 July 2021	Anonymous, Affected resident	Badja Forest, Forest Road Fire
44.	1 August 2021	Richard Fisher, Community resident	Clyde Mountain Fire
45.	8 August 2021	Roger Wood, Affected resident	Myall Creek, Bora Ridge Fire
46.	9 August 2021	Roger Wood, Affected resident	Myall Creek, Bora Ridge Fire
47.	10 August 2021	Robyne Wood, Affected resident	Myall Creek, Bora Ridge Fire
48.	11 August 2021	Stuart Austin, Affected resident	Bees Nest (Guy Fawkes National Park) Fire
49.	12 August 2021	Steve Bellchambers, Affected resident	Dunns Road, Ellerslie Range Fire
50.	18 August 2021	Stuart Austin, Affected resident	Bees Nest (Guy Fawkes National Park) Fire
51.	20 August 2021	Mark Drury, Affected resident	<ul style="list-style-type: none"> Hillville Fire Rumba Complex, Dingo Tops Road (Tapin Tops National Park) Fire Thunderbolt's Way, Bretti Fire
52.	22 August 2021	Warren Salway, Affected resident and family member of Robert and Patrick Salway	Badja Forest, Forest Road Fire
53.	25 August 2021	David Freeman, Affected resident	Currowan Cluster of Fires
54.	26 August 2021	Frank Dale, Affected resident	Currowan Cluster of Fires
55.	29 August 2021	John O'Donnell, Forester/Fire Manager	Fuel loads

NO.	DATE OF SUBMISSION	NAME OF SUBMITTING PARTY	FIRE/INQUEST
56.	7 September 2021	Graeme Freedman, Affected resident	Badja Forest, Forest Road Fire
57.	9 September 2021	Kristina Illingsworth, Neighbour of Richard Steele	<ul style="list-style-type: none"> Badja Forest, Forest Road Fire Inquest into the death of Richard Steele
58.	10 September 2021	Kernin Lambert, Firefighter	Green Wattle Creek (Lake Burragorang) Fire
59.	14 September 2021	Thomas Voase, Affected resident	Carra East (Jacob's Spur) Fire
60.	17 September 2021	John Baker, Firefighter	<ul style="list-style-type: none"> Green Valley, Talmalmo Fire Inquest into the death of Samuel McPaul
61.	20 September 2021	Kernin Lambert, Firefighter	Green Wattle Creek (Lake Burragorang) Fire
62.	21 September 2021	Anonymous, Affected resident	Palmer's Oak, Upper Turon Fire
63.	22 September 2021	Peter and Kathleen Allport, Affected residents	Palmer's Oak, Upper Turon Fire
64.	24 September 2021	Anonymous, Affected resident	Currowan Cluster of Fires
65.	27 September 2021	Anonymous, Affected resident	Palmer's Oak, Upper Turon Fire
66.	29 September 2021	Anonymous, Affected resident	Palmer's Oak, Upper Turon Fire
67.	29 September 2021	Anonymous, Community resident	<ul style="list-style-type: none"> Carra Creek Fire Bees Nest (Guy Fawkes National Park) Fire
68.	29 September 2021	John O'Donnell, Forester/Fire Manager	Fuel loads
69.	29 September 2021	Anonymous, Community resident	Carra Creek Fire
70.	29 September 2021	Michael Roze, Firefighter	Rumba Complex, Dingo Tops Road (Tapin Tops National Park) Fire
71.	29 September 2021	Anonymous, Community resident	Carra Creek Fire
72.	30 September 2021	Andrew Simpson, Firefighter	<ul style="list-style-type: none"> Bees Nest (Guy Fawkes National Park) Fire Gulf Road, Torrington Fire Long Gully Road, Drake Fire Mount Mackenzie, Tenterfield Fire Stockyard Flat, Yarrowitch Fire

NO.	DATE OF SUBMISSION	NAME OF SUBMITTING PARTY	FIRE/INQUEST
73.	30 September 2021	Brian Willey, on behalf of the Killabakh Community Association, Interest group	Rumba Complex, Dingo Tops Road (Tapin Tops National Park) Fire
74.	30 September 2021	David and Carolyn Duff, Affected residents	<ul style="list-style-type: none"> • Carrai East (Jacob's Spur) Fire • Carrai Creek Fire
75.	30 September 2021	Greg Franklin, Affected resident	Currowan Cluster of Fires
76.	30 September 2021	Ian Brown, on behalf of Independent Bushfire Group, Interest group	<p>References earlier submissions (see 5 and 11 above) and in particular submission to coroner (3/11/20) and the IBG main report. Focusses on:</p> <ul style="list-style-type: none"> • Bees Nest (Guy Fawkes National Park) Fire • Green Wattle Creek (Lake Burragorang) • Gaspers Mountain (Wollemi National Park) • Currowan Cluster of Fires (Tianjara)
77.	30 September 2021	Anonymous, Affected resident	Carrai Creek Fire
78.	30 September 2021	Kevin Cooper, RFS analyst	General
79.	30 September 2021	Neil Booth, Affected resident	Carrai Creek Fire
80.	30 September 2021	Dr Warren Bruce, Affected resident	General
81.	30 September 2021	Kernin Lambert, Firefighter	Green Wattle Creek (Lake Burragorang) Fire
82.	20 October 2021	Elizabeth Atkin, Affected resident	Green Wattle Creek (Lake Burragorang) Fire
83.	19 November 2021	Fiona Avery, Community resident	Badja Forest, Forest Road Fire
84.	26 November 2021	Elizabeth Montano, RFS member	<ul style="list-style-type: none"> • Gaspers Mountain (Wollemi National Park) • Grose Valley, Mount Wilson Fire
85.	30 November 2021	Elizabeth Montano, RFS member	<ul style="list-style-type: none"> • Gaspers Mountain (Wollemi National Park) • Grose Valley, Mount Wilson Fire
86.	26 January 2022	Brendon O'Connor, RFS member	<ul style="list-style-type: none"> • Seabrook Road Backburn • Green Wattle Creek (Lake Burragorang) Fire
87.	14 March 2022	Robert Lumby, Community member	• Long Gully Road, Drake Fire

NO.	DATE OF SUBMISSION	NAME OF SUBMITTING PARTY	FIRE/INQUEST
88.	21 March 2022	David Freeman, Affected resident	<ul style="list-style-type: none"> Currowan Cluster of Fires
89.	8 May 2022	Shane Bryant, RFS	<ul style="list-style-type: none"> Inquest into the death of Geoffrey Keaton and Andrew O'Dwyer Green Wattle Creek (Lake Burragorang) Fire
90.	27 May 2022	Jochen Spencer and Kooryn Sheaves, Affected residents	<ul style="list-style-type: none"> Grose Valley, Mount Wilson Fire Backburning and attaching detailed submission (27/5/22)
91.	15 June 2022	Jochen Spencer and Kooryn Sheaves, Affected residents	<ul style="list-style-type: none"> Grose Valley, Mount Wilson Fire Backburning and attaching revised detailed submission (9/6/2022)
92.	25 June 2022	Robert Morse, RFS	Ruined Castle, Kedumba Valley Fire
93.	30 June 2022	Ian Brown, on behalf of the Independent Bushfire Group	Grose Valley, Mount Wilson Fire
94.	29 July 2022	David O'Donnell, Affected resident	<ul style="list-style-type: none"> Yatte Yattah, Currowan Lane Currowan Cluster of Fires
95.	17 October 2022	Shane Bryant, RFS	General
96.	28 November 2022	Ian Brown on behalf of the Independent Bushfire Group	Investigation of bushfires
97.	23 March 2023	Danny Corcoran, RFS	Inquests into the deaths of Rick DeMorgan Jr, Paul Hudson and Ian McBeth
98.	25 March 2023	Geoff Luscombe on behalf of the Independent Bushfire Group	Aerial Firefighting
99.	29 March 2023	Martin and Marion Tebbutt, Affected residents	General
100.	1 April 2023	Gregor Manson, ACT resident	<ul style="list-style-type: none"> Grose Valley, Mount Wilson Fire Gospers Mountain (Wollemi National Park) Fire
101.	22 May 2023	Ian Brown, on behalf of the Independent Bushfire Group	Grose Valley, Mount Wilson Fire
102.	24 May 2023	Anonymous, Affected resident	<ul style="list-style-type: none"> Currowan Cluster of Fires Backburning

Appendix 9: Counsel Assisting's Summary of Findings and Recommendations from Earlier Inquiries

2019-2020 Bushfire Inquiries

Summary of relevant findings arising from the NSW Bushfire Inquiry and the Royal Commission into National Natural Disaster Arrangements

Introduction

- 1) The State Coroner of New South Wales will conduct a series of coronial inquests and coronial inquiries into deaths and major bushfires occurring during the 2019– 2020 bushfire season.
- 2) There were at least 11,774 fires across NSW during the 2019-2020 bushfire season which ran from July 2019 until March 2020.¹
- 3) Twenty-five people died as a result of the fires. The incalculable loss this represents to their families, friends and communities is acknowledged and will be remembered during the course of each coronial inquest into a death.
- 4) In addition to these deaths, huge swathes of the state burnt.
- 5) Although by no means limited to these regions, the five local government areas that lost the greatest total number of houses were:
 - a) Eurobadalla Shire Council: 510 houses lost.
 - b) Bega Shire Council: 465 houses lost.
 - c) Shoalhaven City Council: 286 houses lost.
 - d) Snowy Valleys Council: 193 houses lost.
 - e) Clarence Valley Council: 168 houses lost.

¹NSW Bushfire Inquiry Report, p.23.

- 6) In addition, large numbers of native wildlife were killed or injured, and their habitat destroyed such that their continuing survival is imperiled even after the event.
- 7) Similarly, large numbers of stock and domestic pets were also lost during the fires posing both an emotional and economical loss to some families, farms and other businesses.
- 8) The loss of life, the destruction of property and the sheer geographical reach of the fires triggered important investigations at a local, state and national level as follows:
 - a) Individual fires have been variously investigated by officers from NSW Police and NSW Rural Fire Service.
 - b) The NSW Parliament established the NSW Bushfire Inquiry [‘the NSW Inquiry’] chaired by Dave Owens APM and Mary O’Kane, (with the Final Report delivered on 31 July 2020).
 - c) The Royal Commission into National Natural Disaster Arrangements [‘The Royal Commission’] was established with Air Chief Marshal Mark Binskin AC, the Honourable Dr Annabelle Bennett AC SC and Professor Andrew Mackintosh appointed as Royal Commissioners (with the Final Report delivered on 28 October 2020).
 - d) The Senate Finance and Public Administration References Committee - *Lessons to be learned in relation to the Australian bushfire season 2019-20* [‘The Senate Inquiry’] (with an Interim Report delivered on 7 October 2020).
- 9) The terms of reference for the NSW Inquiry included consideration of *“The causes of, and factors contributing to, the frequency, intensity, timing and location of, bushfires in NSW in the 2019 – 20 bushfire season, including consideration of any role of weather, drought, climate change, fuel loads and human activity”* and also *“Responses to bushfires, particularly measures to control the spread of the fires and to protect life, property and the environment, including: immediate management, including the issuing of public warnings; resourcing, coordination and deployment; and equipment and communication systems.”*²
- 10) The work of the NSW Inquiry has been particularly important in informing the approach the State Coroner proposes to take to the conduct of the coronial inquests and the coronial inquiries that will proceed to hearing.

² NSW Inquiry, p. 1.

- 11) The central task of the Royal Commission was to inquire into national natural disaster arrangements. The terms of reference for the Royal Commission included, relevantly, the responsibilities of and co-ordination between Australian, State, Territory and Local governments relating to natural disasters.³
- 12) The Senate Committee Inquiry is focused on lessons to be learned in relation to the preparation and planning for, response to and recovery efforts following the 2019-20 Australian bushfire season. Areas of particular interest include:
- a) hazard reduction – including existing hazard reduction practices (the possibilities for future hazard reduction regimes) and indigenous burning practices and their efficacy.
 - b) the 2019-20 bushfire season – and the level of recovery one year on (including the progress and status of recovery efforts).
 - c) mitigation infrastructure and land-use planning – including an assessment of the types (and costs) of mitigation infrastructure that would effectively reduce risk in fire-prone areas.
 - d) insurance issues – the effects of fires on insurance premiums in fire affected regions (one year on from the 2019-20 fire season).
 - e) aerial firefighting – including the establishment of a sovereign aerial firefighting fleet, the use of aerial resources and early suppression.
- 13) The Senate Inquiry currently has a timetable whereby its final report is due before the coronial proceedings will conclude. In the event the Senate Inquiry results in findings relevant to the work of the Coroner in these proceedings, further submissions may be made summarising those findings.

³ Royal Commission Report, p. 19 and p. 48.

The importance of review after the events

14) As the NSW Inquiry explained, throughout their investigation, the Inquiry chairs were made aware of:

*numerous examples where key lessons from previous fires seasons were not realised until many years after reviews, inquiries and Royal Commissions had finished, when the data and case studies had been forensically examined. Often these lessons challenge conventional understanding of fires and fire behaviour and are critical to improving our ability to imagine and predict what may happen in the future.*⁴

15) This important observation is also relevant to the work of the State Coroner in at least three ways.

16) First, it is naïve to think there are quick and easy answers to all of the complex problems involved in trying to mitigate bushfire risk, particularly as the nature and extent of risk changes over time.

17) Second, judicial and quasi-judicial investigations and the recommendations that result are not the end point of any consideration of what can be learnt from significant fire events. Viewed in this way the work of these investigations, including the inquests and inquiries that the State Coroner will conduct, are expected to highlight areas in which *further research is needed*.

18) Third, it is acknowledged that there are a range of expert specialties in the field of bushfire risk identification and mitigation. The work of the State Coroner will be informed by relevant expert opinion.

The approach of the State Coroner to matters arising from the 2019-2020 bushfire season

19) The State Coroner has neither the statutory power nor the resources to conduct a wholesale review into matters comprehensively canvassed in these earlier broad reaching inquiries.

20) It follows, not all fires that occurred during the 2019-2020 bushfire season will be the subject of coronial inquiry.

⁴ NSW Inquiry page 22

21) Fires reported to the State Coroner will proceed through a preliminary investigation to determine if any unique systemic issues arise on the facts or if any request for a general inquiry has been received from an authorised public official for the purpose of s.32 of the *Coroners Act 2009*. If not, the State Coroner will consider the outcome of the preliminary investigation and the relevant findings from earlier inquiries (summarised below) in determining whether or not a particular matter should proceed to hearing.

The 2019-2020 bushfire season

22) In deciding whether or not a particular matter should proceed to hearing the State Coroner will take into account the following key findings from the earlier investigations. In particular, the State Coroner will proceed upon the basis that a constellation of factors contributed to conditions across New South Wales leading up to and during the 2019-2020 bushfire season as set out below.

The scale and progression of the bushfires

23) The total amount burnt in the 2019-2020 bushfire season was 5.5 million hectares, which amounted to approximately 7% of the land in NSW.⁵ This is the largest recorded area of land burnt by bushfires in NSW history. The majority of the land that burned was temperate, broadleaf forest (largely eucalypt trees).⁶

24) In a typical fire season approximately 2% of eastern Australia's broadleaf temperate forest burns annually. In the 2019 – 2020 bushfires approximately 20% of this forest biome was burnt.⁷

25) In a typical fire season, the fires move from north to south. In the 2019 – 2020 fire season the fires commenced in the central and southern NSW regions earlier than usual. The fire season started early and was longer than typical duration (approximately 5 months in which fires were burning).⁸ Many fires throughout NSW burned simultaneously.

⁵ NSW Inquiry, p. 25.

⁶ NSW Inquiry, p. 27.

⁷ NSW Inquiry, p. 31.

⁸ NSW Inquiry, p. 29 – 30.

The severity of the bushfires

26) In NSW the categories that measure fire severity are as follows:⁹

- a) *Unburnt* (unburnt surface with green canopy);
- b) *Low* (understory fire with no impact on canopy);
- c) *Moderate* (partial canopy scorch);
- d) *High* (full canopy scorch and partial canopy destruction); and
- e) *Severe* (full canopy destruction).

27) In the 2019 – 2020 bushfires, the severity of the bushfires impacting upon approximately 800,600 hectares (around 15% of the total area burnt in NSW) was categorized as high or severe.¹⁰

28) The Forest Fire Danger Index ('FFDI') is a scale to measure fire danger, ranging from:

- a) Low-Moderate;
- b) High;
- c) Very High;
- d) Severe;
- e) Extreme; and
- f) Catastrophic.

These levels were continually elevated across the 2019 – 2020 bushfire season. A rating of Catastrophic was recorded on 6 September 2019, which is the earliest ever recorded since the scale was introduced.¹¹

The Very Dry Fuel

29) The available fuel throughout NSW was extremely dry (and spatially contiguous through the forested regions).¹² The fuel across the fire effected parts of NSW was at least much drier than on average and likely the driest fuel on record in the State.¹³ The reasons for this very dry fuel were drought and increased temperatures.

⁹ NSW Inquiry, p. 33 (and footnote 60 in particular).

¹⁰ NSW Inquiry p. 31.

¹¹ NSW Inquiry, p. 57.

¹² NSW Inquiry page 36

¹³ NSW Inquiry, p. 40. The three metrics of fuel dryness are the vapour pressure deficit; dead fuel moisture content and the live fuel moisture content. See also the Royal Commission Report findings on bushfire fuel, p. 64.

- 30) NSW experienced prolonged and widespread drought conditions leading up to the 2019–2020 bushfire season. There had been extreme rainfall deficiencies across the State and many years prior without significant drought relief.¹⁴ These conditions resulted, generally, in observations from those involved in fighting the bushfires that wet barriers and soft breaks in the landscape, which typically act as natural firebreaks, were dry.¹⁵
- 31) NSW also experienced its hottest and driest year on record in 2019.¹⁶ Overall, the meteorological trend observed in Australia is higher overall temperatures and reduced cool season rainfall.¹⁷
- 32) Significant global climate drivers contributed to the dryness of the 2019 – 2020 fire season.¹⁸ These drivers included a positive Indian Ocean Dipole event, a combined Southern Annular Mode and Sudden Stratospheric Warming event and a reduced cool season rainfall.¹⁹

Fuel Load

- 33) Fuel loads were generally high across most of the fire-affected areas in NSW but were no higher on average than they have been for the previous 30 years. These estimates of fuel load across the fire-affected areas of NSW are based on fire history datasets and fuel accumulation curves.²⁰
- 34) There has been considerable debate in communities across fire-affected NSW in regard to whether the fuel load in certain areas was too high and whether various hazard reduction options could or should have been adopted. Hazard reduction includes any activity to reduce the amount of fuel or change the structure of fuel in order to reduce the rate of the spread, intensity and severity of bushfires and to increase opportunity for effective suppression of bushfires.²¹ The NSW Inquiry and the Royal Commission comprehensively addressed the issue of land management, bushfire hazard reduction measures, traditional land management and cultural burning.²²

¹⁴ NSW Inquiry page 36 and 39

¹⁵ NSW Inquiry, p. 41.

¹⁶ NSW Inquiry, p. 37 and Royal Commission Report, p. 19.

¹⁷ NSW Inquiry, p. 45.

¹⁸ In particular, the Positive Indian Ocean Dipole, a Sudden Stratospheric Warming event from October - December 2019 and a negative Southern Annular Mode, as discussed in detail in the NSW Inquiry at p. 42 – 44. See also a recognition of these factors and the role of climate change in the Royal Commission Report, p. 55.

¹⁹ NSW Inquiry, p. 15.

²⁰ NSW Inquiry 47

²¹ NSW Inquiry, p. 50.

²² See NSW Inquiry, p. 156 – 183, and Royal Commission Report, p. 369 – 382.

35) Generally, in NSW during the bushfire season, where the weather was moderate, hazard-reduced areas contributed to the slowing of bushfires and provided for some fire containment options. However, where the weather was extreme, fires ran through hazard-reduced areas and fuel load did not effect the spread, intensity and severity of the fires.²³

36) As a *general* proposition, fuel load does not have a significant influence on fire intensity and spread in regard to *extreme* fires.²⁴

Weather patterns – Temperature

37) NSW experienced frequent heatwave conditions across the 2019 – 2020 bushfire season, defined as consecutive days and nights with high maximum and minimum temperatures. As a result of heatwaves, fuel continued to dry at night and the fires continued to spread at night. As a general trend, this challenged fire-fighting efforts to ‘catch-up’ overnight and drained resources.²⁵

Fire-generated thunderstorms

38) The spread of extreme fires is driven not only by environmental conditions but by dynamic interaction between the fire and the surrounding atmosphere.²⁶ This dynamic interaction includes fire – generated thunderstorms. These thunderstorms occur when *pyrocumululus* clouds develop over fires and result in *pyrocumulonimbus*: a fire-generated thunderstorm.

39) Across NSW in the 2019 – 2020 bushfire there were a record number of fire-generated thunderstorms.²⁷

40) Across the State, these fire-generated thunderstorms were observed to:²⁸

- a) Develop rapidly and unexpectedly;
- b) Create plumes of smoke above the fire;
- c) Change the behaviour and force of the fire;
- d) Generate lighting and gusting;
- e) Increase ember travel and spotting; and

²³ NSW Inquiry, p. 50.

²⁴ NSW Inquiry p. 52 and p.164 and Royal Commission Report, p. 373. Here the Royal Commission recognised a need for further research into the role of fuel load in extreme fires.

²⁵ NSW Inquiry, p. 61.

²⁶ NSW Inquiry, p. 64.

²⁷ NSW Inquiry, p. 68.

²⁸ NSW Inquiry, p. 66 - 67. See also the Royal Commission Report findings on the characteristics of fire-generated thunderstorms, p. 64 – 65.

- f) Generate sudden and extreme ‘downbursts’ of wind in the vicinity of the thunderstorm.

Lightning strikes

- 41) Most of the fires of the 2019 – 2020 bushfire season were observed to be started by lightning strikes.²⁹ The likelihood of ignition on the ground from a lightning strike is determined by the fuel moisture content and nature of the point of ignition. Lightning is more likely to ignite a fire in very dry conditions.³⁰ Dry fine fuel is most likely to result in a fire from lightning. Fires started by lightning are generally more likely to create larger fires because they may start in remote locations and often in clusters.³¹

Preparedness

- 42) The NSW pre-season outlook and briefings indicated the 2019-20 bushfire season was going to be severe. The NSW Rural Fire Service expressed pre-season concerns that long term rainfall deficiencies had severely impacted water resources; the preceding months had been some of the driest on record and as noted by the Bureau of Meteorology, by the start of September 2019, much of eastern Australia was primed for high danger ratings.³² However, the NSW Inquiry found that the scale of the actual fires took most – from firefighting and land management agencies, as well as local councils and members of local communities – by surprise. Consequently, the NSW Inquiry found that there did not appear to be a general understanding and preparedness in the community, even in high bush fire risk areas, of what could be coming. The NSW Inquiry for the most part identified areas for improvement in public land management relating to the identification and management of fire trails, risk assessments, cross-agency and jurisdictional collaboration, access to water supply and hazard reduction. The NSW Inquiry identified that tied to improving individual preparedness is the need to enhance community education and engagement and individual and community ownership of risk through nationally consistent high-quality information.

