

Final Report of the NSW Bushfire Inquiry

31 July 2020

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The Hon Gladys Berejiklian MP
Premier
Parliament House
SYDNEY NSW 2000

Dear Premier,

Report – NSW Bushfire Inquiry

In January 2020 you announced the establishment of the NSW Bushfire Inquiry, noting it was to be completed by 31 July 2020. We now submit the final report of that Inquiry.

The 2019-20 bush fires were some of the worst in the world and in recorded history. The Inquiry has worked to understand what happened during the 2019-20 bush fire season and how it was different to seasons that have come before. It makes 76 recommendations for future improvements to how NSW plans and prepares for, and responds to, bush fires. Some of these recommendations are for immediate action; others for actions that need to start now but will take some time to complete. Noting the breadth of the Inquiry's Terms of Reference, the recommendations range from improvements to operational systems and processes through to significant research and strategic policy frameworks that require further development and consultation with key stakeholders.

In presenting this final report we wish to acknowledge the assistance of many people – those who took the time to write submissions or talk to the Inquiry; the NSW fire agencies; colleagues from government departments in NSW and other jurisdictions; colleagues in industry, research organisations, and professional associations; and the Secretariat and Advisors to the Inquiry drawn from several government departments who worked hard to help us make sense of a complex matter.

Yours sincerely,

A stylized, handwritten signature in blue ink, consisting of a series of loops and a long horizontal stroke.

Dave Owens APM
31 July 2020

A stylized, handwritten signature in blue ink, featuring a large, bold 'M' followed by a horizontal line.

Mary O'Kane
31 July 2020

EXECUTIVE SUMMARY

On 30 January 2020 the Premier announced an Inquiry into the 2019-20 bush fire season to make recommendations in relation to bush fire preparedness and response and to report by 31 July 2020, ahead of the 2020-21 bush fire season.

The Inquiry has worked to understand what happened during the 2019-20 bush fire season and how it was different to seasons that have come before, and to make recommendations for future improvements to how NSW plans and prepares for, and responds to, bush fires, rather than to attribute blame. The Inquiry was not asked to and did not examine bush fire recovery issues.

The focus of this report is to provide analysis and recommendations for change to ensure that, when bush fires like this happen again, there is less damage to property and our environment and, as much as possible, there are no lives lost.

The 2019-20 bush fire season was extreme, and extremely unusual. It showed us bush fires through forested regions on a scale that we have not seen in Australia in recorded history, and fire behaviour that took even experienced firefighters by surprise. The total tally of fire-generated thunderstorms in south-eastern Australia since the early 1980s increased from 60 at the end of 2018-19 to almost 90 at the end of the 2019-20 bush fire season – an increase of almost 50% in one bush fire season. Fire-generated thunderstorms are extremely dangerous phenomena that produce extreme winds, lightning, tornadoes and black hail.

The season showed us what damage megafires can do, and how dangerous they can be for communities and firefighters. And it is clear that we should expect fire seasons like 2019-20, or potentially worse, to happen again. A number of factors combined to make this season so extraordinary. Climate change as a result of increased greenhouse gas emissions clearly played a role in the conditions that led up to the fires and in the unrelenting conditions that supported the fires to spread, but climate change does not explain everything that happened.

The 2019-20 bush fire season challenged conventional assumptions. For example, it appears that the extreme dryness of forested regions over large continuous areas was the determining factor in the size of the fires. When taken together with the weather conditions experienced, the fires became extreme, burning through forests and across bare earth. Previous prescribed burning and hazard reduction activity appears to have reduced fire severity in some instances, but in others it appears to have had no effect on the severity and spread of the fires.

This season also challenged assumptions about how we fight fires. The scale of the fires stretched the capacity of fire authorities and the underpinning systems to respond, even with interstate and international support. We couldn't get to all new fires early enough, many of which were started by lightning in remote or rugged terrain and quickly got to the point where suppression was extremely difficult.

It is also clear that, despite the bravery and ingenuity of our firefighters in the face of enormous risk, capable Incident Management Teams coordinating the responses to the various big fires, and the huge expenditure on fire fighting, we need to know much more about bush fire suppression methods and how effective they are, especially in the face of megafires like these. Techniques and strategies that worked in previous seasons often did not work as well in the 2019-20 season. There is a need for much more research into fire

fighting strategies including improving capabilities for immediate detection of new ignitions, especially in remote areas, and fast responses to keep new fires small. There is a need for more research into conventional fire fighting techniques like backburning, and we need to understand and predict better when fires might escalate into dangerous, extreme fires that require firefighters to leave the fireground.

But our systems served us well in many cases. Lessons from the Black Saturday bush fires that have informed much blunter messaging about leaving early seemed to be very effective in getting people out of harm's way. Many people involved in fighting the fires