The Fire Agencies

- 43) In total, NSW firefighters from the NSW Rural Fire Service, National Parks and Wildlife Service, Fire and Rescue NSW and the Forestry Corporation of NSW completed 277,415 shifts throughout the season.³³

²⁹ NSW Inquiry, p. 70.

³⁰ NSW Inquiry, p. 70 – 71.

³¹ NSW Inquiry, p. 71.

³² NSW Inquiry, p. 115-116.

³³ NSW Inquiry, p 251.

44) Throughout the bushfire season NSW received significant assistance from emergency services personnel from interstate and internationally.³⁴

45) Even so, fire - fighting resources in NSW were considerably stretched during the 2019 – 2020 bush fire season.³⁵

The firefighting response

46) The extreme fire conditions in the 2019 – 2020 bushfire season challenged the pre-existing understanding within the field of fire science about how bushfires burn and spread in Australia.³⁶ In some cases, traditional methods of fire-fighting and fire suppression proved unsuccessful (due to, for example, the extreme dryness of the fuel and the intense ember spotting).³⁷

47) Many fires across NSW were very challenging to contain due to difficult terrain, ignition in remote locations and the very dry fuel. As the fires spread, many also became very difficult to contain and extinguish due to size and dynamic fire behaviour. There was very limited capacity to fight fires at night. Contrary to conventional fire activity, many of the fires took big runs at night and in the early morning.³⁸

The use of backburning

48) Fire agencies used backburning as a containment method for many fires across the season. Backburning was characterised as either ‘strategic’ (where it was used as a means to halt the fire) or ‘tactical’ (where it was used to protect a particular asset or where there is a particular threat to containment lines).³⁹

49) There were occasions where backburning was unsuccessful and broke containment lines, usually due to unforeseen wind changes and communication breakdowns.⁴⁰ Some specific examples of this occurring may be examined during the coronial inquests and inquiries that proceed to hearing.

³⁴ Royal Commission Report, p. 155 and p. 159 and NSW Inquiry, p. 252 (which records that over 5,600 interstate and international personnel were deployed across NSW).

³⁵ INSERT INQUIRY REFERENCE. See also findings in the Royal Commission Report that the 2019 – 2020 bushfires tested the capabilities and capacity of emergency services across Australia.

³⁶ NSW Inquiry, p. 57.

³⁷ NSW Inquiry, p. 73.

³⁸ NSW Inquiry 72

³⁹ NSW Inquiry, p. 291.

⁴⁰ NSW Inquiry, p. 289.

50) Specific evidence will be heard by the Court in regard to any coronial inquest or coronial inquiry where the containment strategy of backburning is directly relevant to the cause and origin of any fire and / or the manner and cause of any death that is the subject of an inquest.

Communications infrastructure

51) During the 2019 – 2020 bushfires there was significant fire damage caused to power infrastructure (namely poles, wires and substations). Electricity networks were extensively effected by the bushfires.⁴¹ In NSW there were 818 telecommunication facilities affected by the bushfires (with 514 of these experienced power outages of more than four hours).⁴²

52) There was a high number of requests across the state for mobile generators and there was only a limited supply available. The co-ordination of the distribution of mobile generators was coordinated by the Engineering Services Functional Area (ESFA) (which operates from within Resilience NSW).⁴³ The communication failures were due more to power outages rather than direct fire damage to infrastructure.⁴⁴

53) The main communications platform for emergency services organisations (ESOs) during the 2019 – 2020 bushfire season in NSW was the Public Safety Network (PSN). This network provided ‘mobile radio platform availability and allowed for the ‘interoperability’ between ESOs via the use of shared radio channels. The PSN covered approximately 80% of the NSW population and approximately 33% of NSW at the relevant time.⁴⁵ There were a number of limitations with this network:⁴⁶

- a) In areas not covered by the PSN, agencies relied on their own Private Mobile Radio (PMR) networks, where there was limited capability for wide area shared radio channels;
- b) Radio communication systems did not support heavy data traffic and visual or data streaming;
- c) There was no multi-state interoperability for wide area communications between NSW and Queensland fire fighting vehicles.

⁴¹ NSW Inquiry, p. 327.

⁴² NSW Inquiry, p. 198.

⁴³ NSW Inquiry, p. 332.

⁴⁴ NSW Inquiry, p. 198.

⁴⁵ It is important to note that the NSW Inquiry made findings that Critical Communication Enhancement Program (CCEP) is expanding the PSN so that it will cover 85% of NSW and 98% of the NSW population. The expansion will allow emergency service organisations to operate on a single, interoperable radio network. See NSW Inquiry, p. 337 -339.

⁴⁶ NSW Inquiry, p. 336.

54) Across the state, some fire agencies had challenges communicating with each other.

55) The State Coroner will hear specific evidence on this issue of communication as and where it is directly relevant to findings in specific matters that proceed to hearing.

Public warning systems

56) Public information about the 2019 – 2020 bushfires was widely available throughout the season through a range of platforms. The public accessed information through social media, apps, websites, and television and radio. The NSW RFS published tweets on twitter and posts on facebook from the official NSW RFS Facebook page.⁴⁷ The NSW RFS, together with NSW Police and NSW State Emergency Service (SAS) also engaged in door-knocking to alert residents to fire danger.⁴⁸

57) The 'Emergency Alert' is a national telephone warning system used in NSW by emergency services during the 2019 – 2020 bushfire season where voice and text messages are sent to mobile phones within a defined area of an emergency. During active fire activity in the season, there were 430 Emergency Alert campaigns in which the NSW RFS sent 340,60 voice messages and 2.14 million text messages.⁴⁹ The NSW public also relied significantly on the 'Fires Near Me' smartphone app.⁵⁰ The 'Fires Near Me' app provided information on fires in NSW and contained a 'watch zone' function where an alert was sent to the mobile when a fire entered a particular geographical zone and other developments.⁵¹ The 'Fires Near Me' app had an extremely high uptake during the fire season and it was the most searched term on Google (Australia) in 2019.⁵²

58) The Emergency Alerts were not successful where there were power and telecommunication failures. The location-based text messages were found to be 81% successful, the address-based text messages were 69% successful, and the voice messages were 70% successful.⁵³

59) There was extensive reliance on ABC radio for emergency warning updates and as a source of news and information about the bushfires.⁵⁴

⁴⁷ NSW Inquiry, p. 356 – 357.

⁴⁸ NSW Inquiry, p. 363.

⁴⁹ NSW Inquiry, p. 359.

⁵⁰ NSW Inquiry, p. 356.

⁵¹ NSW Inquiry, p. 364.

⁵² NSW Inquiry, p. 365.

⁵³ NSW Inquiry, p. 360.

⁵⁴ NSW Inquiry, p. 353 and p. 361.

60) Some people in remote or regional areas without mobile telephone coverage had no means to call Triple Zero and could not receive emergency alerts on the occasions where telecommunications infrastructure failed, and landlines were not operational.⁵⁵

Conclusion

61) If a decision is made to dispense with a coronial inquiry into a particular fire, this does not diminish the experience of people affected by the fire, particularly those who have lost land, belongings, pets and wildlife.

62) Rather, it is hoped that a focus upon specifically targeted matters will allow the State Coroner to understand the broader challenges faced by all individuals and communities impacted by fire across the 2019-2020 bushfire season, even those involved in matters that do not ultimately proceed to a hearing.

Counsel Assisting the State Coroner

13 August 2021

⁵⁵ NSW Inquiry, p. 353.

Appendix 10: Counsel Assisting's Summary of Findings and Recommendations concerning Indigenous Land

2019-2020 Bushfire Inquiries

Summary of Findings and Recommendations concerning Indigenous Land and Fire Management Practices

Introduction

- 1) The NSW Bushfire Inquiry [‘the NSW Inquiry’], the Royal Commission into National Natural Disaster Arrangements [‘The Royal Commission’] and the Senate Finance and Public Administration References Committee - *Lessons to be learned in relation to the Australian bushfire season 2019-20* [‘The Senate Inquiry’] had terms of reference in relation to Indigenous land and fire management practices.
- 2) The NSW Inquiry terms of reference included the making of recommendations arising from the Inquiry on ‘*land use planning and management and building standards, including... any appropriate use of indigenous practices*’.¹
- 3) The Royal Commission terms of reference directed it, for the purpose of its inquiry and recommendations, to have regard to ‘*any ways in which the traditional land and fire management practices of Indigenous Australians could improve Australia’s resilience to natural disasters*’.²
- 4) The Senate Inquiry terms of reference included lessons to be learned in relation to the preparation and planning for, response to and recovery efforts following the 2019-20 Australian bushfire season, with particular regard to... ‘*the adequacy of the Federal Government’s existing measures and policies to reduce future bushfire risk, including... Indigenous fire practices*...’³
- 5) The NSW Inquiry and the Royal Commission comprehensively addressed the issue of land management, including traditional land management and cultural burning.⁴ As

¹ The Final Report of the NSW Bushfire Inquiry, delivered 31 July 2020 [‘The NSW Inquiry Report’], p. 1

² Royal Commission into National Natural Disaster Arrangements Final Report, delivered 28 October 2020 [‘The Royal Commission Report’], Appendix 1, p. 11

³ The Senate Finance and Public Administration References Committee, *Lessons to be learned in relation to the Australian bushfire season 2019-20*, Interim Report delivered 7 October 2020 [‘The Senate Inquiry Interim Report’], p. xiii

⁴ See The NSW Inquiry Report, pp. 156 – 183 and The Royal Commission Report, pp. 369 – 382.

part of its inquiry, the NSW Inquiry held expert roundtables on cultural land management, which included a range of Aboriginal land management practitioners and community members.⁵ The Royal Commission heard from Indigenous cultural burning practitioners, researchers and organisations during the course of its inquiry and surveyed the literature on cultural burning practices to produce a background paper on cultural burning practices in Australia⁶.

- 6) The Senate Inquiry has not yet delivered its final report. In its interim report, the Senate Committee stated that it will be further considering the efficacy of hazard reduction as it progresses its inquiry, with a particular focus on the application of Indigenous land management practices.⁷
- 7) It is against this background that this Summary of Findings and Recommendations in relation to Indigenous land and fire management practices has been prepared.

Indigenous land management

- 8) Indigenous land management, also referred to as ‘caring for Country’, aims to ‘protect, maintain, heal and enhance healthy and ecologically diverse ecosystems, productive landscapes and other cultural values’⁸. It allows landscapes to be managed in a way that empowers and reflects the cultural practices, voices and aspirations of Indigenous Australians.⁹
- 9) Indigenous land management is based on cultural understandings of Country, is tailored to specific places, and engages local people in development and implementation.¹⁰ Partly for these reasons, Indigenous land management differs widely across Australia.¹¹
- 10) Indigenous land management activities are diverse and include a range of environmental, natural resource and cultural heritage management activities, including water management, the harvesting of food and fibre and the conduct of

⁵ The NSW Inquiry Report, p. 5

⁶ The Office of the Royal Commission, *Background Paper: Cultural burning practices in Australia*, 15 June 2020 [‘The Royal Commission Background Paper’]

⁷ The Senate Inquiry Interim Report, p. 65

⁸ The Royal Commission Report, p. 388

⁹ The Royal Commission Report, p. 396

¹⁰ The Royal Commission Report, p. 21

¹¹ The Royal Commission Report, p. 21

controlled burns.¹² They are undertaken by Indigenous individuals, groups and organisations across Australia for a range of customary, community, conservation and commercial reasons.¹³

Indigenous fire management

11) Indigenous Australians have used fire to shape and manage the land for over 60,000 years.¹⁴ Indigenous use of fire is one component of a broader practice of Indigenous land management, which ‘aims to achieve a wide range of social, economic and cultural outcomes beyond hazard reduction’¹⁵.

12) Cultural burning is the term used to describe burning practices developed by Indigenous Australians to enhance the health of the land and its people.¹⁶ It is about maintaining healthy, ecologically diverse and productive landscapes and also about practising cultural traditions.¹⁷ While it does not necessarily have fuel reduction as its primary objective, it can often produce that outcome.¹⁸

13) Modern cultural fire practices are developed using a blend of customary and western techniques to manage land and waters to the benefit of Country and communities across Australia.¹⁹ Many of these practices are relatively consistent in design, such as the use of the mosaic system of burning, however these practices vary in application, due to factors such as the type of vegetation, the presence old growth forests and localised weather effects.²⁰

Benefits of Indigenous land and fire management

14) Although reducing bushfire risk is not necessarily the primary purpose of Indigenous land management, reduced fuel loads and improved ecosystem resilience can be important benefits of its application.²¹

¹² The Royal Commission Report, p. 388

¹³ The Royal Commission Report, p. 388

¹⁴ The Royal Commission Background Paper, p. 4

¹⁵ Dr Timothy Neale, Deakin University, Transcript of 18 June 2020 at P-810, as cited in The Royal Commissioner Report, at p. 389

¹⁶ The Royal Commission Background Paper, p. 6

¹⁷ The NSW Inquiry Report, pp. 182-183

¹⁸ The NSW Inquiry Report, p. 182; The Royal Commission Report, pp.389-390

¹⁹ The Royal Commission Background Paper, p. 4

²⁰ The Royal Commission Background Paper, p. 4

²¹ The Royal Commission Report, p. 390

- 15) The incorporation of Indigenous land management practices benefits the resilience of Indigenous Australians and provides opportunities for a whole of community response to bushfires.²² Through their involvement in Indigenous land management, Indigenous communities also accrue health, social and cultural benefits.²³
- 16) Aboriginal land management programs that incorporate cultural burning have also been shown to produce a wide range of social, environmental and cultural benefits.²⁴

Recognition of and support for Indigenous land and fire management practices

- 17) The NSW Inquiry recognised that cultural burning is one component of a broader practice of traditional Aboriginal land management and it is an important cultural practice, not simply another technique of hazard reduction burning.²⁵
- 18) There is growing recognition of the value of Indigenous land and fire management practices as a way to mitigate the effects of bushfires and improve disaster resilience.²⁶ The Australian, state and territory governments are increasingly supporting Indigenous land and fire management practices.²⁷
- 19) There is widespread support for Indigenous land management practices to be more widely implemented, including cultural burning, and for such opportunities to be explored.²⁸ However, barriers to the greater use of these practices were recognised and further work is required for their wider implementation.²⁹

Recommendations made by Inquiries

- 20) The Royal Commission made the following recommendations:

18.1 Australian, state, territory and local governments should engage further with Traditional Owners to explore the relationship between Indigenous land and fire management and natural disaster resilience; and

²² The Royal Commission Report, p. 391

²³ The Royal Commission Report, p. 396

²⁴ The NSW Inquiry Report, p. 185; The Royal Commission Report, pp. 390-392

²⁵ The NSW Inquiry Report, p. 183

²⁶ The Royal Commission Report, p. 21

²⁷ The Royal Commission Report, p. 391

²⁸ The NSW Inquiry Report, pp. 181 and 186; The Royal Commission Report, pp. 389 and 396

²⁹ See The NSW Inquiry Report, pp. 183,184 and 186

18.2 *Australian, state, territory and local governments should explore further opportunities to leverage Indigenous land and fire management insights, in the development, planning and execution of public land management activities.*

21) In relation to **Recommendations 18.1** and **18.2** made by the Royal Commission, the National Recovery and Resilience Agency reports that the New South Wales Government's response to these recommendations is that it supports or supports in principle each of the recommendations directed to states and territories, and notes those recommendations directed to the Commonwealth.³⁰

22) Further, it reports that the Commonwealth Government supports **Recommendations 18.1** and **18.2** in principle and states the following in relation to the Commonwealth Government's response to these recommendations:³¹

- a. the National Indigenous Australians Agency (NIAA) works closely with Indigenous land managers, funding 127 Indigenous ranger groups across Australia to manage natural and cultural values of Country, including fire management. NIAA and the Commonwealth Department of Agriculture, Water and the Environment (DAWE) also support Traditional Owners to manage more than 74 million hectares of land under the Indigenous Protected Areas (IPA) program. Indigenous rangers and IPA managers undertake fire management as part of their regular activities for a range of benefits including natural disaster resilience on Indigenous and state held land.
- b. The Commonwealth's National Bushfire Recovery Fund provides \$2 million to empower Traditional owners to share knowledge and build understanding of traditional indigenous fire management practices, as part of the \$149.7 million support for native wildlife and habitat restoration following the 2019/20 fires.
- c. In relation to supporting initiatives, DAWE is coordinating environmental recovery following the Black Summer bushfires in 2019-20 in collaboration with the National Recovery and Resilience Agency (formerly the National Bushfire Recovery Agency (NBRA)) and the states and territories. There are

³⁰ National Recovery and Resilience Agency, *Royal Commission into National Natural Disaster Arrangements Implementation of Recommendations* (as at June 2021) ['the Royal Commission Implementation of Recommendations Report'], pp. 35-36

³¹ The Royal Commission Implementation of Recommendations Report, pp. 35-36

also other programs (beyond the Indigenous Fire and Land Management Workshops Program) under the \$200 million investment in bushfire recovery for wildlife and habitats include Traditional Owner engagement and partnerships. For example, the Australian Government is investing more than \$9.5 million in Traditional Owner-led activities including cultural burning, through Natural Resource Management (NRM) organisations and state governments under the Bushfire Recovery Regional Fund.

23) The NSW Inquiry made the following recommendations:

25. That Government adopt the principle that cultural burning is one component of a broader practice of traditional Aboriginal land management and is an important cultural practice, not simply another technique of hazard reduction burning.

26. That, in order to increase the respectful, collaborative and effective use of Aboriginal land management practices in planning and preparing for bush fire, Government commit to pursuing greater application of Aboriginal land management, including cultural burning, through a program to be coordinated by Aboriginal Affairs and Department of Planning, Industry and Environment working in partnership with Aboriginal communities. This should be accompanied by a program of evaluation alongside the scaled-up application of these techniques.

24) In relation to **Recommendation 25** made by the NSW Inquiry, Resilience NSW reports that as at June 2021, the implementation status of the recommendation is 'in progress' and the target date is second quarter of 2022.³² The action to be taken in response to this recommendation is that the Department of Primary Industries and Environment (DPIE) and Aboriginal Affairs NSW (AANSW) are to develop a long term Cultural Fire Management Strategy working in partnership with Aboriginal communities.³³ The progress to date for this recommendation includes that NSW Government has committed \$1.29 million over two years to enable the commencement of a community driven, co-design process, leading to the development of a long-term Cultural Fire Management Strategy and business model.³⁴

³² Resilience NSW, *NSW Bushfire Inquiry 2020 Progress Report: Implementation of the NSW Government's Response to the NSW Bushfire Inquiry* (Reporting Period April to June 2021) ['the NSW Inquiry Progress Report'], p. 22

³³ The NSW Inquiry Progress Report, p. 22

³⁴ The NSW Inquiry Progress Report, p. 22

25) In relation to **Recommendation 26** made by the NSW Inquiry, Resilience NSW reports that as at June 2021, the implementation status of the recommendation is 'in progress' and the target date is 'ongoing'.³⁵ The action to be taken in response to this recommendation is that DPIE will measure benefits of Aboriginal land management (cultural burning) to conservation, soil properties, and community wellbeing, and to work with Aboriginal communities to foster and deliver cultural burning.³⁶ The progress to date records that this recommendation is being addressed in conjunction with Recommendation 25.³⁷ DPIE has been funded through the Commonwealth Disaster Risk Reduction Funding Package to develop a framework to assess the vulnerability of Cultural Heritage to fire and determine how key management actions, such as prescribed burning and fire suppression, can mitigate fire risk to Cultural Heritage.³⁸

Counsel Assisting the State Coroner
2 September 2021

³⁵ The NSW Inquiry Progress Report, p. 22

³⁶ The NSW Inquiry Progress Report, p. 22

³⁷ The NSW Inquiry Progress Report, p. 22

³⁸ The NSW Inquiry Progress Report, p. 22

Appendix 11: Counsel Assisting's Summary of Findings and Recommendations concerning Climate Change

2019-2020 Bushfire Inquiries

Summary of Findings and Recommendations concerning Climate Change

Introduction

- 1) The NSW Bushfire Inquiry ('the NSW Inquiry'), the Royal Commission into National Natural Disaster Arrangements ('the Royal Commission') and the Senate Finance and Public Administration References Committee – *Lessons to be learned in relation to the Australian Bushfire season 2019-20* ('the Senate Inquiry'), referred to collectively as the Inquiries, considered the role of climate change in the 2019-20 bushfire season with respect to the cause of the fires, its contribution to the severity of the fires and consequently, its contribution to the broader impacts of those fires.
- 2) The NSW Inquiry terms of reference included considering and reporting on '*the causes of, and factors contributing to, the frequency, intensity, timing and location of, bushfires in NSW in the 2019-20 bushfire season, including consideration of any role of weather, drought, climate change, fuel loads and human activity*'.¹
- 3) The Royal Commission terms of reference directed it, for the purpose of its inquiry and recommendations, to have regard to '*...Australia's arrangements for improving resilience and adapting to changing climatic conditions...*'.²
- 4) The Senate Inquiry terms of reference included lessons to be learned in relation to the preparation and planning for, response to and recovery efforts following the 2019-20 Australian bushfire season, with particular reference to '*...advice provided to the Federal Government, prior to the bushfires, about the level of bushfire risk this fire season, how and why those risks differed from historical norms, and measures that should be taken to reduce that risk in the future...*' and '*...the adequacy of the Federal Government's existing measures and policies to reduce future bushfire risk, including in relation to assessing, mitigating and adapting to expected climate change impacts...*'.³
- 5) There are four key ingredients required for serious fire activity: spatially continuous fuel, dry fuel, weather conducive to spread and ignition sources.⁴ The 2019-20 season would ultimately combine all four key ingredients to surpass expectations.⁵
- 6) The 2020 State of the Climate Report ('the 2020 Report') prepared jointly by the Australian Bureau of Meteorology ('BoM') and the Commonwealth Scientific and

¹ The Final Report of the NSW Bushfire Inquiry, delivered 31 July 2020 ('The NSW Inquiry Report'), p. 1

² Royal Commission into National Natural Disaster Arrangements Final Report, delivered 28 October 2020 ('The Royal Commission Report'), Appendix 1, p. 10

³ The Senate Finance and Public Administration References Committee, *Lessons to be learned in relation to the Australian bushfire season 2019-20*, Final Report delivered 7 October 2020 ('The Senate Inquiry Final Report'), p. 1

⁴ The NSW Inquiry Report, p. 36

⁵ The NSW Inquiry Report, p. 36

Industrial Research Organisation ('CSIRO') reported that Australia's climate had warmed 1.44 ± 0.24 °C since 1910, leading to changes to climate and weather, including:

- a) increased frequency of extreme heat events;
 - b) decreased rainfall of approximately 12 per cent in the southeast of Australia since the late 1990s between April to October; and
 - c) a long-term increase in extreme fire weather, and in the length of the fire season, across large parts of Australia since the 1950s.⁶
- 7) Accordingly, the Inquiries examined the following themes which relate to the above changes in Australia's climate and weather in the context of the 2019-20 bushfire season:
- a. Dryness of NSW landscape, including increased fuel load;
 - b. Unusual/extreme weather and fire behaviour; and
 - c. Longer and hotter fire seasons.

Each of these themes is explored in further detail in the body of this paper.

- 8) The NSW Inquiry focused on hearing from the community about their experiences by way of public submissions and hearings. It also reviewed previous bushfire reports, inquiries and coronial investigations to understand the response to previous bushfires in NSW and Australia generally. Importantly, the NSW Inquiry received evidence from a range of fire experts and researchers in relation to the extreme weather conditions and unusual fire behaviours observed in the 2019-20 bushfire season.⁷
- 9) The NSW Inquiry received many submissions which stated that climate change was a contributing factor to the fires and encouraged governments to take further action to address the impact and effects of climate change.⁸
- 10) The Royal Commission called for public submissions from any person or organisation, particularly seeking contributions from any person affected by the fires. It also sent notices seeking information from various people, government agencies and organisations. The Royal Commission received 1,772 submissions and 3,317 tendered documents from more than 270 witnesses.⁹
- 11) The Senate Inquiry invited submissions from relevant Commonwealth, state and territory government departments and agencies, local government associations, business and tourism bodies, charity groups, insurance companies, banking and housing organisations, academic and research institutions, wildlife and conservation organisations, fire services and other stakeholder groups. The Committee received a total of 192 submissions to inform its inquiry.
- 12) It is against this background that this Summary of Findings and Recommendations in relation to climate change has been prepared.

⁶ Bureau of Meteorology and Commonwealth Scientific and Industrial Research Organisation, *State of the Climate 2020* [2020] ('State of the Climate 2020 Report'), p. 2

⁷ State of the Climate 2020 Report, p. 3

⁸ State of the Climate 2020 Report, p. 8

⁹ The Royal Commission Report, p. 6

Dryness of NSW landscape and fuel loads

- 13) The NSW Inquiry Report stated that the landscape of NSW was extremely dry prior to the 2019-20 fire season as most of NSW was in the third year of severe drought.¹⁰
- 14) BoM advised the NSW Inquiry that the drought leading up to the 2019-20 fire season was exceptional in terms of severity as indicated by rainfall deficiencies, spatial extent (as it covered most of NSW), and its duration of multiple years.¹¹ This period of drought also coincided with the warmest period on record for NSW. The combination of rainfall deficiency and maximum temperatures resulted in 2019 being the hottest and driest year on record for NSW.¹²
- 15) The NSW Bushfire Risk Management Research Hub ('the Research Hub'), a body developed by the NSW Government in 2018 which was then directed by Professor Ross Bradstock of the University of Wollongong, examined whether fuel dryness in NSW was unprecedented ahead of and during the 2019-20 fire season. This study by the Research Hub showed that conditions ahead of and during the 2019-20 fire season were either much drier than average or the driest on record for the fire-affected areas of NSW.¹³ The study concluded that it is likely that the unprecedented fuel dryness across eastern NSW contributed to the vastness of the area that burned in the 2019-20 fire season.¹⁴
- 16) The NSW Inquiry cited studies that found that an unprecedented proportion of Australia's temperate broadleaf forests burned in the 2019-20 fire season.¹⁵ Ordinarily, less than 2% of these forests burn annually, even in extreme fire seasons. Comparatively, almost 20% of these forests burned in the 2019-20 fire season.¹⁶
- 17) The dryness of the landscape resulted in:
 - a. greater size of fires in areas of large continuous forest;
 - b. fires occurring in areas that are usually too damp for a fire to burn, such as areas of rainforest and peat;
 - c. lightning being able to 'catch' well to initiate fire;
 - d. suitable conditions for fire spread once alight; and
 - e. a lack of naturally occurring fire breaks, such as moist gullies, swamps or south-facing slopes which ordinarily break up the forest landscape, thereby increasing the probability of 'mega forest fire events'.¹⁷
- 18) Each of the Inquiries considered whether the extraordinary drought and extreme dryness of landscape in NSW during the period preceding the 2019-20 fire season either was or may have been caused by climate change.

¹⁰ The NSW Inquiry Report, p. 36

¹¹ The NSW Inquiry Report, p. 36

¹² The NSW Inquiry Report, pp.36-37

¹³ The NSW Inquiry Report, p. 40 citing NSW Bushfire Risk Management Research Hub (2020) 'Fuel dryness'.

¹⁴ The NSW Inquiry Report, p. 40

¹⁵ The NSW Inquiry Report, p. 31

¹⁶ The NSW Inquiry Report, p. 31 citing Boer, M, Resco de Dios, V, and Bradstock, R (2020) 'Unprecedented burn area of Australian mega forest fires' 10(3) *Natural Climate Change* 171

¹⁷ The NSW Inquiry Report, pp. iv, 28, 41

- 19) When consulted by the NSW Inquiry, Professor Andy Pitman AO¹⁸ explained that based on available evidence, one cannot definitively say that climate change caused the extent and severity of the drought experienced in NSW preceding the 2019-20 fire season, but it also cannot be ruled out as the cause.¹⁹
- 20) However, the Royal Commission Report cited evidence from the CSIRO which stated that climate change is driving changes in average and extreme weather with a drying trend occurring across the majority of the southern half of Australia.²⁰
- 21) Similar to the Royal Commission Report, the Senate Report noted that the Emergency Leaders for Climate Action (ELCA) stressed that climate change is driving worsening bushfire conditions by creating, amongst other things, drier vegetation and fuel.²¹ The ELCA also submitted to the NSW Inquiry that it is 'irrefutable that climate change was the main driver of the unprecedented 2019-20 bushfire season'.²²
- 22) Further, the State of the Climate 2020 Report stated that climate change affects dryness and amount of fuel by influencing rainfall, air temperature and atmospheric moisture content, which exacerbates drying of landscape.²³ The Report also stated that increased CO₂ can affect the rate and amount of plant growth, which can affect fuel loads.²⁴
- 23) However, it is important to note that there were also usual large-scale climate drivers that occurred prior to and during the 2019-20 fire season which contributed to the dry conditions.²⁵ These include a long-lived positive Indian Ocean Dipole, a negative Southern Annular Mode associated with a sudden stratospheric warming event, and neutral El Nino/Southern Oscillation.²⁶
- 24) BoM submitted to the NSW Inquiry that the alignment of these usual climate drivers acted on top of longer-term observed climate trends of higher temperatures and reduced cool season rainfall, which increased the tendency for dry/warm winter and spring conditions across south-east Australia.²⁷
- 25) Nonetheless, the CSIRO reported that Australia's mean annual temperature has increased since 1850 and this has been attributed to climate change associated with increased greenhouse gases in the atmosphere.²⁸

¹⁸ Professor of University of NSW and Director of the Australian Research Council Centre of Excellence for Climate Extremes.

¹⁹ The NSW Inquiry Report, p. 21

²⁰ The Royal Commission Report, p. 58

²¹ The Senate Inquiry Final Report, p. 82

²² Emergency Leaders for Climate Action, *Submission to NSW Independent Bushfire Inquiry* (15 April 2020) p. 6

²³ State of the Climate 2020 Report, p. 5

²⁴ State of the Climate 2020 Report, p. 5

²⁵ The NSW Inquiry Report, pp. 42-43

²⁶ The NSW Inquiry Report, pp. 42-44

²⁷ The NSW Inquiry Report, p. 45

²⁸ The NSW Inquiry Report, p. 45

Extreme/unusual weather and fire behaviour

- 26) The NSW Inquiry Report stated that dryness of the landscape and fuel loads resulted in an increased ease of ignition, in most cases by lightning, but extreme fire weather conditions exacerbated and propelled fires.²⁹
- 27) Fire-conducive weather conditions which exacerbated the fires included repeated heatwave conditions with high temperatures overnight, high solar insolation, very low humidity and hot westerly winds.³⁰
- 28) Warm and dry conditions overnight, when some moisture recovery in fuels would typically occur, meant that fires were routinely propagating and provided no relief to firefighters.³¹
- 29) The NSW Inquiry also noted that lightning was the suspected immediate ignition source for many of the largest and most dangerous fires.³² BoM reported to the NSW Inquiry that there is a consensus amongst NSW meteorologists that there was not an unusual amount of lightning activity in the season.³³ There may have been, however, more 'dry' lightning strikes due to lower rainfall; this observation is also reported in other academic studies.³⁴ Whilst there likely was not an unusual amount of lightning during the 2019-20 fire season, BoM advised that the dry conditions in NSW allowed easy ignition of fires from lightning.³⁵
- 30) Significantly, the NSW Inquiry reported that the 2019-20 fire season was characterised by an unprecedented amount of fire-generated thunderstorms, also known as pyro cumulonimbus.³⁶ Pyro cumulonimbus are extremely dangerous events which can escalate fire spread and create very hazardous conditions for firefighters.³⁷ These fire-generated thunderstorms are caused by pyro convective atmospheric conditions.
- 31) Pyro convective conditions can cause weather phenomenon that can suddenly and unexpectedly change fire behaviour.³⁸ These conditions can also cause independent hazardous weather phenomenon, such as extreme wind gusts and/or lightning; the latter of which may result in the ignition of further fires.³⁹
- 32) Prior to the 2019-20 fire season, there had been 60 fire-generated thunderstorms recorded in NSW since 1978, however, there were 29 fire-generated thunderstorms in the 2019-20 fire season alone.⁴⁰
- 33) In his submission to the NSW Inquiry, Professor Jason Sharples of the Australian National University provided data which correlated pyro cumulonimbus events with low

²⁹ The NSW Inquiry Report, p. 15

³⁰ The NSW Inquiry Report, p. 57

³¹ The NSW Inquiry Report, p. 61

³² The NSW Inquiry Report, p. 28

³³ The NSW Inquiry Report, p. 70

³⁴ The NSW Inquiry Report, p. 70

³⁵ The NSW Inquiry Report, p. 71

³⁶ The NSW Inquiry Report, p. 22, 68

³⁷ The NSW Inquiry Report, p. 22

³⁸ The NSW Inquiry Report, p. 66

³⁹ The NSW Inquiry Report, p. 66

⁴⁰ The NSW Inquiry Report, p. 68

fuel moisture, indicating that dryness of fuel was a prerequisite for the events observed in the 2019-20 fire season.⁴¹

- 34) Aside from the unprecedented number of pyro cumulonimbus events, the NSW Inquiry received evidence that the fires that occurred in the 2019-20 fire season exhibited unusual or unexpected fire behaviour, including:
- a. quicker spread than expected during night time (when fires would typically self-extinguish or burn at a lower intensity);
 - b. ease of ignition by lighting and/or embers;
 - c. fire spreading in all directions simultaneously;
 - d. fire spreading into the wind;
 - e. frequent 'blow up' days (where there is a sudden increase in intensity and/or rate of spread);
 - f. fire burning through areas that should not typically burn (i.e. recently hazard-reduced areas, previously burnt areas from earlier in the season, mown grass, sheets of water, and bare soil); and
 - g. embers spotting a great distance ahead of the fire front and/or over large bodies of waters thereby creating new fires.⁴²
- 35) Based on evidence provided by the CSIRO, the Royal Commission attributed the increased frequency and intensity of extreme weather to climate change, noting that climate change influences Australia's natural climate variability, which causes changes in average and extreme weather.⁴³
- 36) BoM also reported to the NSW Inquiry that NSW is trending towards conditions more favourable to development of fire-generated thunderstorms.⁴⁴ It is reported that climate change could amplify these conditions by, in particular, increasing atmospheric dryness and instability across south-eastern Australia.⁴⁵ This would result in more fire-generated weather and a longer fire season (extending into spring), which would have resourcing impacts for firefighting.⁴⁶
- 37) The 2020 Report stated that there is a significant trend in some regions of southern Australia towards a greater number of days during which weather conditions are conducive to extreme bushfires that can generate pyro cumulonimbus.⁴⁷

Longer and hotter fire season

- 38) Section 81 of the *Rural Fires Act 1997* (NSW) sets the statutory bushfire danger period as commencing on 1 October and ending on 31 March of the following year. However, the 2019-20 fire season started months earlier on 1 July 2019 with fires burning until the

⁴¹ The NSW Inquiry Report, p. 69

⁴² The NSW Inquiry Report, p. 34

⁴³ The Royal Commission Report, pp. 55, 57

⁴⁴ The NSW Inquiry Report, p. 83

⁴⁵ The NSW Inquiry Report, p. 83 citing Di Virgilio, G, Evans, J, Blake, S, Armstrong, M, Dowdy, A, Sharples, J, and McRae, R (2019) 'Climate change increases the potential for extreme wildfires' 46(14) *Geophysical Research Letters* 8517

⁴⁶ The NSW Inquiry Report pp. 83-84 citing Di Virgilio, G, Evans, J, Blake, S, Armstrong, M, Dowdy, A, Sharples, J, and McRae, R (2019) 'Climate change increases the potential for extreme wildfires' 46(14) *Geophysical Research Letters* 8517

⁴⁷ State of the Climate 2020 Report, p. 5

last fires were extinguished on 2 March 2020, spanning a total of 240 consecutive days of active fire.⁴⁸

39) The NSW Inquiry Report noted that along with the 2019-20 fire season starting earlier than usual in Northern NSW, Northern NSW experienced unseasonably late fires at the end of the previous fire season.⁴⁹

40) The ELCA submitted to the Senate Inquiry that climate change is causing hotter temperatures which is resulting in a higher number of hot days and therefore, a longer fire season.⁵⁰ Similarly, BoM submitted to the Royal Commission that background climate trends have resulted in longer fire seasons and moreover, more extreme fire days.⁵¹

41) The study by the Research Hub also supported observations that the 2019-20 fire season started earlier, partially attributing this to the greater number of days in 2019 where dead fuel was critically dry as compared to any other time since 1950.⁵²

The State of the Climate 2020 Report reports a long-term increase in the length of the fire season across large areas in Australia since the 1950s. This report stated that climate change, particularly the associated increase in temperatures, is contributing to the increased length of the fire season.⁵³ However, whilst the Report stated that climate change is influencing long-term trends in some key risk factors for bushfires in Australia, it clarifies that it is difficult to attribute a single fire event to climate change; though this subject is currently being researched.⁵⁴ The 2020 Report notes that there is considerable variability across years, particularly in years where La Niña occurs, as these years are associated with a lower number of days with high FFDI ratings.⁵⁵

Recommendations made by the Inquiries

42) The NSW Inquiry made the following recommendations relating to climate change:

Recommendation 3

That the NSW Government, along with other Australian governments, ask AFAC⁵⁶ to establish a national bush fire database. This database would enable:

- *monitoring of trends in bush fire activity and impacts, including timing, cause, extent and intensity across all land tenures and vegetation types*
- *tracking trends and identifying patterns in associated weather and climate signals that contribute to severe bush fires*
- *evaluation of the cost and effectiveness of risk mitigation efforts, including hazard reduction, and fire suppression activities so we have a better understanding of what works.*

⁴⁸ The NSW Inquiry Report, pp. 29, 105

⁴⁹ The NSW Inquiry Report, p. 29

⁵⁰ The Senate Inquiry Final Report, p. 82

⁵¹ The Royal Commission Report, p. 58

⁵² The NSW Inquiry Report, p. 40

⁵³ State of the Climate 2020 Report, p. 5

⁵⁴ State of the Climate 2020 Report 2020, p. 5

⁵⁵ State of the Climate 2020 Report, p. 5

⁵⁶ AFAC is the Australian and New Zealand National Council for fire and emergency services which focuses on creating safer, more resilient communities by developing doctrine and supporting operations.

Recommendation 27

That Government commit to shifting to a strategic approach to planning for bush fire, and develop a new NSW Bush Fire Policy similar to the NSW Flood Prone Land Policy in order to accommodate changing climate conditions and the increasing likelihood of catastrophic bush fire conditions; to build greater resilience into both existing and future communities; and to decrease costs associated with recovery and rebuilding.

Recommendation 36

That Government invest in long-term ecosystem and land management monitoring, modelling, forecasting, research and evaluation, and harness citizen science in this effort. This will include, among other things:

- *tracking and trying to forecast what is happening to ecosystems over decades under projected changes to climate extremes, including fire regime change*
- *better understanding interaction of fire with other disturbances, e.g. drought, hydrological changes in the landscape*
- *commissioning experiments and feasibility studies for ecosystem adaptation experiments – for example, facilitating shift of high conservation-value rainforest vegetation communities further south as climatic conditions change*
- *better understanding the influence of different land management practices on landscape flammability (in different landscapes) over the short, medium and long-term, and enabling an adaptive management approach.*

43) In relation to **Recommendation 3** made by the NSW Inquiry, Resilience NSW reports that as at December 2021, the implementation status of the recommendation is 'In Progress'⁵⁷ with a target completion date of the second quarter of 2023.⁵⁸ The action to be taken in response to this recommendation is that the NSW Rural Fire Service (RFS) will collaborate with the AFAC and the Disaster Research Centre to ensure a national repository for bushfire history including those elements listed within the recommendation. In terms of the progress made in implementing the recommendation, as at December 2021, NSW RFS has participated in multiple national projects, including the National Bush Fire Intelligence Capability led by CSIRO, and research and bushfire history mapping projects led by AFAC and the Emergency Management Spatial information Network Australia.⁵⁹

44) In relation to **Recommendation 27** made by the NSW Inquiry, Resilience NSW reports that as at December 2021, the implementation status of the recommendation is 'In Progress' with a target completion date of the first quarter of 2024; though it is noted that the target date has been revised by the lead agency.⁶⁰ The action to be taken in response to this recommendation is that NSW RFS will work with the Department of Planning, Industry and Environment (DPIE) to design and establish a new bushfire planning framework which will incorporate a new strategic planning approach and fit into the existing Planning for Bush Fire Protection regulatory scheme. The State Emergency Management Committee (SEMC) will consider the development of a new NSW Bush Fire Planning Policy to support this new approach as part of the work program of its land use

⁵⁷ A recommendation is given the status of 'In Progress' where the recommendation has a project that is being progressed as at the end of the reporting period.

⁵⁸ Resilience NSW, *NSW Bushfire Inquiry 2020 Progress Report: Implementation of the NSW Government's Response to the NSW Bushfire Inquiry* (Reporting Period October to December 2021) ('the NSW Inquiry Progress Report'), p. 7

⁵⁹ The NSW Inquiry Progress Report, p. 7

⁶⁰ The NSW Inquiry Progress Report, p. 21

advisory group. In terms of the progress made in implementing the recommendation, as at December 2021, NSW RFS, in partnership with DPIE, developed a delivery strategy and implementation road map for embedding enhanced strategic planning processes for bushfire resilience into the NSW planning system, which was endorsed by SEMC in December 2021.⁶¹

45) In relation to **Recommendation 36** made by the NSW Inquiry, Resilience NSW reports that as at December 2021, the implementation status of the recommendation is 'In Progress' with a target completion date of the fourth quarter of 2023.⁶² The action to be taken in response to this recommendation is that DPIE enhance capability to assess priority at-risk species and ecosystems and identify long-term recovery actions. In terms of the progress made in implementing this recommendation, as at December 2021, the NSW Government has committed \$2 million over a period of three years to support DPIE projects to examine the effect bushfires have on NSW water quality objectives, and assess and mitigate the risk to soil health during hazard reduction activities. There has been progress in the areas of research and project planning to investigate the impacts from the 2019-20 bushfires and related activities (such as hazard reduction) on the soil and landscape and NSW waterways. Further, the Minister of Energy and the Environment declared 58 environmental Asset of Intergenerational Significance (AIS) sites protecting habitat for 15 threatened species. To date, 279 sites have been declared as AIS, protecting habitat for 108 species.⁶³

46) The Royal Commission made the following recommendations:

4.2 – Australian, state and territory governments should create common information platforms and share technologies to enable collaboration in the production, analysis, access, and exchange of information, data and knowledge about climate and disaster risks.

4.3 – Australian, state and territory governments should support the implementation of the National Disaster Risk Information Services Capability and aligned climate adaptation initiatives.

4.4 - Features of the National Disaster Risk Information Services Capability - The National Disaster Risk Information Services Capability should include tools and systems to support operational and strategic decision making, including integrated climate and disaster risk scenarios tailored to various needs of relevant industry sectors and end users.

4.5 - Australian, state and territory governments should produce downscaled climate projections:

- 1) to inform the assessment of future natural disaster risk by relevant decision makers, including state and territory government agencies with planning and emergency management responsibilities*
- 2) underpinned by an agreed common core set of climate trajectories and timelines, and*
- 3) subject to regular review.*

⁶¹ The NSW Inquiry Progress Report, p. 21

⁶² The NSW Inquiry Progress Report, p. 30

⁶³ The NSW Inquiry Progress Report, p. 30

- 47) In response to **Recommendations 4.2, 4.3 and 4.5** made by the Royal Commission, the National Recovery and Resilience Agency ('NRRRA') reports that the NSW Government's response to these recommendations is that it supports or supports in principle each of the recommendations directed to states and territories, and notes those recommendations directed to the Commonwealth.⁶⁴
- 48) In response to **Recommendation 4.4** made by the Royal Commission, the NRRRA reports that the NSW Government's response to this recommendation is that it notes all recommendations directed to the Commonwealth.⁶⁵
- 49) The NRRRA reports that the Commonwealth Government supports **Recommendations 4.2, 4.3 and 4.4** and states the following response in respect of each:
- a. **Recommendation 4.2:** The Commonwealth has committed to establishing a new virtual climate and disaster risk information and services centre, 'Resilience Services', by 1 July 2021. 'Resilience Services' will connect and leverage the Commonwealth's data, information and capabilities to manage climate and disaster risk, including those of the Bureau of Meteorology, the CSIRO, Geoscience Australia and the Australian Bureau of Statistics. The Commonwealth Government welcomes the opportunity to work with state and territory governments to create common information platforms and share technologies to enable collaboration in the production, analysis, access, and exchange of information, data and knowledge about climate and disaster risks.
 - b. **Recommendation 4.3:** The Commonwealth will establish 'Resilience Services' at the federal level, based on findings of the National Climate and Disaster Risk Information and Services Capability pilot and aligned climate adaptation initiatives. Resilience Services will better connect and leverage the Commonwealth's extensive data, information and capabilities to manage climate and disaster risk, including those of the Bureau of Meteorology, the CSIRO, Geoscience Australia and the Australian Bureau of Statistics. The Commonwealth Government notes the state and territory governments hold datasets relevant to disaster risk and information planning. The Commonwealth welcomes an opportunity to work with state and territory governments to further progress implementation of this capability to deliver a truly national approach.
 - c. **Recommendation 4.4:** The Commonwealth Government will establish 'Resilience Services' at the federal level, based on findings of the National Climate and Disaster Risk Information and Services Capability pilot and aligned climate adaptation initiatives. Resilience Services will better connect and leverage the Commonwealth's extensive data, information and capabilities to manage climate and disaster risk, including those of the Bureau of Meteorology, the CSIRO, Geoscience Australia and the Australian Bureau of Statistics. The capability will focus on meeting the information needs of Emergency Management Australia and the new national resilience, relief and recovery agency. The Commonwealth Government welcomes an opportunity to work with state and territory governments to further progress implementation and establish a truly national capability.

⁶⁴ National Recovery and Resilience Agency, *Royal Commission into National Natural Disaster Arrangements Implementation of Recommendations* (as at June 2021) ('the Royal Commission Implementation of Recommendations Report'), pp. 16-18

⁶⁵ The Royal Commission Implementation of Recommendations Report, p. 4

50) In relation to **Recommendation 4.5**, the NRRRA reports that the Australian government supports in principle the recommendation and states as a response that ‘the Commonwealth Government supports the objective of this recommendation and welcomes the opportunity to work with state and territory governments to better understand their information need and how such projections can inform planning and emergency management decision-making’.⁶⁶

51) The Senate Inquiry made the following recommendations:

Recommendation 15

The committee recommends that the National Cabinet agree to establish a working group to undertake a review into each jurisdiction’s legislative framework and processes for:

- *hazard reduction;*
- *vegetation management; and*
- *land use management strategies, including Indigenous land use management practices;*

with a view to developing a national position and strategy on hazard reduction and land use management, in urban, regional and rural settings. The review would consider the impact of climate change on fuel loads and other bushfire hazards.

Recommendation 16

The committee recommends that the working group draw on the expertise of subject matter specialists, including (but not limited to) tertiary researchers, wildlife and environmental managers, climate change experts, peak bodies (such as the CSIRO and the Bushfire and Natural Hazards Cooperative Research Centre), and First Nations communities with regard to land use management practices and cultural burning.

52) On 6 May 2021, the Australian Government issued a response to the Senate Inquiry Report. However, no responses to **Recommendations 15 and 16** made by the Senate Inquiry were included.⁶⁷

Conclusions drawn by the Inquiries on the role of climate change in the 2019-20 fire season

53) There is consensus amongst experts who provided evidence to the Inquiries that climate change at least contributed to the severity of the 2019-20 bushfires, though it does not provide a full explanation for the unprecedented fire season.⁶⁸

54) Unprecedented dryness of the NSW landscape, extreme weather and extreme fire behaviour created challenges for traditional fire-fighting methods, rendering some prediction models and firefighting techniques less effective whilst firefighting agencies also faced inadequate resourcing to combat the extreme fires through an extended fire season.⁶⁹

⁶⁶ The Royal Commission Implementation of Recommendations Report, pp. 4, 16-18

⁶⁷ The Australian Government, *Australian Government response to the Finance and Public Administration References Committee report: Lessons to be learned in relation to the Australian bushfire season 2019-20* (6 May 2021)

⁶⁸ The NSW Inquiry Report, pp. iv, 21; The Senate Inquiry Final Report, pp. 81, 87, 89

⁶⁹ The Royal Commission Report, p. 55; The NSW Inquiry Report, p. 73

- 55) Generally, much of what is being observed in south-eastern Australia is consistent with climate change projections.⁷⁰ It was noted by the Research Hub that *“if current climate trends continue then the fire weather conditions experienced during the 2019-20 fire season will become increasingly likely”*.⁷¹
- 56) The State of the Climate 2020 Report stated that *‘climate change influences the frequency, magnitude and impacts of many types of extreme weather and climate events’*, the impacts and severity of which can be compounded by how closely in time these events occur. The Report noted that the period of spring to early Summer of 2019 demonstrated the effects of compounding extreme weather and climate conditions. During this time, there was record-breaking low rainfall which coincided with extreme heat, both of which continued into early 2020. Simultaneously, there was an extreme positive Indian Ocean Dipole and rare Antarctic stratospheric warning. The compounding of these factors resulted in severe drought, record-breaking heatwaves and fire weather.
- 57) The 2020 Report noted that whilst weather and climate may not be as extreme every year as that of 2019 due to natural climate variability, there is a warming trend primarily caused by climate change which is increasing the likelihood of extreme events beyond that observed historically.⁷²
- 58) The 2020 Report stated that a new set of simulations from global climate models, including simulations from Australia’s climate model, indicate that Australia is projected to experience the following over the coming decades:
- *‘Continued warming, with more extremely hot days and fewer extremely cool days;*
 - *A decrease in cool season rainfall across many regions of the south and east, likely leading to more time spent in drought; and*
 - *A longer fire season for the south and east and an increase in the number of dangerous fire weather days’*.⁷³
- 59) The Royal Commission concluded that extreme weather has become more frequent and intense due to climate change and it is inevitable that these trends will continue in the next 20 to 30 years.⁷⁴ As such, it found there is a need to increase Australia’s resilience to natural disasters in the areas of land-use planning, infrastructure, emergency management, social policy, agriculture, education, health, community development, energy and the environment.⁷⁵

Counsel Assisting the State Coroner

5 August 2022

⁷⁰ The NSW Inquiry Report, p. 80

⁷¹ The NSW Inquiry Report, p. 80

⁷² State of the Climate 2020 Report, p. 8

⁷³ State of the Climate 2020 Report, p. 22

⁷⁴ The Royal Commission Report, p. 22

⁷⁵ The Royal Commission Report, p. 22

Appendix 12: Counsel Assisting’s Summary IPCC Report Chapter 11 (Australasia)

2019-2020 Bushfire Inquiries

Summary of “*Climate Change 2022: Impacts, Adaptation and Vulnerability*” – the Contribution of Working Group II to the Intergovernmental Panel on Climate Change Sixth Assessment Report (AR6) Cycle

Background

The Intergovernmental Panel on Climate Change (‘IPCC’) is the United Nations body for assessing the scientific literature related to climate change, including its impacts and options for responding to it. Its objective is to provide governments, at all levels, with scientific information they can use to develop climate policies.

The work of the IPCC is shared among three Working Groups: Working Group I, dealing with the physical science basis of climate change; Working Group II, dealing with impacts, adaptation and vulnerability; and Working Group III, dealing with the mitigation of climate change.

Working Group II published its contribution to the IPCC’s Sixth Assessment Report (AR6) cycle: “*Climate Change 2022: Impacts, Adaptation and Vulnerability*” (‘the Report’). The Report was released in February 2022 and is the result of a combined effort of hundreds of experts in the scientific, technological, and socio-economic fields of climate science.

It presents an assessment of the state of knowledge of the observed impacts and projected risks of climate change, including to the Australasian region, and outlines current and future adaptation interventions. It is based on scientific and technical literature published up to 1 September 2021.

The Report states that further climate change is inevitable, with the rate and magnitude of impact largely dependent on the emission reduction pathways that we choose. It warns of the need for urgent action, concluding that: “*The cumulative scientific evidence is unequivocal: climate change is a threat to human wellbeing and planetary health. Any further delay in concerted anticipatory global action on adaptation and mitigation will miss a brief and rapidly closing window of opportunity to secure a liveable and sustainable future for all.*”¹

¹ Intergovernmental Panel on Climate Change (‘IPCC’): ‘*Climate Change 2022: Impacts, Adaptation and Vulnerability*’, Contribution of Working Group II to the Sixth Assessment Report of the IPCC, dated February 2022, (hereafter referred to as ‘Climate Change 2022: Impacts, Adaptation and Vulnerability Report’), p. vii.

The Report presents a picture consistent, on the whole, with the findings of the Bureau of Meteorology and Commonwealth Scientific and Industrial Research Organisation ('CSIRO') in their joint report, *'State of the Climate 2020'*.

Observed climate change

Citing evidence from the *'State of the Climate 2020'* report, the Report in its chapter on the Australasian region (Chapter 11) identified the following observed climate change trends in Australia, including²:

- Air temperature over land has increased by 1.4°C from 1910 to 2019, with 2019 being the warmest year, and nine of the ten warmest on records have occurred since 2005 – there is clear anthropogenic³ attribution to this (i.e., human driven climate change is making the planet hotter). Air temperature has continued to warm with more extremely hot days and fewer extremely cold days in most regions of Australia. Very high monthly maximum or minimum temperatures that occurred around 2% of the time in the past (between 1960–1989) now occur 11–12% of the time (between 2005–2019). Multi-day heatwave events have increased in frequency and duration across many regions of Australia since 1950, and in 2019, the national average maximum temperature exceeded the 99th percentile on 43 days (more than triple the number in any of the years prior to 2000) and exceeded 39°C on 33 days (more than observed from 1960 to 2018 combined).
- April to October rainfall observations in south-eastern Australia have decreased 12% since the 1970s (partly attributable to anthropogenic climate change). The lowest recorded average rainfall in Australia occurred in 2019.
- There was an increase in the number of extreme fire weather days, especially in southern and eastern Australia, from July 1950 to June 1985 compared to July 1985 to June 2020, – regarded as partly attributed to climate change. More dangerous conditions for extreme pyro convection events were observed since 1979, particularly in south-eastern Australia.
- From 1979 to 2016, thunderstorms and dry lightning observed to have increased in the southeast of Australia within all seasons.

² Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 11, p. 1636.

³ Resulting from or produced by human activities.

The Report notes that some of the above observed trends and events can be partly attributed to anthropogenic climate change (including regional warming trends, sea level rise, terrestrial and marine heatwaves, declining rainfall and increasing fire weather in southern Australia).

A further observed trend has been that of major and widespread droughts, including from 2017 to 2019 (partly attributable to anthropogenic climate change – medium to high confidence). There have been more droughts occurring in the south-west of Australia since the 1970s and mixed drought trends in the south-east of Australia since the late 1990s. Extreme fire weather in south-eastern Australia in 2019–2020 was 30% more likely due to anthropogenic climate change.⁴

In relation to droughts, the Report indicates that anthropogenic climate change has contributed to drying in dry summer climates, including in south-western Australia.⁵ There is high confidence in anthropogenic influence on increased meteorological drought in south-western Australia. Increased agricultural/ecological and/or meteorological and/or hydrological drought is also seen with either medium confidence or high confidence in the trend but with low confidence on attribution to anthropogenic climate change in eastern Australia.⁶ The Report notes that anthropogenic climate change has contributed to the increased likelihood or severity of drought events in many parts of the world, causing increased wildfire risk, amongst others impacts (a medium confidence rating).⁷

In relation to the year 2019, the Report notes that it was the warmest and driest year on record and that in the summer of 2019/20, the seasonal mean and mean maximum temperatures were the hottest by almost 1°C above the previous record, with eight of the 10 hottest days on record occurring in December 2019.

Although the prevailing weather conditions were said to be strongly influenced by large climate scale drivers (the Indian Ocean Dipole pressure pattern with a contribution from weakly positive El Niño–Southern Oscillation conditions in the Pacific) the Report states that the fact that Australia is approximately 1°C warmer than the early 20th century, demonstrates links to anthropogenic climate change.⁸

Citing a scientific study on the attribution of the Australian bushfire risk to anthropogenic climate change, the Report states that the findings, based on climate models, indicates that

⁴ Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 16, Supplementary Material, p. 16SM47.

⁵ Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 4 (Water), p. 563.

⁶ Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 4 (Water), p. 579.

⁷ Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 4 (Water), p. 579.

⁸ Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 4 (Water), p. 590.

anthropogenic climate change made the heat conditions of December 2019 more than twice as likely. That 2020 study found that although a clear connection between climate change and fire weather is identified, more understanding of the biases in climate models is needed before a more quantitative statement can be made about how strong the connection is and how it will evolve in the future.⁹

In addition to that study, the Report indicates that in Australia, and in other regions of the world, wildfires are burning wider areas and more often than in the past – consistent with climate change – however, analyses have not yet shown if climate change is more important than other factors.¹⁰

The Report outlines that in Australia, much of the south-eastern part of the continent has experienced extreme wildfire years, but analyses suggests that El Niño is more important than long-term climate change – and can exert a stronger influence than climate change. While the effects of climate cycles on fire are superimposed on long-term climate change, the Report notes that the relative importance of anthropogenic climate change in explaining changes in burned area in Australia remains unquantified.¹¹

The Report did highlight that in relation to the burnt forests of western North America, the evidence shows that human-caused climate change has, at least on one continent, clearly driven increases in wildfire.¹²

In relation to observed changes in fire seasons, climate change is said to have contributed to increases in the fire weather season or the probability of fire weather conditions in Australia. The published literature indicates that anthropogenic climate change (through a 0.9°C surface temperature increase since the pre-industrial period) has lengthened or increased the frequency of periods with heat and aridity that favour wildfire on up to one-quarter of global vegetated area since 1979.¹³

Furthermore, in Australia, an overall increase in the forest fire danger index, associated with warming and drying trends has been observed particularly for southern and eastern Australia in recent decades.¹⁴

⁹ See: <https://nhess.copernicus.org/articles/21/941/2021/>.

¹⁰ Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 2, p. 247.

¹¹ Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 2, p. 245-248.

¹² Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 2, p. 248.

¹³ Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 2, p. 246.

¹⁴ Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 11, p. 1591.

Projected climate change

While acknowledging that uncertainties exist in climate projections, the Report predicts with very high confidence that further climate change is inevitable, with the rate and magnitude dependent on the emission pathway. The three main sources of uncertainty in climate projections are:

1. Emission scenario uncertainty: captured in Representative Concentration Pathways (RCPs) for greenhouse gases and aerosols, noting:
 - RCP2.6 represents low emissions;
 - RCP4.5 represents medium emissions; and
 - RCP8.5 represents high emissions.
2. Regional climate responses: captured in climate model simulations driven by the RCPs.
3. Internal climate variability: captured in climate model simulations driven by the RCPs. Climate variability is affected by the El Niño–Southern Oscillation, Southern Annular Mode, Indian Ocean Dipole and Interdecadal Pacific Oscillation.

Australia's climate projections include (relative to average in 1986-2005)¹⁵:

- Further warming with more hot days and fewer cold days: the projected change with respect to annual mean temperature for the year 2050 is +0.5–1.5°C (RCP2.6, low emissions) and +1.5–2.5°C (RCP8.5, high emissions), and yet higher projections for the year 2090. In relation to air temperature extremes: the annual frequency of days over 35°C is projected to increase between 20–70% by 2030 (RCP4.5, medium emissions) and between 25–85% (at low emissions).
- Winter and spring rainfall and soil moisture are projected to decrease, with higher evaporation rates: the projected annual rainfall for the east region of Australia for the year 2050 is –13 to +7% (at low emissions) and –17 to +8% (at high emissions).
- The intensity, frequency and duration of fire weather events are projected to increase throughout Australia, with a high confidence rating. More extreme fire weather is projected for southern and eastern Australia: for eastern Australia, the projection for

¹⁵ Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 11, p. 1592.

annual number of severe fire weather days is 0 to +30% for the year 2050 (at low emissions) and 0 to +60% (at high emissions).

- More time in drought over southern and eastern Australia is projected, with a medium confidence rating.

Observed impacts of climate change

The Report summarises the observed and cascading impacts of the 2019-20 bushfires on people, economic activity, built assets, ecosystems and species. It notes that the fires had resulted in 33 deaths, the destruction of over 3000 houses, including losses for tourism, hospitality, agriculture and the forestry sector, amongst other observed impacts. Smoke from the fires was also reported to have caused 429 deaths and 3230 hospitalisations.¹⁶

Concerning terrestrial and freshwater ecosystems, the Report states that the 2019-20 fires in south-eastern Australia had burnt between 5.8 and 8.1 million hectares of temperate broadleaf forest and woodland, with substantial impacts observed to rainforests and flow-on impacts for aquatic fauna.¹⁷ The fires had resulted in the loss or displacement of nearly 3 billion vertebrate animals, with 114 threatened species having lost at least 50% of their habitat, and 49 having lost 80%.¹⁸

Climate-related impacts on Aboriginal and Torres Strait Islander Peoples

The Report indicates that climate-related impacts on Aboriginal and Torres Strait Islander Peoples, countries and cultures have been observed across Australia and are pervasive, complex and compounding.

Estimates of the loss from fire impacts on ecosystem services¹⁹ that contribute to the well-being of remotely located Indigenous Australians were found to be higher than the financial impacts from the same fires on pastoral and conservation lands.

¹⁶ Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 11, p. 1599.

¹⁷ Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 11, p. 1591.

¹⁸ Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 11, p. 1599.

¹⁹ Ecosystem services are the benefits provided to humans through the transformations of resources (or environmental assets, including land, water, vegetation and atmosphere) into a flow of essential goods and services e.g., clean air, water, and food (Constanza et al. 1997).

The Report provides examples of Aboriginal and Torres Strait Islander Peoples' practices of adaptation to a changing climate, including:

- Fire management using cultural practices can achieve greenhouse gas emission targets while maintaining Indigenous cultural heritage.
- Indigenous Ranger programmes provide a means for Indigenous-guided land management, including for fire management and carbon abatement, fauna studies, medicinal plant products, weed management and recovery of threatened species

Projected impacts of climate change

Further climate change is inevitable, with the rate and magnitude largely dependent on the emission pathway. Ongoing warming is projected, with more hot days and fewer cold days and less winter and spring rainfall is projected in southern Australia. More extreme fire weather is projected in southern and eastern Australia (high confidence). Increased drought frequency is projected for southern and eastern Australia (medium confidence).²⁰

The Report provides that in Australia, the frequency and severity of dangerous fire weather conditions is increasing and is partly attributed to climate change (high confidence rating), especially in southern and eastern Australia during spring and summer.²¹

Fire weather is projected to increase in frequency, severity and duration for southern and eastern Australia (high confidence), with projected increases in pyro-convection risk for parts of southern Australia and increased dry-lightning and fire ignition for southeast Australia were also noted.²² Pyro-convective fire conditions could reach more frequently into the more populated areas of NSW, particularly at the start of summer.²³

Based on assessment of the literature and expert judgement, nine key risks from anthropogenic climate change were identified, based on magnitude, likelihood, timing and adaptive capacity. The key risks have potential to be severe but can be reduced substantially by rapid, large-scale and effective mitigation and adaptation. Of those nine key risks, three are relevant.²⁴

²⁰ Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 11, p.1591.

²¹ Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 11, p.1599.

²² Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 11, p.1599.

²³ Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 2, p. 272.

²⁴ Climate Change 2022: Impacts, Adaptation and Vulnerability Report, Chapter 11, p.1636-1637.

- *Transition or collapse of alpine ash, snow gum woodland, pencil pine and northern jarrah forests in southern Australia due to hotter and drier conditions with more fires – a high confidence rating.*

The number of severe fire weather days is projected to increase by 5 to 35% (under low emissions) and by 10-70% (under high emissions) by 2050. In terms of exposure, the Report notes a shift in landscape fire regimes to larger, more intense and frequent wildfires over extensive areas of forests and woodlands from longer fire seasons and more hazardous fire conditions and increasing human-sourced ignitions from urbanisation and projected increase in frequency of lightning strikes.

Adaption options to reduce the risk include increased capacity to extinguish wildfires during extreme fire weather conditions and avoiding and reducing forest degradation from inappropriate forest management practices and land use.

- *Increase in heat-related mortality and morbidity for people and wildlife in Australia – a high confidence rating.*

Heat-related excess deaths, including in Sydney, are projected to increase by about 300/year (low emission pathway) to 600/year (high emission pathway) during the 2031–2080 period relative to 142/year in the period 1971–2020.

Health risks are noted to multiply with other harmful exposures, for example, to wildfire smoke.

Adaption options to curb risk include heatwave/fire early-warning systems.

- *Cascading, compounding and aggregate impacts on cities, settlements, infrastructure, supply chains and services due to extreme events (a cross-sectoral and system-wide risk) – a high confidence rating.*

Risk drivers include the hazards of heatwaves, fires etc and includes cascading and compound events such as heatwaves with fires. Those exposed to the risk regarding fires include peri-urban areas and settlements near forests.

Adaption options to reduce the risk include, amongst others, improved emergency services and early-warning systems and use of climate-resilient standards for buildings and infrastructure.

The Report also provides examples of adaption options (and enablers) to reduce wildfire risk:

- In relation to land management, examples include prescribed burning to reduce fuel load close to assets and engagement with Aboriginal and Torres Strait Island Peoples to utilise and learning from their fire management knowledge and skill (to assist in landscape management and greenhouse gas mitigation), amongst others.
- In respect of communications, examples include increased research to understand interactions between fire, fuel, weather, climate and human factors to enhance projections of fire occurrence and behaviour and the improvement of early-warning systems, more targeted messaging and increased emergency evacuation planning and sheltering options.
- In relation to infrastructure, examples include enhanced training and support for firefighters and aerial firefighting assets, including sharing of resources nationally and internationally to address the increasing overlap of fire seasons, which are lengthening across the world and the development of new systems to augment capability of fire services and technological advances to detect and respond to fires, amongst others.

Australia's ability to adapt to climate change rests on better coordination and collaboration between government agencies, communities, Aboriginal and Torres Strait Islanders, not-for-profit organisations and businesses to help prepare for climate impacts (wildfires, heatwaves and droughts etc) in combination with future climate risks integrated into their decisions and planning. Work is already being undertaken but more adaptation is needed in light of the ongoing and intensifying climate risks.

Australia's ability to adapt to climate change impacts also rests on every region in the world playing its part in reduction greenhouse gas emissions.

Appendix 13: Counsel Assisting's Summary of Findings and Recommendations concerning Aerial Resources

2019-2020 Bushfire Inquiries

Summary of findings and recommendations concerning aerial resources

INTRODUCTION

- 1) The 2019-2020 bushfire season witnessed the deployment of large numbers of aerial resources. From 1 July 2019 to 12 February 2020, aircraft flew approximately 63,000 hours across 2,518 taskings in response to bushfires in NSW.¹
- 2) The role and effectiveness of aircraft in aiding fire responses during the 2019-2020 bushfire season has already been considered by three separate inquiries and an audit recently performed by the NSW Auditor-General:
 - a) the NSW Bushfire Inquiry ('the NSW Inquiry'), the terms of reference for which included considering and reporting on '*responses to bushfires, particularly measures to control the spread of the fires and to protect life, property and the environment, including...resourcing, coordination and deployment...*';²
 - b) the Royal Commission into National Natural Disaster Arrangements ('the Royal Commission'), which was directed to have regard to '*...what actions should be taken to mitigate the impacts of natural disasters...*' and '*...whether changes are needed to Australia's legal framework for the involvement of the Commonwealth in responding to national emergencies...*';³
 - c) the Senate Finance and Public Administration References Committee – *Lessons to be learned in relation to the Australian Bushfire season 2019-20* ('the Senate Inquiry'), the terms of reference for which included '*...the adequacy of the Federal Government's existing measures and policies to reduce future bushfire risk, including in relation to ... support for firefighters and other disaster mitigation*

¹ The Final Report of the NSW Bushfire Inquiry, delivered 31 July 2020 ('The NSW Inquiry Report'), p. 308.

² The NSW Inquiry Report, p. iv.

³ Royal Commission into National Natural Disaster Arrangements Final Report, delivered 28 October 2020 ('The Royal Commission Report'), Appendix 1, p. 10.

measures... and *'...best practice funding models and policy measures to reduce future bushfire risk, both within Australia and internationally...'*; ⁴ and

- d) an audit performed by the NSW Auditor-General ('the NSW Auditor-General's Audit') on how effectively the NSW Rural Fire Service ('NSW RFS') plans and manages the firefighting equipment needed to prevent, mitigate, and suppress bushfires for the period of 2017-2022;⁵

(referred to collectively as 'the Inquiries').

- 3) The Inquiries examined the following themes which relate to Australia's aerial resources in the context of the 2019-20 bushfire season:
 - a) Aerial firefighting arrangements and systems;
 - b) Strategies to control the spread of fires;
 - c) The use of different aerial resources; and
 - d) Training.
- 4) These themes are explored below by quoting from the reports resulting from the Inquiries set out at [2].

AERIAL FIREFIGHTING ARRANGEMENTS AND SYSTEMS

The Australasian Fire and Emergency Service Authorities Council ('AFAC')

- 5) The AFAC operates as a not-for-profit company with 34 member organisations and 25 affiliate member organisations across Australasia. Fire and Rescue NSW ('FRNSW'), the NSW RFS, Forestry Corporation, NSW National Parks and Wildlife Service ('NPWS') (representing the Department of Planning and Environment ('DPE')), and the NSW State Emergency Service are full member organisations. The NSW Environment Protection Authority and Resilience NSW are affiliate organisations.⁶

⁴ The Senate Finance and Public Administration References Committee, *Lessons to be learned in relation to the Australian bushfire season 2019-20*, Final Report delivered December 2021 ('The Senate Inquiry Final Report'), p. 1.

⁵ The NSW Auditor-General's Report, *Performance Audit of Planning and Management of Bushfire Equipment*, 27 February 2023 ('The NSW Auditor-General's Report') p. 5.

⁶ The NSW Inquiry Report p. 132.

- 6) The AFAC has no direct role in the delivery of emergency services. Rather, it facilitates member collaboration through its Collaboration Framework, with a range of technical groups and networks working together on developing shared practice and research.⁷
- 7) The AFAC's collaborative model is operationalised through its four business units, the:
 - a) National Resource Sharing Centre ('NRSC');
 - b) National Aerial Firefighting Centre ('NAFC');
 - c) Australian Institute for Disaster Resilience; and
 - d) Emergency Management Professionalism Scheme.⁸
- 8) For the purpose of this paper, the work of the NRSC and the NAFC are summarised below.

National Resource Sharing Centre ('NRSC')

- 9) The NRSC coordinates and facilitates international and interstate deployments, as authorised by the Commissioners and Chief Officers Strategic Committee ('CCOSC').⁹

National Aerial Firefighting Centre ('NAFC')

- 10) The NAFC provides a cross-jurisdictional arrangement for aerial bushfire combat. It facilitates the "*coordination and procurement of a fleet of highly specialised firefighting aircraft that are readily available for use by State and Territory emergency service and land management agencies across Australia.*"¹⁰
- 11) The majority (about two-thirds) of all aerial firefighting assets in Australia are owned or contracted directly by States and Territories, who are responsible for meeting those costs. The Commonwealth is involved with contracting the remaining one-third of aircraft through the NAFC. The States and Territories are also responsible for the costs of aviation services procured through the NAFC with some of the fixed costs of these services reimbursed by the Australian Government.¹¹
- 12) A Resource Management Agreement governs the relationship between the AFAC and the State and Territory governments with regard to the NAFC.¹² There are more than 140

⁷ The NSW Inquiry Report p. 132-133.

⁸ The NSW Inquiry Report p. 133.

⁹ The NSW Inquiry Report p. 133.

¹⁰ The NSW Inquiry Report p. 133.

¹¹ The Royal Commission Report, p. 212.

¹² The Royal Commission Report, p. 83.

aircraft available to the NAFC. As outlined at [11], these aircraft are in addition to the aerial firefighting aircraft owned by State and Territory governments and those available to be hired from private operators when needed, to meet peak demand across Australia.¹³

- 13) The Australian Government has provided financial support to the NAFC since 2003 through grants. The Australian Government provides approximately \$15 million per year toward the fixed cost of making the contracted national fleet available.¹⁴ An additional \$11 million in December 2019 and a further \$20 million in January 2020 was provided due to the unprecedented scale and impact of the 2019-2020 bushfire season.¹⁵

Sharing of aviation resources and procurement

- 14) Each State and Territory has its own organisational arrangements for aerial firefighting with sharing of aviation services between States and Territories during bushfire seasons being a feature of aerial firefighting in Australia. State and Territory response agencies contact each other directly to determine the availability of additional aircraft and arrange for their relocation.¹⁶ Approximately 500 aircraft are used in aerial firefighting operations across Australia, with the supplemented NAFC fleet accounting for approximately 160 of these aircraft.¹⁷
- 15) Severe to extreme bushfire activity (or the risk of such activity) was being experienced across almost all States and Territories for much of the period between November 2019 and January 2020. This meant that the aviation surge capacity usually available to NSW was limited, and fleet sharing was difficult. This resulted in jurisdictions being unable to satisfy operational demands at times.¹⁸
- 16) When the extraordinary scale of the 2019-2020 bushfire season was made apparent, the NAFC contracted 21 additional services nationally at the request of States and Territories, with two large air tankers, along with supervision aircraft, added at the request of NSW. The NAFC also implemented a national 'call when needed' contracting system, which allowed jurisdictions to access aircraft on an ad hoc, short-term basis to supplement the core fleet.¹⁹

¹³ The Senate Inquiry Final Report, p. 15.

¹⁴ The Senate Inquiry Final Report, p. 16.

¹⁵ The Royal Commission Report, p. 213.

¹⁶ The Royal Commission Report, p. 218.

¹⁷ The Royal Commission Report, p. 213.

¹⁸ The NSW Inquiry Report p. 311, the Royal Commission Report, p. 222.

¹⁹ The NSW Inquiry Report p. 307.

- 17) In addition to the reports resulting from the Inquiries set out at [2], this paper draws upon a response from the NSW RFS dated 29 June 2022 to questions posed on behalf of the NSW State Coroner. A copy of the NSW RFS response is annexed and marked “A”.
- 18) The NSW RFS response at Annexure A refers to that organisation being able to access aircraft in one of three ways over the 2019-2020 bushfire season:
- a) NSW RFS owned and operated aircraft (1 light helicopter, 2 medium helicopters and 1 large air tanker). The NSW RFS also chartered a fixed-wing aircraft over an 8-week period for personnel movement.
 - b) NAFC seasonal contracted aircraft (31 aircraft through NAFC, one very large air-tanker (‘VLAT’) funded by the NSW Government, one VLAT funded by the Federal Government and 6 additional aircraft procured via the NAFC ‘call when needed’ process).
 - c) NSW state-based ‘call when needed’ aircraft (398 aircraft of varying capabilities as referred to in Annexure A and including tactical aircraft, aviation fuel trucks, specialist aircrew and aerial intelligence capability).
- 19) Figures quoted in the NSW Inquiry Report, drawn from the NAFC’s national shared information system known as ARENA, showed from 1 July 2019 to 12 February 2020, aircraft flew some 63,000 hours in conjunction with bushfires in NSW. The AFAC advised the NSW Inquiry that this figure significantly exceeded any previous season. In total, there were 2,518 aircraft taskings (some for single missions, some lasting multiple days) across the State. The NSW RFS further advised the NSW Inquiry that there were numerous days where adverse weather conditions (e.g., wind, lack of visibility due to smoke) prevented the deployment of aircraft which otherwise would have been used.²⁰

International support

- 20) International support was also crucial in ensuring continuity of supply of aerial firefighting capability. NSW, and all other jurisdictions across Australia, relies on international support through the NAFC and AFAC to meet fleet requirements. The availability of the aerial firefighting fleet sought from overseas continues to be an issue, particularly at short notice. The availability of large air-tankers (‘LATs’), VLATs and Type-1 helicopters in particular had been problematic.²¹

²⁰ The NSW Inquiry Report p. 308.

²¹ The NSW Inquiry Report p. 311, the Royal Commission Report, p. 216, 221.

- 21) It was noted in the AFAC's submission to the NSW Inquiry that, although aircraft sourced from the northern hemisphere meet their contractual obligations, there was an ongoing risk to these arrangements. There has been a worldwide increase in demand for these larger firefighting assets, which has not necessarily been accompanied by a commensurate increase in supply. This was already experienced to an extent in the 2019-2020 bushfire season, with the NAFC having difficulty securing additional aircraft at short notice, exacerbated by the lack of clarity around whether additional Commonwealth funding could be secured for 2019-2020 and for future years²² (in relation to which a recommendation was made by the NSW Inquiry, that Government work with other Australian governments to provide long-term funding certainty to AFAC, including the NRSC and the NAFC; see further below under the heading Recommendations at [126]-[127]).
- 22) Another obstacle to obtaining aircraft from overseas in a timely manner is the requirement to obtain the necessary approvals from the Civil Aviation and Safety Authority ('CASA'). The Royal Commission heard that before an agreement to procure an aircraft from overseas can be finalised, the CASA must first enter into an agreement with the national aviation authority of the country where the aircraft is registered. These agreements specify who will be responsible for the airworthiness and flight operations oversight of the relevant aircraft. Delays in the provision of aircraft-specific information can delay the signing of formal agreements which is necessary before operations can commence.²³
- 23) Submissions were also made to the Royal Commission that Australian-licensed pilots were not licensed to operate foreign-registered aircraft used in Australia during the 2019-2020 bushfire season. For example, with the exception of the NSW-owned LAT, none of the LATs used in Australia during the 2019-2020 bushfire season were Australian-registered, and therefore Australian-licensed pilots were precluded from operating them.²⁴
- 24) The Australian Federation of Air Pilots told the Royal Commission that it had approximately 5,000 Australia-based members employed as commercial pilots. This suggests Australia may have the potential to recruit and train personnel with the necessary expertise to operate firefighting aircraft currently sourced from overseas, including LATs, if such aircraft were owned and registered in Australia.²⁵

²² The NSW Inquiry Report p. 311-312.

²³ The Royal Commission Report, p. 221.

²⁴ The Royal Commission Report, p. 222.

²⁵ The Royal Commission Report, p. 222.

- 25) Given future bushfire seasons are predicted to be more protracted and extreme in both the northern and southern hemispheres, the NSW Inquiry expected NSW to experience similar aviation surge capacity challenges if another extreme bushfire season occurs.²⁶
- 26) While the NSW Inquiry supported the NAFC continuing to work with States and Territories on strategies to ensure surge capacity can be maintained in future seasons, it also considered that the Commonwealth should be involved in augmenting this capacity given its current aviation asset base.²⁷
- 27) In the course of the Senate Inquiry a number of stakeholders argued that there was an obvious need to increase Australia's national firefighting capacity, and that it needed to be done as a matter of urgency. Noting the high costs of leasing available aircraft, a number of stakeholders expressed their support for the establishment of a permanent, Australian-based aerial firefighting fleet.²⁸
- 28) The Royal Commission noted that the Aerial Application Association of Australia described Australia's reliance on overseas-based aviation services as a 'sovereign risk' to Australia.²⁹ The Royal Commission concluded:
- "Australian, State and Territory governments should work together to continue to improve Australia's collective, Australian-based and operated, aerial firefighting capabilities. Though we see merit in the continued use of overseas-based aviation services and air crew in some instances, Australia's current reliance represents a vulnerability, as demonstrated during the 2019-2020 bushfire season."*³⁰
- 29) The Royal Commission recommended that a broader Australian-based sovereign aerial firefighting industry be supported and developed.³¹ The Senate Inquiry also recommended the establishment of a permanent, sovereign aerial firefighting fleet so that reliance on overseas leasing arrangements is greatly reduced.³² This is addressed further below under the heading Recommendations at [149]-[161].
- 30) The NSW Inquiry, whilst acknowledging the significant capital investment required to purchase aviation assets and the efficiencies associated with multipurpose equipment, recommended that the NSW Government request the Commonwealth to conduct a trial

²⁶ The NSW Inquiry Report p. 312.

²⁷ The NSW Inquiry Report p. 312.

²⁸ The Senate Inquiry Final Report, p. 17.

²⁹ The Royal Commission Report, p. 221.

³⁰ The Royal Commission Report, p. 222.

³¹ The Royal Commission Report, p. 224.

³² The Senate Inquiry Final Report, p. 17.

with NSW RFS on the feasibility of retrofitting Royal Australian Air Force C130 aircraft with modular airborne firefighting systems and training to provide the Australian Defence Force ('ADF') with the capacity to augment aerial firefighting during major disasters.³³

- 31) However, the Royal Commission noted that aerial firefighting is not a task that the Australian Government requires the ADF to perform. The ADF has emphasised that safe and effective aerial firefighting is a specialised skill requiring training. Moreover, modification of the limited number of existing aircraft for aerial firefighting would reduce ADF capacity to perform other tasks, including responding to other natural disasters, such as floods and cyclones, and broader national security tasks.³⁴
- 32) The NAFC reported that the most important assistance that the ADF can provide is seamless use of ADF airbases, including the provision of fuel, refuelling equipment, crew welfare facilities and administrative support. ADF airbases were used during the 2019-2020 bushfire season to support State and Territory aerial firefighting operations, including LAT operations.³⁵

Private operators

- 33) The Royal Commission highlighted that the current terms of aircraft service contracts were a disincentive for some Australia-based service providers. Evidence given before the Royal Commission on behalf of providers indicated that the short contracts and minimal work during the off season made it unviable to invest in expensive aviation equipment. The contracts would traditionally engage providers for 84 service days (70 in Tasmania) within the bushfire season. It was heard that more contracted service days would allow providers to invest in more equipment and offer greater value for money to fire agencies.³⁶
- 34) Conversely, one service provider advised that longer-term contracts may have the potential to encourage more overseas-based providers to enter the market and consequently lock out Australian-based providers.³⁷
- 35) Further, the Royal Commission heard from the Aerial Application Association of Australia, an association of aircraft service operators, on the issue of 'call when needed' arrangements encouraging a practice referred to as 'tow-trucking'. This is where aircraft

³³ The NSW Inquiry Report p. 312.

³⁴ The Royal Commission Report, p. 215.

³⁵ The Royal Commission Report, p. 216.

³⁶ The Royal Commission Report, p. 214.

³⁷ The Royal Commission Report, p. 215.

service operators, at their own cost, attempt to 'game' the system by pre-positioning their aircraft around the country in the areas they believe are most likely to be used by States and Territories during periods of high demand. The Royal Commission heard that surge capacity for aviation services in bad bushfire seasons could be better managed by the States and Territories maintaining aviation services on contracts with nominated service periods.³⁸

Supporting systems

State Air Desk and ARENA

- 36) States and Territories usually coordinate the use of aerial assets through a central mechanism, such as an Air Desk. The State Air Desk facilitates coordinated aviation management during times of severe fire weather, major emergencies or when there is high demand for aircraft across NSW. In addition to aircraft owned by NSW, the State Air Desk has access to aviation resources from other jurisdictions and private operators through contract arrangements facilitated by the NAFC.³⁹
- 37) The NAFC maintains the national shared information system ARENA which provides a common registry of aircraft, operators, and crew available for combat agencies to use during fire and emergency operations. ARENA provides visibility of available 'call when needed' aircraft, real-time tracking of aircraft locations and dispatch functionality as well as details on aircraft rates, contract service periods, and provides real time data to the Air Desk module.⁴⁰ All States and Territories use the registry functions of ARENA, including for some aircraft that are not procured through the NAFC.⁴¹
- 38) In recent bushfire seasons, ARENA has also had a dispatch capability, which is used by authorities in Queensland, NSW, ACT, Victoria, and Tasmania to task aircraft to incidents.⁴² State Air Desk staff use the ARENA Air Desk module to dispatch aircraft based on which aircraft is closer to an incident, or the most cost-effective aircraft that meets the requested capability. Details of aircraft availability and location, as well as the contract aircraft in-service period, inform search results and dispatch decisions. When an aircraft is dispatched, an email with the dispatch details and dispatch number is sent to

³⁸The Royal Commission Report, p. 214.

³⁹ The NSW Inquiry Report p. 288, the NSW Auditor-General's Report, p. 21.

⁴⁰ The NSW Inquiry Report p. 288, the Royal Commission Report, p. 163.

⁴¹ The Royal Commission Report, p. 163.

⁴² The Royal Commission Report, p. 217.

the aircraft operator which confirms authorisation to fly. There is also a situation board that provides a visual display of aircraft dispatched per incident.⁴³

- 39) However, not all aircraft are recorded in ARENA and not all States and Territories use the aircraft dispatch functions. The Royal Commission heard that, at times, resource requests were unable to be filled, and some fire agencies considered that resource sharing processes were not sufficiently responsive or agile.⁴⁴ The information available to the NRSC was reliant on the information provided by each State and Territory as to their assessment of their available resources. The NRSC did not have the capability to report a forecast of resources against the committed capacity of the jurisdictions particularly at a time of concurrent national disaster activity.⁴⁵
- 40) The AFAC advised the Royal Commission that the utilisation of a common national system, such as ARENA, for dispatch and monitoring would enhance the effective sharing of resources, providing national, real-time visibility of resource availability and commitment as well as additional data for post incident analysis and reporting.⁴⁶ The AFAC accepted that there were improvements that could be made to the NRSC to facilitate future sharing of aviation services and, with the CCOSC, had been actively considering those improvements.⁴⁷

A National Deployment Register

- 41) The Royal Commission heard that a national register for resources, both personnel and equipment, would assist decision making during natural disasters. It would improve resource sharing by ensuring available resources are easily identified and can be efficiently and strategically deployed in response. It could also be used to create a national picture of capability and national situational awareness.⁴⁸
- 42) For a national register to be effective, there must be some consistency of descriptions used to register personnel, equipment, and aircraft between jurisdictions. The Royal Commission heard that different descriptors for resources across States and Territories cause confusion when requesting resources. Standardised descriptions for resources would provide greater clarity for all jurisdictions, improving resource sharing.⁴⁹

⁴³ The NSW Inquiry Report p. 306.

⁴⁴ The Royal Commission Report, p. 160.

⁴⁵ The Royal Commission Report, p. 160.

⁴⁶ The Royal Commission Report, p. 163, 217.

⁴⁷ The Royal Commission Report, p. 160.

⁴⁸ The Royal Commission Report, p. 161.

⁴⁹ The Royal Commission Report, p. 161.

- 43) The AFAC proposed the development of a National Deployment Registry through the NRSC, which was endorsed by the CCOSC in July 2020 subject to further development in consultation with AFAC members. However, no funding was committed, and the proposal was in its early stages as at July 2020. The proposal included a registry of personnel and a single national IT system to manage interstate personnel deployments. The IT system would support the NRSC to fill resource requests, share information, track resources, and create situation reports. The AFAC previously launched a Deployment Registry to support outbound international deployment.⁵⁰
- 44) The Royal Commission heard that it is AFAC's aim for the National Deployment Registry to provide near to real-time data of available fire and emergency services resources for the purposes of resource sharing through the NRSC. The AFAC acknowledged that this would require considerable development of the software tool and would not be possible in the first iteration of the Registry.⁵¹
- 45) The National Deployment Registry proposal, if accepted and developed, would provide benefits. However, it would not have a complete picture of national resources, as the NRSC does not capture all domestic resource sharing and is accordingly unable to provide situational awareness for all deployment activity.⁵² This addressed further below under the heading Recommendations at [147].

The Australasian Inter-Service Incident Management System ('AIIMS')

- 46) All fire and state emergency services in Australia also use the Australasian Inter-Service Incident Management System ('AIIMS') when coordinating a response to natural disaster incidents. AIIMS involves the use of an Incident Action Plan for response to bushfires. The Incident Action Plan details the objectives of the response effort and is designed to ensure an integrated and coordinated response. When aerial operations are involved in a response, an Air Operations Plan forms part of the Incident Action Plan.⁵³
- 47) The AIIMS structure includes aerial support roles within the incident management team; including an Air Operations Manager to manage the Air Operations Unit in larger and more complex incidents, and an Air Attack Supervisor, responsible for direct tactical coordination with ground crews. The Air Attack Supervisor directs the tactics that the pilot

⁵⁰ The Royal Commission Report, p. 162.

⁵¹ The Royal Commission Report, p. 163.

⁵² The Royal Commission Report, p. 163.

⁵³ The Royal Commission Report, p. 216.

of the aircraft is to employ when attacking the bushfire, in accordance with the objectives of the Incident Action Plan.⁵⁴

Communications equipment between aircraft and ground crews

- 48) Communications between aircraft and ground crews are important to ensure a coordinated tactical response and to ensure the safety of crews in the air and on the ground. Aircraft can provide ground crews with important situational awareness of their surroundings and advise of escape routes where necessary. NAFC contracts require that aircraft be equipped to communicate with the relevant fire agencies operating on the ground during operations.⁵⁵
- 49) Because each State or Territory operates a different tactical radio communications system for ground operations, there are implications for communication with aircraft. Tactical radio communication systems are separate from, and incompatible with, the aeronautical radio systems that are normally used in aircraft. This means that firefighting aircraft need to be equipped with at least two radio systems: one to communicate with ground crews and the other to communicate with air traffic control and other aircraft. This makes communications difficult and has safety implications for pilots.⁵⁶
- 50) There are technical and practical limitations to equipping aircraft with multiple tactical radio systems. In most instances, at least two tactical radio units are required per jurisdiction. Different radio antennas are also required for different jurisdictions, and most aircraft have limited space for mounting antennas. The acquisition and support of tactical radios is also costly.⁵⁷
- 51) The Royal Commission heard that incompatible communication impacts the coordination and use of aerial firefighting assets. Additional problems arise in border areas where two separate ground communications systems might be required in addition to aeronautical radio. For example, during 2019, when there were bushfires in northern NSW and southern Queensland, Queensland authorities requested assistance from a nearby, NSW-based, helicopter in gathering situational awareness on a fire on the Queensland side of the border. As the helicopter had no means of direct communication with the

⁵⁴ The Royal Commission Report, p. 216.

⁵⁵ The Royal Commission Report, p. 168.

⁵⁶ The Royal Commission Report, p. 168-169.

⁵⁷ The Royal Commission Report, p. 169.

Queensland personnel on the ground it was necessary to land the aircraft and arrange a meeting in-person to convey the necessary information to the ground personnel.⁵⁸

- 52) When an aircraft moves to another jurisdiction, work is required to change radios such as by reprogramming, changing the radio unit or installing new radios. This impacts aerial resource sharing, requiring additional time and costs to allow aircraft to work interstate.⁵⁹
- 53) The Royal Commission encouraged governments to prioritise arrangements to deliver and improve on interoperable communications equipment. It was acknowledged that achieving interoperability will take significant investment and that it cannot occur overnight however progress should still be made.⁶⁰ This is addressed further below under the heading Recommendations at [148].

STRATEGIES TO CONTROL THE SPREAD OF FIRES

Remote Area Firefighting Teams ('RAFTs')

- 54) The NSW Inquiry noted that NSW has large areas of bushland where rapid response by vehicle is not possible due to access, topography or the distances involved. NSW fire agencies have developed a high level of organisational skill, expertise, and experience in suppressing fires in remote locations. Early suppression of fires in remote areas is critical in preventing large fires developing and becoming a major threat.⁶¹
- 55) Remote Area Firefighting Teams ('RAFTs') are established within the NSW RFS and the NPWS as a pivotal tool in such conditions. The deployment of RAFTs is typically by helicopter winching (by cable into gaps between the vegetation), by helicopter hovering just above or touching the ground (in a clearing where the ground is not level enough to land) or by helicopter landing (often in a specially cleared landing area constructed by RAFTs). A Joint Operational Protocol for Remote Area Firefighting exists between the NSW RFS and the NPWS to facilitate cooperative operations.⁶²
- 56) The NSW Inquiry was informed that RAFTs were used to great effect throughout the 2019-2020 bushfire season, despite the severity of the fire conditions and the scale of the resulting fires in some areas.

⁵⁸ The Royal Commission Report, p. 169.

⁵⁹ The Royal Commission Report, p. 169.

⁶⁰ The Royal Commission Report, p. 170.

⁶¹ The NSW Inquiry Report p. 283.

⁶² The NSW Inquiry Report p. 283.

- 57) In particular, during the 2019-2020 bushfire season there were 41 ignitions (primarily as a result of lightning) across the Greater Blue Mountains World Heritage Area. Twenty of these remote ignitions were successfully contained by NPWS RAFTs to an average fire size of less than 1.2 hectares. All the fires were in remote and rugged terrain and the response involved highly trained and skilled crews winching in from helicopters.⁶³
- 58) However, NPWS advised the NSW Inquiry that at times during the 2019-2020 bushfire season, RAFTs were deployed to high priority non-RAFT fire operations which reduced their availability to undertake remote firefighting.⁶⁴
- 59) The NSW Inquiry noted that on 8 June 2020 the NSW Government announced increased funding (\$22.9 million) to increase the number of NPWS RAFT firefighters by up to 80 (an increase of 20 per cent), as well as an additional helicopter.⁶⁵

Rapid Aerial Response Teams ('RARTs')

- 60) Rapid Aerial Response Teams ('RARTs') is a program where specially trained firefighting teams (trained RAFT firefighters) and dedicated rotary aircraft are placed on standby at appropriate times and in appropriate places on days when bushfire ignition is likely (such as following lightning storms), or when there is a risk of fires spreading rapidly (such as during severe fire weather conditions). The primary objective of RARTs is to respond rapidly to minimise fire size and potential for impact on assets. The NSW RFS and the NPWS both manage a RARTs program.⁶⁶
- 61) Over 80 per cent of NPWS firefighters are RART qualified, while NSW RFS RART members are drawn from volunteers supported as necessary by mitigation crews. All undertake the same level of training and work to the same standards.⁶⁷
- 62) NPWS RARTs were critical in minimising the size of fires on NPWS managed land. Of the 243 fires that started on national parks during the 2019-2020 bushfire season, a total of 161 (66 per cent) were contained on national parks and 145 fires (60 per cent) were kept to less than 10 hectares in size.⁶⁸

⁶³ The NSW Inquiry Report p. 286.

⁶⁴ The NSW Inquiry Report p. 286.

⁶⁵ The NSW Inquiry Report p. 287.

⁶⁶ The NSW Inquiry Report p. 283-284.

⁶⁷ The NSW Inquiry Report p. 284.

⁶⁸ The NSW Inquiry Report p. 286.

- 63) However, NPWS advised the NSW Inquiry that there were many days during the 2019-2020 bushfire season where the extreme weather and conditions on the ground meant it was unsafe to deploy RARTs. The NSW Inquiry noted that the risk must always be assessed and qualified. For example, if 'high risk' is created by unfavourable weather conditions in rugged terrain, then inserting ground crews may not be advisable. However, if conditions are benign and the 'high risk' is assessed as the potential for the landscape to carry fire once bad weather arrives, then ground crew insertion may be recommended.⁶⁹

Initial aerial attack as an early suppression strategy

- 64) It was further noted by the NSW Inquiry that, in addition to expanding RAFTs capacity in light of increasing fire risks, deployment decisions must also be based on enhanced research and predictive modelling to ensure early suppression is prioritised. This may sometimes require prioritising the deployment of RAFTs for rapid initial attack of new remote area ignitions over ongoing suppression operations in already active fires on a case-by-case basis, informed by an assessment of the relative risks. At a state-wide level, there did not appear to be clear criteria for prioritising, allocating and re-allocating aircraft to fires based on risk and initial attack.⁷⁰
- 65) In addition to the reports resulting from the Inquiries set out at [2], this paper further draws upon correspondence from the DPE (on behalf of the NPWS) to the Department of Communities and Justice, Legal dated 30 August 2022. A copy of the correspondence is annexed and marked "**B**".
- 66) Annexure B highlights that during the 2019-2020 bushfire season, aircraft allocation to existing fires was prioritised over maintaining aircraft resources for response to new ignitions. Insufficient aircraft availability meant that the initial weight of attack was inadequate to prevent new ignitions from propagating and developing into large fires.
- 67) Annexure B further highlights that Incident Management Teams responding to the new ignitions were unable to obtain appropriate air support to enable an effective initial response as aircraft were tasked elsewhere in the State on existing larger fires. As a result, initial attack was unsuccessful resulting in large fires with significant impacts on assets and NPWS parks.

⁶⁹ The NSW Inquiry Report p. 286.

⁷⁰ The NSW Inquiry Report p. 287.

- 68) In acknowledging the importance of the RARTs program in early suppression, a number of submissions to the NSW Inquiry supported introducing a 'Rapid Initial Response' aerial capability within NSW to enhance early suppression outcomes.
- 69) In South Australia and Victoria, the use of aerial suppression in rapid initial response to control bush and grass fires has become a routine strategy. When a new fire is detected, an initial aerial rapid response is dispatched in concert with suitable ground firefighting resources (which may include RAFTs), with the aim of limiting the spread of the fire. The objective is to keep fires small and limit their spread across the landscape, particularly fires in remote areas. Research shows this corresponds with the increased likelihood of earlier control and a smaller total area burnt.⁷¹
- 70) Based on a review of the initial aerial dispatch models in those states, the NSW Inquiry considered that effective early suppression requires:
- a) The right mix of aircraft that are able to respond within very tight timeframes;
 - b) Pre-positioning of aircraft in strategic locations (i.e., in areas of high bushfire risk, understanding the different risks presented); and
 - c) Logistical support on the ground.⁷²
- 71) The Royal Commission noted that research conducted by the Bushfire Cooperative Research Centre in 2007 found that the time it takes for aircrafts to respond to bushfires was critical in the success of aerial firefighting strategies and particularly on days of high fire danger rating. It was further noted that research conducted by the South Australia Country Fire Service found that the effectiveness of rapid aerial attacks on bushfires on days of elevated fire danger rating was limited. However, the research suggested increasing the number of aircraft initially responding to a bushfire in conditions of elevated fire danger could improve the chances of effective suppression. It was heard during the Royal Commission that when bushfires develop to a certain size, there are no aerial, or ground-based, firefighting techniques or strategies which can effectively contain or suppress them.⁷³
- 72) The NSW Inquiry found that firefighting strategies need to adapt to cope with extreme fire weather and behaviour like that experienced during the 2019-2020 bushfire season and predictions of increasing fire risks associated with factors such as climate change. The success of rapid response operations in extinguishing fires while they are still small (even

⁷¹ The NSW Inquiry Report p. 287-288, the Royal Commission Report, p. 217.

⁷² The NSW Inquiry Report p. 288.

⁷³ The Royal Commission Report, p. 212.

under extremely dry conditions) suggests that priority should be given to increasing rapid response capacity.⁷⁴

- 73) In order to improve NSW's ability to suppress fires early and keep them small in conditions rated severe and above,⁷⁵ the NSW Inquiry recommended that the NSW RFS trial the dispatch of suitable aircraft when a fire is initially detected (at time of call), coordinated via the State Air Desk, building on the research that has already been undertaken by the AFAC.⁷⁶
- 74) The NSW Inquiry recommended that the trial should:
- a) Be targeted in pre-determined geographical areas that are at high risk of bushfire and align with enhanced operational doctrine incorporating lessons learnt from the 2019-2020 bushfire season.
 - b) Be linked to the introduction of early detection technology. Trialling initial aerial dispatch would complement the existing RART program, as it would enable aerial retardant / water-bombing to commence before RARTs arrive.
 - c) Include the NSW RFS undertaking a review of all air bases and determine the level of infrastructure that would or may be required at different air bases to appropriately support initial rapid response and ongoing operations.
 - d) Review the performance, cost effectiveness and most appropriate operating model for different aircraft. Such review would inform aircraft targeted for various roles, including immediate dispatch and those most appropriate to form part of any single government firefighting fleet managed through the State Air Desk.⁷⁷
- 75) These recommendations are addressed further below under the heading Recommendations at [128]-[134] and further details have been sought from the NSW RFS as to the outcome of the trial.

Aerial firefighting at night as an additional fire suppression tool

- 76) The NSW Inquiry identified increased aerial night firefighting as one of the important firefighting enhancements needed after the 2019-20 bushfire season.⁷⁸

⁷⁴ The NSW Inquiry Report p. 286.

⁷⁵ It is noted that a new Australian Fire Danger Rating System has since been developed with four levels instead of six – "Moderate", "High", "Extreme" and "Catastrophic".

⁷⁶ The NSW Inquiry Report p. 288.

⁷⁷ The NSW Inquiry Report p. 288.

⁷⁸ The NSW Inquiry Report, p. v.

- 77) Aerial firefighting at night could enable advantage to be taken of more favourable conditions – lower temperatures and higher humidity – and could assist ground crews for extended periods of time. Improvements in Night Vision Devices ('NVD') and infrared technology have increased the likelihood and effectiveness of aerial firefighting at night.⁷⁹ Despite this, the NSW Inquiry acknowledged that the overnight extreme weather conditions experienced in the 2019-2020 bushfire season sometimes prohibited aircraft from operating. In many instances, aircraft were not able to operate until later in the day as conditions in the early morning were not conducive to aerial operations.⁸⁰
- 78) The NSW RFS commenced a night-time aerial operations trial during the 2016-2017 bushfire season. The trial researched the ability to gather intelligence and undertake aerial ignition during night operations, for the purposes of both hazard reduction and fire suppression. The aircraft involved were upgraded with the necessary equipment and pilots were trained in accordance with CASA requirements. The NSW RFS purchased NVD, and five NSW RFS aviation specialists were trained in their use. The NSW RFS advised the NSW Inquiry that the results of the trial were "not documented" and it is not clear from the face of the NSW Inquiry Report why the results of the trial were "not documented". Since that time, the NSW RFS has also engaged an alternative aviation provider which includes NVD capability as part of contractual arrangements.⁸¹
- 79) Emergency Management Victoria conducted a phased trial of aerial firefighting at night in collaboration with CASA and NAFC during the 2017-2018 and 2018-2019 bushfire seasons, which involved the use of two-night suppression enabled helicopters (fixed tank from open water sources). The first phase of the trial was based on simulations to prove it could be done safely, with the second phase focused on developing and testing safety procedures and training. In order to conduct night-time aerial firefighting, the helicopters must have previously been to the area during the day in order to identify hazards, water supply and where the fire might potentially spread to. The NSW RFS advised the NSW Inquiry that NSW RFS aviation personnel attended the Victorian trial, and it would closely monitor the outcomes.⁸²
- 80) Based on the trials conducted, and the need for expanded firefighting capacity at night, the NSW Inquiry supported a further trial of aerial firefighting at night to ensure the NSW RFS has all available tools at its disposal where these are safe and appropriate to use.⁸³

⁷⁹ The NSW Inquiry Report p. 316.

⁸⁰ The NSW Inquiry Report p. 316.

⁸¹ The NSW Inquiry Report p. 316.

⁸² The NSW Inquiry Report p. 316.

⁸³ The NSW Inquiry Report p. 317.

- 81) The NSW Inquiry recommended the NSW RFS conduct a further aerial night-time firefighting trial during the 2020-2021 fire season, to include:
- a) Appropriate safety requirements (e.g., management of fatigue);
 - b) Quantifying the associated costs (e.g., the use of additional ground crews to support aerial operations);
 - c) Helicopter search and rescue (which was successfully deployed during the 2019-2020 bushfire season using ADF aircraft crewed by NSW RFS personnel); and
 - d) An evaluation of trial outcomes, including a cost-benefit analysis.⁸⁴
- 82) Subject to the results of the trial, the NSW Inquiry supported including night-time aerial firefighting as a permanent fire suppression tool in future bushfire seasons.⁸⁵ This is addressed further below under the heading Recommendations at [140]-[144] with the trial to continue into the 2022-2023 bushfire season. It is noted that further details have been sought from the NSW RFS regarding the outcome.

THE USE OF DIFFERENT AERIAL RESOURCES

Helicopters were the most frequently used type of aircraft

- 83) The multifunctionality of helicopters led them to being the most used type of aircraft during the 2019-2020 bushfire season. Helicopters were engaged in early fire suppression, aerial intelligence, and search and rescue operations. They were involved in the successful rescue of 51 people over the course of the season.⁸⁶
- 84) Because of their vertical take-off and landing capability, helicopters are an essential element to aerial firefighting capability. Although they have a shorter range than fixed-wing aircraft, they have the capability to re-fill tanks or buckets from a variety of water sources and transport people and equipment to remote locations. Owing to their higher manoeuvrability, helicopters can operate more effectively than fixed-wing aircraft over mountainous terrain and deep valleys.⁸⁷
- 85) Helicopters are generally categorised as Type 1 (heavy), Type 2 (medium) or Type 3 (light) models. Heavier helicopters are generally used for firebombing and transportation,

⁸⁴ The NSW Inquiry Report p. 317.

⁸⁵ The NSW Inquiry Report p. 317.

⁸⁶ The NSW Inquiry Report p. 308.

⁸⁷ The Royal Commission Report, p. 209.

whereas lighter helicopters are used for command and control, mapping, and aerial ignition roles.⁸⁸

- 86) The RARTs program uses two specially configured medium utility helicopters (BK117). These helicopters are equipped with a winch to rapidly deploy and retrieve firefighters to and from the point of ignition of fires to support early suppression, particularly in remote or difficult to access areas. The NSW RFS advised the NSW Inquiry that, while the use of RARTs and RAFTs was considered to be successful during the 2019-2020 bushfire season, the number and spread of fires across the State challenged the capacity of suitable and available aircraft for these operations. While some contract aircraft can be used for this purpose, the two NSW RFS-owned BK117 helicopters are prioritised for the RART program.⁸⁹
- 87) The NSW RFS also has a single-engine squirrel helicopter (AS350) equipped to provide 'real time' video footage of incidents, providing invaluable 'live' information to support personnel in firefighting efforts or support other combat agencies in undertaking their emergency roles.⁹⁰

Single-engine versus twin-engine helicopters

- 88) As well as NSW RFS' and NPWS' own strict operating guidelines for RART and RAFT operations, helicopters must comply with Civilian Aviation Orders set by the CASA on helicopter winching and rappelling activities. A marked difference between the two agencies is that NPWS continues to use single-engine helicopters for deployments involving personnel being winched into and away from a remote site. For some time, the NSW RFS has required all winching operations to be carried out from a twin-engine helicopter. The key safety advantage of a twin-engine helicopter is that it still has fly-away capability if one of the engines is lost.⁹¹
- 89) The fact that the NPWS fleet of helicopters is all single engine presents problems for the State Air Desk. Should there be a need for an urgent task to be undertaken on a fireground, NPWS' fleet of helicopters may not be able to undertake the mission, even if they are the only available aircraft in the fleet, as they do not meet the minimum winching safety requirements set by the NSW RFS.⁹²

⁸⁸ The Royal Commission Report, p. 209.

⁸⁹ The NSW Inquiry Report p. 308.

⁹⁰ The NSW Inquiry Report p. 308.

⁹¹ The NSW Inquiry Report p. 309.

⁹² The NSW Inquiry Report p. 309.

- 90) The NSW Inquiry requested advice from the NPWS on why it had chosen to purchase single-engine helicopters over the more functional twin-engine model. The NPWS indicated it had commissioned two independent assessments to review the use of single-engine helicopters for winching activities. While both concluded there were no apparent technical or operational reasons indicating single-engine aircraft are not safe for crew winching operations, the 2018 report recommended that the NPWS consider transitioning over time to use modern Category A rated twin-engine helicopters for winching. The NSW Inquiry noted that the NPWS would undertake further research to inform future aviation business planning and further details have been sought from the NPWS in this regard. The NSW Inquiry noted its support for the move to twin-engine helicopters for winching.⁹³

Fixed-wing aircraft

- 91) Fixed-wing aircraft require an airfield or landing strip to take-off and land and tend to be able to travel greater distances and at higher speeds than helicopters.⁹⁴ Fixed-winged aircraft include LATs, VLATs, single-engine air tankers ('SEATs') and other conventional fixed-wing aircraft.⁹⁵
- 92) SEATs are an effective option in aerial firefighting because they can operate from regional and remote airfields and can be deployed quickly in response to a bushfire. SEATs carry approximately 3,000 litres of suppressant and can be tasked in groups of two or more aircraft to increase their overall effectiveness. In addition to dropping suppressant, SEATs can also perform coordination, fire detection and mapping roles. Some SEATs are also fitted with amphibious floats which afford them the ability to land on and scoop water from lakes, rivers, or reservoirs.⁹⁶
- 93) The primary role of LATs and VLATs is firebombing using water or fire suppressant⁹⁷ as they are capable of carrying up to approximately 35,000 litres.⁹⁸ LATs and VLATs have a greater operational flying range than other aircraft, which means they can cover a wider geographical area than other appliances in the aerial fleet⁹⁹ and can operate in worse conditions than smaller aircraft.¹⁰⁰ NAFC evaluations also suggest that because LATs and

⁹³ The NSW Inquiry Report p. 310.

⁹⁴ The Royal Commission Report, p. 206.

⁹⁵ The Royal Commission Report, p. 206.

⁹⁶ The Royal Commission Report, p. 206.

⁹⁷ The NSW Inquiry Report p. 310.

⁹⁸ The Royal Commission Report, p. 206.

⁹⁹ The NSW Inquiry Report p. 310.

¹⁰⁰ The Royal Commission Report, p. 206.

VLATs can be deployed relatively quickly, they are best placed to provide surge capacity where there are resource shortages or resources are fully engaged.¹⁰¹

- 94) Due to weather conditions and the high volume of fire activity experienced in August 2019, the NSW RFS negotiated an additional VLAT (commenced in November 2019), an additional LAT (commenced December 2019) as well as lead planes,¹⁰² above the existing contract arrangements with NAFC. In addition, NSW received another VLAT in February 2020 due to supplementary Commonwealth Government funding.¹⁰³
- 95) While the NSW Inquiry understood the additional Commonwealth funding was welcome, the timing of the announcement in mid-December 2019 and early January 2020 highlighted the challenges of sourcing appropriate aircraft at short notice.¹⁰⁴
- 96) In total, the NSW RFS used four LATs and two VLATs to undertake 1,708 collective missions and drop over 24 million litres of fire suppressants, in order to support ground firefighting personnel. This represented the largest contingent of LATs / VLATs ever used in NSW and included the NSW RFS-owned LAT (737), named the Marie Bashir.¹⁰⁵
- 97) With the Marie Bashir permanently at the Royal Australian Air Force base at Richmond, the NSW RFS has access to a LAT all year round. As at 20 March 2020, it had flown 455 missions and dropped 6.825 million litres of suppressant. NSW is the only Australian State or Territory with a permanent LAT. The NSW RFS advised the NSW Inquiry that having the Marie Bashir available from the start of the season was invaluable to the NSW RFS' firefighting capability during the 2019-2020 bushfire season, particularly given the early start to the season when access to contract aircraft was limited due to the overlap with the northern hemisphere bushfire season.¹⁰⁶
- 98) LATs and VLATs however are not without limitations. They are relatively more expensive to operate than smaller aircraft, require significant supporting infrastructure with longer runways, have slower turnarounds, sometimes have less fire attack accuracy than smaller aircraft, and can be harder to integrate into firefighting operations as they often require an additional lead aircraft to help coordinate their bushfire attacks.¹⁰⁷

¹⁰¹ The NSW Inquiry Report p. 310.

¹⁰² Lead aircraft are small, dual engine fixed wing aircraft used to coordinate and guide suppressant drops of larger aircraft such as LATs.

¹⁰³ The NSW Inquiry Report p. 310.

¹⁰⁴ The NSW Inquiry Report p. 310.

¹⁰⁵ The NSW Inquiry Report p. 310.

¹⁰⁶ The NSW Inquiry Report p. 310.

¹⁰⁷ The Royal Commission Report, p. 208.

- 99) Other fixed-wing aircraft types used in aerial firefighting include line-scanning aircraft, which are small aircraft equipped with specialised intelligence gathering and mapping equipment; and lead aircraft, which are used to coordinate and guide suppressant drops of larger aircraft such as LATs. Lead aircraft also communicate directly with ground teams to ensure that firefighting strategies are coordinated.¹⁰⁸

Remotely Piloted Aircraft Systems ('RPAS')

- 100) NPWS, FRNSW and Forestry Corporation used Remotely Piloted Aircraft Systems ('RPAS') – more commonly known as drones – throughout the 2019-2020 bushfire season. FRNSW's capability comprises a combination of two platforms: Mavic 2 Enterprise dual (fixed daytime and thermal camera) and Matrice 210 V1 with XT2 (daytime and thermal camera) Z30 30 x optical zoom X5S.¹⁰⁹
- 101) FRNSW and NPWS drones were a valuable part of the aerial response over the course of the 2019-2020 bushfire season, providing real time intelligence to incident command. When flight conditions were unsuitable for manned aircraft (mostly due to smoke), these drones were sometimes deployed to ensure situational awareness was maintained, with livestreaming of bushfire conditions and thermal data sent to Fire Control Centres and the NSW RFS State Operations Centre for immediate viewing. Drones also provided 'digital scouting' by identifying hot spots in advance of aerial firefighting manned aircraft. Thermal technology fitted to the units was able to identify hot spot coordinates and captured latitude / longitude locations. This was then forwarded to Fire Control Centres to assist in the deployment of available and suitable resources.¹¹⁰
- 102) The NSW Inquiry noted that small and medium drones provide a short-term local advantage in that they can provide an enhanced perspective of a fire, at a much smaller cost than a helicopter or aeroplane. The versatility of use is such that they can be flown at close range to a fire without placing the operator at any real risk of injury but are also capable of capturing a broad view to assist with situational awareness during an active fire event. Information can be collected and relayed back in real time without ambiguity or subjectivity. They are also effective at night and in low-level visibility conditions.¹¹¹
- 103) However, drones have a number of limitations that affected their use during the 2019-2020 bushfire season. This ranged from the size of drone available and extreme weather

¹⁰⁸ The Royal Commission Report, p. 208.

¹⁰⁹ The NSW Inquiry Report p. 313.

¹¹⁰ The NSW Inquiry Report p. 315.

¹¹¹ The NSW Inquiry Report p. 315.

conditions (with winds above 40 kilometres per hour) that made their use problematic. There is also a need to integrate the use of drones with aircraft to ensure that a safe and coordinated approach is taken. The NSW Inquiry shared the view that NSW combat agencies should take advantage of these emerging technologies. Expanding the existing FRNSW capability (in terms of both capital equipment and trained operators) and sharing this with the NSW RFS and other NSW government agencies on a year-round basis would provide the best return on investment.¹¹²

- 104) The NSW Inquiry acknowledged that, although NPWS also has a drone fleet that undertakes significant work to support land management operations, FRNSW has a more advanced capability. This should be expanded and leveraged by other agencies working with FRNSW to ensure that there is not a duplication of effort in resourcing.¹¹³
- 105) FRNSW must be granted approval from the NSW RFS to conduct low level drone operations within airspace covered by a section 44 declaration. In discussions with the CASA, the NSW Inquiry was informed that expanding the use of drones outside of section 44 declared areas (e.g., for fire spotting) would require an operations plan including common risks and mitigation strategies to be prepared beforehand, without being restricted to a particular geographic area. This could be submitted to CASA for pre-approval, and the pro forma plan could then be modified with particular geographic area details and any bespoke risks and mitigation strategies for CASA approval immediately pre-deployment. This would enable drone operations to commence in a timely way and on a larger scale during future bushfire seasons.¹¹⁴
- 106) To reap the full benefits of the drone program as a State-wide resource, the NSW Inquiry recommended these additions to the drone fleet be based outside of the Sydney Metropolitan Area and immediate surrounds. Ideally, additional units would be based in major regional centres where FRNSW already has a presence and where their use could be maximised in supporting FRNSW's core services, such as structural firefighting.¹¹⁵ This is addressed further below under the heading Recommendations at [137]-[139].
- 107) As drone capability increases (including ensuring that data is transferrable into NSW RFS systems), the NSW Inquiry encouraged NAFC to include drones in the ARENA system.¹¹⁶

¹¹² The NSW Inquiry Report p. 315.

¹¹³ The NSW Inquiry Report p. 315.

¹¹⁴ The NSW Inquiry Report p. 315.

¹¹⁵ The NSW Inquiry Report p. 315.

¹¹⁶ The NSW Inquiry Report p. 315.

Review of the mix of aircraft in the current fleet

- 108) The NSW Inquiry acknowledged that there is no ‘silver bullet’ when it comes to the right type of aircraft for firefighting and there are a range of factors to consider. This includes operational limitations that go beyond cost and availability, access to water, prevailing weather conditions, remoteness of terrain, and suitable infrastructure to accommodate larger aircraft (especially in regional areas).¹¹⁷
- 109) A submission from the Emergency Leaders for Climate Action stated that:
*“Australia uses small aircraft, then jumps to large and very large. Arguably lack of a medium sized, cheaper and more flexible option in the “middle” limits strategic and tactical options, impacts on cost effectiveness and ultimately the effectiveness of response strategies (for example the 2016 Tasmanian experience). There is clearly a need for all types and sizes of aircraft in Australia’s aerial firefighting fleet in order to maximise flexibility.”*¹¹⁸
- 110) The NSW Inquiry received a range of submissions advocating for particular models or types of aircraft to be added to the existing Australian firefighting fleet. In light of the extreme weather conditions experienced during the 2019-2020 bushfire season, the NSW Inquiry agreed that a review of the existing fleet should be undertaken to ensure NSW (and Australia) has fit-for-purpose aerial firefighting assets that support firefighting in a range of conditions.¹¹⁹ This is addressed further below under the heading Recommendations at [135]-[136].
- 111) The Royal Commission found that a mix of aviation services is an essential element of Australia’s ability to fight and control bushfires and the availability of some of these assets is limited. Existing arrangements facilitated through NAFC have historically provided a cost-effective means of collectively enhancing Australia’s aerial firefighting capabilities, although these same arrangements have left Australia reliant on overseas-based aviation services, particularly in relation to larger aircraft types such as LATs.¹²⁰
- 112) The NSW Auditor-General’s Audit noted that the aircraft purchases between 2019 and 2021, which amounted to approximately \$31 million, was needed for ‘rapid firefighting response capability’ and to offset costs of aircraft hire, which from 2019–2020, amounted to \$255.5 million during the unprecedented bushfire season. This expenditure was more

¹¹⁷ The NSW Inquiry Report p. 312.

¹¹⁸ The NSW Inquiry Report p. 313.

¹¹⁹ The NSW Inquiry Report p. 313.

¹²⁰ The Royal Commission Report, p. 222.

than six times the amount spent in the previous year, when aircraft hire costs totalled \$42.5 million.¹²¹

- 113) Although the NSW RFS does not have a framework for assessing the capabilities of its permanent firefighting fleet, including its aerial fleet, (in relation to which the NSW Auditor-General made a recommendation; see further below under the heading Recommendations at [162]-[164]), the NSW Auditor-General's Audit noted that the NSW RFS is working with other Australian States and Territories to ensure the right mix and type of aerial assets are available across Australia.
- 114) According to the information contained within Annexure A, by the 2021-2022 bushfire season the NSW RFS aerial fleet had expanded to include:
- a) Three large air tankers; the NSW RFS owned B737, the 'Marie Bashir'; Avro RJ85 and C130.
 - b) Two NSW RFS owned Citation jets for aerial intelligence and lead plane duties.
 - c) Three NSW RFS owned Bell 412 multi role helicopters.
 - d) Two NSW RFS owned BK117 multi role helicopters.
 - e) One NSW RFS Squirrel AS350 helicopter for aerial intelligence.
 - f) Two large type 1 helicopters (1 Chinook and 1 Blackhawk).
 - g) Nine medium type 2 helicopters.
 - h) Nine single engine air tankers (fixed wing) including two on floats.
- 115) The mix of aerial resources referred to at [114] invites consideration of the way in which different appliances perform different roles in aerial firefighting.

TRAINING

Specialist aviation personnel

- 116) The NSW Inquiry identified training gaps over the course of the 2019-2020 bushfire season including the need for more specialist aviation personnel.¹²²
- 117) The NSW State Bush Fire Plan identifies that the NSW RFS engages specialist aviation resources on behalf of all agencies and facilitates coordinated dispatch arrangements through the NSW State Air Desk. The effective use of these resources is reliant on highly

¹²¹ The NSW Auditor-General's Report, p. 21.

¹²² The NSW Inquiry Report p. 129.

trained personnel to ensure resources operate safely and effectively in a dynamic environment.¹²³

- 118) The nature of the 2019-2020 bushfire season, with ongoing requirements for aerial support over extended periods of time, stretched the availability of qualified aviation personnel as fires occurred concurrently across multiple jurisdictions.¹²⁴ Resource sharing of personnel occurred on a scale not seen before.¹²⁵ Trained specialist staff from other Australian and international jurisdictions were made available and sourced through the NRSC.¹²⁶ However, the AFAC identified that the NRSC was unable to fulfil some resource requests due to a lack of appropriate trained and qualified personnel available.¹²⁷
- 119) Specialist aviation personnel such as Air Attack Supervisors, Air Observers and Aerial Incendiary Operators undertake initial and ongoing training to ensure safe operation of aircraft, and safety of aircraft and ground personnel. Such training is resource intensive and is delivered by the NSW RFS and NPWS. One-on-one training requires appropriate aircraft, conditions and trainers that are not always available. The NSW Inquiry identified that agencies and jurisdictions need to develop more personnel in these critical roles.¹²⁸
- 120) The NSW Inquiry noted that there was an opportunity for NSW to take the lead nationally on a new approach to the provision of training and certification of aviation personnel. The introduction of a more streamlined approach which augments existing training would improve opportunities to increase personnel numbers and further enhance the safety and effectiveness of aerial operations to support firefighters. The NSW Inquiry learned that the NSW RFS is implementing simulators to assist with training personnel in aircraft crewing and winching activities. The opportunity exists to further develop this capability, expand capacity to include other aviation roles, and integrate with Incident Management Team training.¹²⁹
- 121) By introducing and integrating simulator-based training into existing training and certification, the NSW RFS would be able to:
- a) Provide increased simulated flight time, giving trainees increased learning opportunities to practise and enhance their new skills.

¹²³ The NSW Inquiry Report p. 129.

¹²⁴ The NSW Inquiry Report p. 129.

¹²⁵ The Royal Commission Report, p. 154.

¹²⁶ The NSW Inquiry Report p. 129.

¹²⁷ The Royal Commission Report, p. 154, 216.

¹²⁸ The NSW Inquiry Report p. 129.

¹²⁹ The NSW Inquiry Report p. 129.

- b) Ensure regular competency maintenance, currency and reassessment activities.
 - c) Enhance the ability for current aircrew to enhance their skill in simulated situations which would not be readily available otherwise, including emergency situations, night operations and the use of LATs.
 - d) Undertake reviews of a trainee's aptitude for airborne work.¹³⁰
- 122) The NSW RFS Training Academy at Dubbo is easily accessed, as it is close to the regional airport which has regular connections to Sydney. To develop as a national centre of excellence, the Academy, which has existing infrastructure, would require support from the NSW Government to expand its simulator capabilities.¹³¹ This is addressed further below under the heading Recommendations at [124]-[125].

RECOMMENDATIONS

NSW Inquiry

- 123) The NSW Inquiry made the following recommendations concerning aerial resources.

Recommendation 10

*That, in order to expand NSW's specialist aviation personnel safety and capacity, Government expand simulator capabilities at the NSW RFS Training Academy.*¹³²

- 124) In response to Recommendation 10, the NSW Government committed to investing \$5.4 million over five years (commencing in 2020-2021) for the NSW RFS to enhance the aerial fleet and aviation training facilities. An aviation simulator was formally commissioned at the NSW RFS Training Academy in Dubbo on 13 March 2021.¹³³
- 125) The NSW RFS aviation simulator is integrated into aviation training courses, including the interstate Air Attack Course conducted in June 2021 at the NSW RFS Dubbo Training Academy. It was also noted that the NSW RFS was working with Dubbo Regional Council to progress a development application for a building dedicated to house simulators at the NSW RFS Training Academy in Dubbo.¹³⁴ Recommendation 10 was marked as having been completed in quarter 2 of 2021.¹³⁵

¹³⁰ The NSW Inquiry Report p. 129.

¹³¹ The NSW Inquiry Report, p. 130.

¹³² The NSW Inquiry Report, p. 130.

¹³³ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period January to March 2021, p. 14.

¹³⁴ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period April to June 2021, p. 13.

¹³⁵ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period July to September 2021, p. 11.

Recommendation 12

*That Government work with other Australian governments to provide long-term funding certainty to AFAC, including the NRSC and the NAFC.*¹³⁶

- 126) In response to Recommendation 12, long term funding and resourcing for current AFAC functions was considered at the national level through the National Emergency Management Minister's Meeting ('NEMMM') and Australia-New Zealand Emergency Management Committee ('ANZEMC'). It was reported that the AFAC and NAFC were developing the National Aerial Firefighting Strategy for consideration by NEMMM, with substantial assistance from the NSW RFS.¹³⁷
- 127) Recommendation 12 was marked as having been completed in quarter 1 of 2021 noting that NSW continues to support the AFAC arrangements through existing national forums including the NEMMM and ANZEMC.¹³⁸

Recommendation 45

That, in order to prioritise early suppression and keep fires small:

- a) *Government set a KPI for NPWS regarding the percentage of fires that start on-park and are contained within 10 hectares, and consider whether 70 per cent is an appropriate KPI for the NSW RFS and NPWS;*
 - b) *NSW fire authorities deploy remote area firefighting resources based on enhanced research and predictive modelling. In some circumstances, this may require prioritising the deployment of RART to enable rapid initial attack of new remote area ignitions over ongoing suppression operations, where supported by a relative risk assessment.*¹³⁹
- 128) In response to Recommendation 45, it was reported that the NSW RFS had adopted the KPI target and would report on it annually.¹⁴⁰ This aspect of the Recommendation 45 was marked as having been completed in quarter 1 of 2021.¹⁴¹
- 129) It was further reported that the NSW RFS continued to deploy RARTs on days of heightened fire danger. Scoping had commenced to develop a predictive model that

¹³⁶ The NSW Inquiry Report, p. 134.

¹³⁷ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period January to March 2021, p. 15.

¹³⁸ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period April to June 2021, p. 14.

¹³⁹ The NSW Inquiry Report, p. 287.

¹⁴⁰ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period January to March 2021, p. 40.

¹⁴¹ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period April to June 2021, p. 37.

would assist with prioritising RART deployments for rapid initial attack in remote areas.¹⁴² A trial predictive model commenced operations within the Common Operating Picture that forecasts ignition potential and identifies areas expected to reach (and exceed) RART triggers up to four days in advance.¹⁴³ The NSW RFS subsequently embedded the predictive model into its systems.¹⁴⁴ This aspect of Recommendation 45 was marked as having been completed in quarter 3 of 2021.¹⁴⁵

130) Further, the NSW Auditor-General's Audit noted that the NSW RFS is in the process of implanting a new system (called Athena) that uses artificial intelligence to predict fire behaviour. Athena has capabilities for fire risk visualisation, risk modelling, and the use of social media to gather fire risk intelligence to improve its operational awareness and incident response.¹⁴⁶ An update has been sought from the NSW RFS in relation to its predictive model embedded into its systems.

131) It is noted that further details have also been sought from the NPWS regarding its response to Recommendation 45.

Recommendation 46

*That, in order to improve early fire suppression, the NSW RFS trial initial aerial dispatch in areas of high bush fire risk. The trial should identify the most appropriate and cost-effective mix of aircraft, and any associated infrastructure improvements that would be required.*¹⁴⁷

132) In response to Recommendation 46, the NSW RFS reported that a pre-determined dispatch trial was conducted between December 2020 and February 2021 in Wagga Wagga, Cowra and Bankstown. Aircraft were stood up over 9 days resulting in 11 dispatches with an average response time of 20.14 minutes, delivering 34,800 litres over 12 drops. A formal evaluation report was in the process of being finalised at that time to inform future operational arrangements.¹⁴⁸

133) The NSW RFS further reported that the trial would be expanded during the 2021-2022 bushfire season to include Narrabri, Armidale, Scone, Kempsey and those locations

¹⁴² NSW Bushfire Inquiry 2020 Progress Report, Reporting Period January to March 2021, p. 40.

¹⁴³ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period April to June 2021, p. 37.

¹⁴⁴ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period July to September 2021, p. 36.

¹⁴⁵ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period October to December 2021, p. 36.

¹⁴⁶ The NSW Auditor-General's Report, p. 26.

¹⁴⁷ The NSW Inquiry Report, p. 289.

¹⁴⁸ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period January to March 2021, p. 40.

identified during the 2020-2021 bushfire season.¹⁴⁹ Recommendation 46 was marked as having been completed in quarter 2 of 2021.¹⁵⁰

- 134) It is noted that a request has been made for a copy of the NSW RFS' formal evaluation report and further details have been sought from the NSW RFS in relation to the expansion of the trial.

Recommendation 50

That, in order to ensure Australia's firefighting aerial capacity capitalises on existing assets and is made up of the right mix, Government:

- a) *Request the Commonwealth to conduct a trial with NSW RFS on the feasibility of retrofitting RAAF C130 aircraft with modular airborne firefighting systems to provide the ADF with the capacity to augment aerial firefighting during major disasters;*
- b) *Work with States and Territories through the NAFC to review the current mix of aviation assets and determine whether it is fit-for-purpose, noting the current lack of mid-sized firefighting aircraft.*¹⁵¹

- 135) In response to Recommendation 50, the NSW RFS reported that Emergency Management Australia advised that the Department of Defence was not willing nor in a position to conduct a trial into the modular airborne firefighting system but would make available previous research and trial outcomes.¹⁵² Further discussions with the Department of Defence identified that the trial information from previous research would not assist in providing any relevant information to the NSW RFS beyond its existing knowledge.¹⁵³ This aspect of Recommendation 50 was marked as having been completed in quarter 1 of 2021.¹⁵⁴

- 136) Further, the NSW RFS provided comprehensive input into the NAFC National Aerial Firefighting Strategic Plan. The NSW RFS also reviewed aircraft requirements as part of the 2021-2022 contract fleet arrangements.¹⁵⁵ The NSW RFS engaged with the NAFC for a tender process relating to Type 1 and Type 2 Helicopters.¹⁵⁶ This aspect of

¹⁴⁹ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period April to June 2021, p. 37.

¹⁵⁰ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period July to September 2021, p. 36.

¹⁵¹ The NSW Inquiry Report, p. 313.

¹⁵² NSW Bushfire Inquiry 2020 Progress Report, Reporting Period January to March 2021, p. 42.

¹⁵³ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period July to September 2022, p. 35.

¹⁵⁴ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period April to June 2021, p. 40.

¹⁵⁵ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period January to March 2021, p. 43.

¹⁵⁶ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period April to June 2021, p. 39-40.

Recommendation 50 was marked as having been completed in quarter 2 of 2021 with the NAFC publishing the National Aerial Firefighting Strategy for 2021-2026 in July 2021.¹⁵⁷

Recommendation 51

*That, in order to enhance NSW's ability to improve situational awareness, Government expand FRNSW's RPAS capability (both capital assets and trained operators) to major regional centres and ensure the NSW RFS and other NSW government agencies can access this capability as required.*¹⁵⁸

- 137) In response to Recommendation 51, FRNSW invested in RPAS (drones) for emergency management support and made this capability available for use by other agencies.¹⁵⁹ It was also reported that the NSW Government allocated \$5.2 million over five years, from 2021-2022, to acquire additional drone capability for FRNSW.¹⁶⁰
- 138) FRNSW reported that under the Fire and Rescue Plus Plan, drone capability supports operations in Fire, Urban Search and Rescue, Counter Terrorism, Hazmat, Protection of the Environment, Natural Disaster and Humanitarian. It is used across the four sectors of emergency management: prevention, preparedness, response, and recovery and is available for use by other agencies.¹⁶¹ It is ably supported by the Bushfire and Aviation Unit for data analysis to provide more accurate, highly responsive, information-driven emergency response across the State leading to greater protection of the community and timely and relevant warnings to communities.¹⁶²
- 139) Further, FRNSW reported that procurement of hardware for regional stations, FRNSW Aviation, Hazmat, Counter-Terrorism, and Natural Disaster / Humanitarian teams, was completed. Recruitment into full-time positions within their Aviation team was also completed. Remote Pilot Licence training was delivered to regional stations included in the RPAS expansion project. Twenty-five fire stations have been commissioned and online with RPAS Tier 1 capability. FRNSW reported that such capability has been used to great effect in many operations to date including a flood event.¹⁶³ Recommendation 51 was marked as having been completed in quarter 3 of 2022.¹⁶⁴

¹⁵⁷ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period July to September 2021, p. 38.

¹⁵⁸ The NSW Inquiry Report, p. 316.

¹⁵⁹ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period January to March 2021, p. 43.

¹⁶⁰ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period April to June 2021, p. 40.

¹⁶¹ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period July to September 2021, p. 38.

¹⁶² NSW Bushfire Inquiry 2020 Progress Report, Reporting Period April to June 2022, p. 36; NSW Bushfire Inquiry 2020 Progress Report, Reporting Period July to September 2022, p. 36.

¹⁶³ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period April to June 2022, p. 36; NSW Bushfire Inquiry 2020 Progress Report, Reporting Period July to September 2022, p. 36.

¹⁶⁴ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period April to June 2022, p. 36; NSW Bushfire Inquiry 2020 Progress Report, Reporting Period July to September 2022, p. 36.

Recommendation 52

*That, in order to enhance NSW's firefighting capacity, Government trial aerial firefighting at night in the 2020-2021 season with a view to full implementation if successful.*¹⁶⁵

- 140) In response to Recommendation 52, the NSW Government committed to investing \$5.4 million over five years (commencing in 2020-2021) for NSW RFS to enhance the aerial fleet and aviation training facilities. It was reported that seven NSW RFS aircraft are configured to operate at night-time for various taskings. Additional night operations equipment for pilot and crew members were also being finalised. A Concept of Operations Plan was developed, and an aircraft and organisational capability review was completed. NSW also sought input from Victorian Fire Authorities and NAFC on trials undertaken in Victoria.¹⁶⁶
- 141) A mission profile to enable firefighting night operations was being finalised in conjunction with NSW RFS aircraft operators.¹⁶⁷ Testing and validation of the night intelligence capability using the forward looking infra-red ('FLIR') mission system installed in the NSW RFS owned Bell 412 helicopters was successfully completed.¹⁶⁸
- 142) Training packages were also finalised for the use of the FLIR system installed in the NSW RFS Bell 412 helicopters as part of night-time operations (intelligence gathering). NSW RFS members commenced comprehensive training in the use of the systems.¹⁶⁹
- 143) The NSW RFS reported that operating helicopters at night will allow the NSW RFS to directly attack fires at times when weather conditions are typically more favourable. Over the 2021-2022 bushfire season, the NSW RFS completed night-time firebombing trials, which involved a RFS Bell 412 helicopter and a contracted Chinook specially brought out from the United States. The RFS helicopter was fitted with infrared technology to identify power lines and other hazards, safely guiding the Chinook to drop water on a fire. The evaluation report of 2021-2022 night-time aerial firebombing was completed. Further trials were planned for 2022-2023 bushfire season, including night-time aerial incendiary, observation, winching and transport operations. Aviation contract discussions, to support further trials, were underway.¹⁷⁰

¹⁶⁵ The NSW Inquiry Report, p. 317.

¹⁶⁶ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period January to March 2021, p. 43.

¹⁶⁷ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period April to June 2021, p. 40.

¹⁶⁸ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period July to September 2021, p. 38.

¹⁶⁹ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period October to December 2021, p. 39.

¹⁷⁰ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period April to June 2022, p. 36.

- 144) It was last reported that the NSW RFS owned medium helicopters are now capable of undertaking night-time operations for aerial incendiary and aerial observations which includes image capturing and live streaming. Further, the NSW RFS is developing night-time capabilities for helicopter search and rescue operations. The response to Recommendation 52 remains as being 'in progress' and an update has been sought from the NSW RFS.¹⁷¹
- 145) It is noted that quarterly progress reports are provided in relation to the NSW Inquiry and implementation of the recommendations.

Royal Commission

- 146) The Royal Commission made the following recommendations concerning aerial resources. Where available, this paper also incorporates the response from the Commonwealth Government to the recommendations. It is not clear what, if any, response has been made by the NSW Government beyond an announcement that the NSW Government would work with the Commonwealth in responding to these recommendations. Further enquiries are being made in this regard.

Recommendation 6.2

*Australian, State and Territory governments should establish a national register of fire and emergency services personnel, equipment, and aerial assets.*¹⁷²

- 147) The Commonwealth Government supported in principle the objective of Recommendation 6.2 but noted that acquisitions and management of operational response capabilities are primarily the responsibility of States and Territories.¹⁷³

Recommendation 6.3

*State and Territory governments should update and implement the National Framework to Improve Government Radio Communications Interoperability, or otherwise agree a new strategy, to achieve interoperable communications across jurisdictions.*¹⁷⁴

¹⁷¹ NSW Bushfire Inquiry 2020 Progress Report, Reporting Period April to June 2022, p. 36.

¹⁷² The Royal Commission Report, p. 164.

¹⁷³ Department of the Prime Minister and Cabinet, *A national approach to national disasters: The Commonwealth Government response to the Royal Commission into National Natural Disaster Arrangements*, November 2020 ('The Commonwealth Government Response to the Royal Commission'), p. 11.

¹⁷⁴ The Royal Commission Report, p. 170.

148) The Commonwealth Government noted Recommendation 6.3 and supported the objective underpinning it. It further noted that it is directed at States and Territories.¹⁷⁵

Recommendation 8.1

Australian, State and Territory governments should develop an Australian-based and registered national aerial firefighting capability, to be tasked according to greatest national need. This capability should include:

- 1) *A modest, very large air tanker/large air tanker, and Type-1 helicopter capability, including supporting infrastructure, aircrew and aviation support personnel, and*
- 2) *Any other aerial firefighting capabilities (e.g. Light Detection and Ranging (LiDAR), line-scanning, transport, and logistics) that would benefit from a nationally coordinated approach.*¹⁷⁶

149) The Commonwealth Government noted Recommendation 8.1 and acknowledged the maturity, experience, and effectiveness of the operational response capabilities of the States and Territories. The Commonwealth Government noted it had no desire to replicate or replace these capabilities, including in aerial firefighting.¹⁷⁷

150) The Commonwealth Government noted the suggestion made by the Royal Commission concerning a role for Emergency Management Australia¹⁷⁸; but that it is comfortable with the present arrangements of the States and Territories involving the NAFC.¹⁷⁹ Further, the Commonwealth would continue its annual contribution of \$26 million to the NAFC, indexed from 2020-2021.¹⁸⁰

151) The Commonwealth also encouraged States and Territories to work collaboratively and with industry to build Australian-based aerial firefighting capacity, consistent with their sovereign obligations to maintain appropriate operational response capabilities.¹⁸¹

Recommendation 8.2

Australian, State and Territory governments should support ongoing research and evaluation into aerial firefighting. This research and evaluation should include:

- 1) *Assessing the specific capability needs of States and Territories, and*
- 2) *Exploring the most effective aerial firefighting strategies.*¹⁸²

¹⁷⁵ The Commonwealth Government Response to the Royal Commission, p. 12.

¹⁷⁶ The Royal Commission Report, p. 223.

¹⁷⁷ The Commonwealth Government Response to the Royal Commission, p. 14.

¹⁷⁸ The Royal Commission Report, p. 27.

¹⁷⁹ The Commonwealth Government Response to the Royal Commission, p. 14.

¹⁸⁰ The Commonwealth Government Response to the Royal Commission, p. 14.

¹⁸¹ The Commonwealth Government Response to the Royal Commission, p. 14.

¹⁸² The Royal Commission Report, p. 223.

- 152) The Commonwealth Government supported in principle Recommendation 8.2. On 23 July 2020, the Commonwealth Government announced \$88.1 million to extend and scale-up funding for critical research into bushfires and natural hazards. The Commonwealth would support the use of some of these funds, and/or some of the Commonwealth's annual contribution of \$26 million to the NAFC, indexed from 2020-2021, for research into aerial firefighting capabilities.¹⁸³
- 153) However, before any decision or long-term commitment is made regarding particular aircraft in the fleet, ownership, and strategic operation, it was noted that it is imperative to have a full and evidence-based understanding of the capability actually required. It was also acknowledged that this recommendation is pivotal to informing decisions on the future of aerial firefighting to deliver an operationally effective fleet that is scalable, adaptive and provides value for money.¹⁸⁴

Recommendation 8.3

*Australian, State and Territory governments should adopt procurement and contracting strategies that support and develop a broader Australian-based sovereign aerial firefighting industry.*¹⁸⁵

- 154) The Commonwealth Government noted Recommendation 8.3 and supported the objective underpinning it. It further noted that it is directed at States and Territories.¹⁸⁶

Senate Inquiry

- 155) The Senate Inquiry made the following recommendations concerning aerial resources.

Recommendation 8

*The committee recommends that the Commonwealth Government develop a business case to progress the establishment of a permanent, sovereign aerial firefighting fleet, which includes Large Air-Tankers and Very Large Air-Tankers, and small and medium-sized aircraft as appropriate.*¹⁸⁷

¹⁸³ The Commonwealth Government Response to the Royal Commission, p. 14.

¹⁸⁴ The Commonwealth Government Response to the Royal Commission, p. 14.

¹⁸⁵ The Royal Commission Report, p. 224.

¹⁸⁶ The Commonwealth Government Response to the Royal Commission, p. 14.

¹⁸⁷ The Senate Finance and Public Administration References Committee, *Lessons to be learned in relation to the Australian bushfire season 2019-20*, Interim Report delivered October, p. 115.

- 156) In May 2021, the Commonwealth Government noted the Recommendation 8 made by the Senate Inquiry and noted that the NAFC, established by the States and Territories, provides a cooperative arrangement for the delivery and sharing of aerial firefighting resource. Whilst acknowledging the maturity, experience, and effectiveness of the operational response capabilities of the States and Territories, the Commonwealth noted it had no desire to replicate or replace the capabilities of the States and Territories, including in aerial firefighting.¹⁸⁸
- 157) Further, it was noted that the Commonwealth does not determine the makeup, size and positioning of the aerial firefighting fleet. These are decisions for the operational experts in the States and Territories through the CCOSC. The Commonwealth noted that it must take the advice of operational experts on future aerial firefighting options and requirements. The NAFC and the CCOSC were asked to provide this advice to the Commonwealth Government.¹⁸⁹
- 158) The Commonwealth noted that it is imperative that it has a full understanding, informed by evidence, of the capability actually required and that this would inform decisions on the future of aerial firefighting to deliver an operationally effective national fleet that is scalable, adaptive and provides value for money. This ensures that States and Territories are able to access appropriate aerial firefighting capacity when it is needed most and can introduce new technology as it becomes available.¹⁹⁰ The Commonwealth noted that it would continue to contribute \$26 million annually to the NAFC.¹⁹¹
- 159) Further, the Commonwealth noted that it works with, and encourages, States and Territories to work collaboratively with industry to build Australian-based aerial firefighting capacity, consistent with their sovereign obligations to maintain appropriate operational response capabilities'¹⁹²
- 160) The Senate Inquiry in its Final Report published its views in relation to the Commonwealth Government response to Recommendation 8. Most notably, the Senate Inquiry expressed its concern that despite the findings of the Royal Commission as well as the Senate Inquiry, and strong support from key stakeholders and members of the community, the

¹⁸⁸ Australian Government response to the Finance and Public Administration Reference Committee report: *Lessons to be learned in relation to the Australian bushfire season 2019-20*, May 2021, ('The Commonwealth Government Response to the Senate Inquiry') p. 12-13.

¹⁸⁹ The Commonwealth Government Response to the Senate Inquiry, p. 13.

¹⁹⁰ The Commonwealth Government Response to the Senate Inquiry, p. 13.

¹⁹¹ The Commonwealth Government Response to the Senate Inquiry, p. 13.

¹⁹² Australian Government response to the Finance and Public Administration Reference Committee report: *Lessons to be learned in relation to the Australian bushfire season 2019-20*, May 2021, p. 11-12.

Commonwealth Government had continued to maintain the view that a sovereign aerial firefighting fleet was not required.¹⁹³ It recommended that research and analysis be conducted regarding the need for a sovereign fleet, including the right mix between small and medium aircraft, and the need for a LAT and VLAT fleet to be maintained onshore.¹⁹⁴

161) Subsequently, the Senate Inquiry again recommended:

Recommendation 1

*The committee recommends the Australian Government work with AFAC, the NAFC and State and Territory governments to progress the establishment of a permanent, sovereign aerial firefighting fleet, which includes LATs and VLATs, and small and medium-sized aircraft as appropriate.*¹⁹⁵

NSW Auditor-General's Audit

162) The NSW Auditor-General's Audit resulted in the following recommendation in respect of fleet planning and reporting:

Recommendation 2

By December 2023, that the NSW RFS develop performance measures to assess the performance and capabilities of the fleet in each RFS District by recording and publicly reporting on:

- *Fire response times and fire response outcomes*
- *Completion of fire hazard reduction works.*¹⁹⁶

163) The NSW RFS in its response acknowledged that while the NSW Auditor-General's Audit predominately focused on the management of the RFS road fleet, it overlooked their significant achievements in development and managing the largest aerial firefighting fleet in Australia. It noted that this deployment is far more effective in meeting the intent of Recommendation 2 than a vehicle response time matrix.¹⁹⁷

164) The NSW RFS noted that it has already committed to a target of limiting 80 percent of bushfires to less than 10 hectares in area and disagreed that the introduction of fire response time targets across the State would enhance its operational success. Further,

¹⁹³ The Senate Inquiry Final Report, p. 22.

¹⁹⁴ The Senate Inquiry Final Report, p. 22.

¹⁹⁵ The Senate Inquiry Final Report, p. 23.

¹⁹⁶ The NSW Auditor-General's Report, p. 10.

¹⁹⁷ The NSW Auditor-General's Report, Appendix 1, p. 35.

the NSW RFS noted that a trial of pre-determined dispatch of aircraft at the same time as ground resources was conducted in the 2021-2022 bushfire season and was expanded to another 10 locations in the 2022-2023 bushfire season (referred to at [132]-[133] above). The NSW RFS noted that dispatching aviation assets that can attack a fire as soon as practicable after it is reported would help achieve its own target and provide essential support to ground crews, reducing the risk of a fire spreading and requiring numerous crews to respond.¹⁹⁸

CONCLUSIONS DRAWN ON THE ROLE OF AERIAL RESOURCES

- 165) The scale of the 2019-2020 bushfire season in NSW meant that a large contingent of aerial resources was required, not just for firefighting purposes, but also for personnel and resource movement, and surveillance and reconnaissance missions. Aircraft are particularly valuable for fires in difficult terrain or fast-moving fires that are too dangerous for ground crews to confront and are an effective resource particularly when used in close coordination with ground-based firefighting crews.¹⁹⁹
- 166) The increasing duration of fire seasons in the northern and southern hemispheres and the increasing duration and severity of bushfire seasons in Australia, will make it increasingly difficult to share aircraft domestically, and to acquire aviation services when required, particularly at short notice. Also in some instances, contracting arrangements do not incentivise the development of Australian-based aviation services, particularly with respect to LATs. Australian-licensed pilots are also precluded from operating foreign-registered aircraft. These features of Australia's aerial firefighting arrangements further increase Australia's reliance on overseas providers. The Inquiries highlighted the importance of investing in Australian-based aerial resources and having less reliance on overseas resources.

¹⁹⁸ The NSW Auditor-General's Report, Appendix 1, Annexure A, p. 39.

¹⁹⁹ The NSW Inquiry Report p. 307.



REQUEST 4 – USE OF AIR SUPPORT

Questions

The NSW State Coroner asked:

1. How many aircraft were in the RFS fleet during the 2019-20 bushfire season?
2. Please briefly describe the capabilities (for example, whether or not the aircraft had water-bombing capabilities) of the different classifications (such as fixed-wing aircraft, helicopters etc.) of the fleet.
3. Has the size or composition of the RFS aerial fleet changed since the 2019-20 bushfire season?

Responses

1. How many aircraft were in the RFS fleet during the 2019-20 bushfire season?

During the 2019-20 fire season, the NSW RFS had access to **398** aircraft¹. In total, there were **2,518 aircraft taskings** (some for single missions, some lasting multiple days) across the State.

The NSW RFS engages aircraft in three ways: NSW RFS owned aircraft, National Aerial Firefighting Centre contracted aircraft and through state-based Call When Needed engagements.

NSW RFS owned aircraft

During the 2019-2020 season the NSW RFS operated 4 owned aircraft including: 1 light helicopter, 2 medium helicopters and 1 Large Air Tanker (LAT).

The NSW RFS's new LAT, 'Marie Bashir', came online in Australia on 4 August 2019 and was deployed on the same day. It flew more than 455 missions and dropped over 6.8 million litres of suppressant during the season.

In addition, the NSW RFS made the decision to charter a fixed-wing passenger aircraft over an eight week period to facilitate personnel movement. This gave the NSW RFS greater control over fire fighter movements to critical areas. It was particularly important over the holiday season when seats on commercial aircraft were limited (and expensive).

NAFC Seasonal Contracted aircraft

Through the National Aerial Firefighting Centre (NAFC) aircraft may also be engaged for the season or on a shorter-term contract, dependent on need and seasonal outlooks. NAFC facilitates the coordination and procurement of a fleet of highly specialised firefighting aircraft that are readily available for use by State and Territory emergency service and land management agencies across

¹ This is the number of aircraft that were tendered for the 2019-2020 for the fire season. The number of aircraft available fluctuates as aircraft insurances expire or aircraft transfer to contracts interstate, etc. As such, not all 398 aircraft were around all the time during the 2019-2020 season.

Australia. NAFC also facilitates a national CWN process, which the NSW RFS is able to access additional aircraft.

During the 2019-2020 season NSW RFS:

- engaged 31 aircraft through NAFC, which was increased to 38 between July 2019 and March 2020
- funded and engaged one Very Large Air Tanker (VLAT) (NSW Government funded); and
- engaged a second VLAT in Feb 2020, funded by the Federal Government; and
- engaged 6 aircraft through the NAFC CWN process.

NSW State-based Call When Needed (CWN)

NSW RFS has access to a range of aviation resources (aircraft and fuel services) on contractual arrangements through state-based Call When Needed (CWN). The NSW RFS conducts a Request for Standing Offers (RFSO) process inviting aircraft operators to submit pricing for aircraft and / or aviation fuel solutions. A panel evaluates the RFSO responses against the relevant procurement criteria and an approved list is developed.

2. Please briefly describe the capabilities (for example, whether or not the aircraft had water-bombing capabilities) of the different classifications (such as fixed-wing aircraft, helicopters etc.) of the fleet.

NSW RFS owned aircraft

For the 2019-20 fire season, the NSW RFS owned and operated four aircraft, which included:

Qty	Aircraft	Capability
1	Light Helicopter (AS350B2 Squirrel)	Aerial Intelligence – streaming video feed; and Aerial Incendiary
2	Medium Helicopter (BK117)	Search & Rescue; Winch Operations; Aerial Incendiary
1	Large Air Tanker (Boeing 737-300)	Firebombing

Within the 2020-21 financial year, the NSW RFS acquired another four aircraft operational, bringing the total to eight owned aircraft. The additional aircraft include:

Qty	Aircraft	Capability
2	Fixed Wing Lead Plane (Cessna Citation V)	Lead plane; High Frequency Scanning; Personnel Transport
2	Medium Helicopter (B412)	Search & Rescue; Winch Operations; Aerial Incendiary

Seasonal Contracted aircraft through NAFC

At the start of the 2019-20 fire season, the NSW RFS initially engaged 31 aircraft through NAFC, which included:

Qty	Aircraft	Service
2	Heavy (High Volume) Helicopter	Firebombing
8	Single Engine Air Tankers (SEAT)	Firebombing
1	Single Engine Air Tankers (SEAT) on floats – Fireboss	Firebombing
3	Medium Helicopter	Firebombing
5	Medium Helicopter	Firebombing / Winch
1	Light Helicopter	Firebombing
2	Fire Spotter	Air Attack / Aerial Intelligence
1	Light Helicopter	Air Attack / Aerial Intelligence
1	Light Helicopter (Camera)	Special Intelligence Gathering
3 [#]	Fixed Wing Line scan	Line scan
2	Large Air Tanker	Firebombing
2	Fixed Wing Lead Plane	Air Attack

[#]Second line scan aircraft was shared 50/50 with Victoria. The third line scan aircraft was unable to operate throughout the 2019-20 fire season due to aircraft and crew limitations.

However, as aircraft became available and / or released from service in Queensland, the NSW RFS engaged an additional seven aircraft during the 2019-20 fire season, which included:

Qty	Aircraft	Service
1	Heavy Helicopter [#]	Firebombing
2	Single Engine Air Tanker (SEAT) [#]	Firebombing
2	Very Large Air Tanker [*]	Firebombing
1	Large Air Tanker	Firebombing
1	Fixed Wing Lead Plane	Air Attack

New South Wales Call When Needed (CWN)

During the 2019-2020 season there were 398 aircraft and aviation fuel solutions approved for CWN purposes in NSW, this included:

Qty	Aircraft	Service
6	Fixed Wing	Type 1
48	Fixed Wing	Type 4
1	Fixed Wing	Very Large Air Tanker
18	Fixed Wing	Air Attack
59	Fixed Wing	Other
28	Rotary	Type 1 (Heavy)
72	Rotary	Type 2 (Medium)
161	Rotary	Type 3 (Light)
5	Rotary	Other

3. Has the size or composition of the RFS aerial fleet changed since the 2019-20 bushfire season?

For the 2021/2022 season the NSW RFS had 28 firefighting contracted aircraft on exclusive use contracts, these were in addition to NSW RFS owned and Call When Needed aircraft.

The dedicated fleet includes:

- Three large air tankers; the NSW RFS owned B737, the 'Marie Bashir'; Avro RJ85 and C130.
- Two NSW RFS owned Citation jets for aerial intelligence and lead plane duties.
- Three NSW RFS owned Bell 412 multi role helicopters.
- Two NSW RFS owned BK117 multi role helicopters.
- One NSW RFS Squirrel AS350 helicopter for aerial intelligence.
- Two large type 1 helicopters (1 x Chinook and 1 x Blackhawk)
- Nine medium type 2 helicopters
- Nine single engine air tankers (fixed wing) including two on floats

The new mix of contracted aircraft provides enhanced operational capability for NSW with a substantial increase in firebombing capacity of 87,553 litres from the previous aircraft mix providing of 80,821 litres.

The Chinook Helicopter alone is able to drop 11,356 litres of firefighting water or suppressant. This is a 4,356 litre increase on the capacity of the Aircrane helicopter the NSW RFS has utilised in previous fire seasons. The Chinook aircraft, when configured with a sling line, will also enable the NSW RFS to move heavy plant and equipment into inaccessible areas when required.



'B'

Department of Planning and Environment

30 August 2022

Lincoln Chee
Director Inquests, Inquiries and Representation
Legal, Department of Communities and Justice
Locked Bag 5111, Parramatta NSW 2124

By Email only to *bushfires.legal@justice.nsw.gov.au*

Dear Mr Chee

Bushfire Coronial Inquiry – Executive Statement

We write on behalf of the NSW National Parks and Wildlife Service (NPWS) to raise a number of issues for consideration during the upcoming Stage 2 hearings.

Prioritisation of aircraft, particularly for rapid response to new ignitions

NPWS is mindful of the limited number of fire-fighting aircraft that may be available at any one time, but is concerned that, on a number of occasions during the fire season, aircraft allocation to existing fires was prioritised over maintaining aircraft resources for response to new ignitions. In a number of cases, insufficient aircraft availability meant that the initial weight of attack was inadequate to prevent new ignitions from propagating and developing into large fires. Examples of this include the Gospers Mountain and Ruined Castle Fires.

In both of these cases, Incident Management Teams (IMTs) responding to the new ignitions were unable to obtain appropriate air support to enable an effective initial response as aircraft were tasked elsewhere in the state on existing larger fires. As a result, initial attack on both these fires was unsuccessful and both became large fires with significant impacts on assets and Parks.

At a statewide level, there did not appear to be clear criteria for prioritising, allocating and re-allocating aircraft to fires based on risk and initial attack. This issue was also raised during the NSW Bushfire Inquiry, which included recommendations directed to this issue.

This area of concern also includes the issue of re-fuelling of aircraft. The procedure for re-fuelling fire-fighting aircraft is confusing and time consuming, involving contractual restrictions about which fuel sources are available for which aircraft. During periods of intense fire fighting activity, multiple aircraft required re-fuelling but had to complete paperwork and follow procedures that caused delay. A simplified procedure, or one that could be adapted to emergency situations, would allow aircraft to re-fuel quickly and carry on with fire-fighting.

Command and control of fires

During the 2019-20 bushfire season, previously effective boundaries for the management of fires became ineffective.

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A s44 declaration with nominated boundaries may have been made in relation to a fire, but the rapid spread saw it move beyond those designated management areas, often into areas managed by another s44 declaration. NPWS is particularly concerned to raise the issue of the scale of fire in the landscape and the capacities of individual IMTs to deal with rapidly escalating risk coming from outside their area, which often lead to a lack of strategic oversight and control of decisions affecting fire management within the areas of control of those IMTs.

Investigation of fires

NPWS is raising this issue because it is of the view that there are opportunities for better coordination between agencies (such as NPWS, RFS and NSW Police) at the investigation stage.

Because agencies like NPWS have specialised knowledge about land tenure, topography, and local fire activity, it would be useful to ensure that fire investigators are appropriately briefed by agency officers about the history and/or behaviour of a fire, for example. This will help ensure that key people are interviewed and the broader context of a fire is taken into account, to ensure that the most accurate conclusions are reached and important lessons are learned.

If there is any further information that we can provide, or should we be able to assist in any way, please let us know. Please note that NPWS reserves its right to address these issues further following the evidence in Stage 2.

Yours sincerely,



Jennifer Coburn
Director Environment Litigation

NSW State Coroner

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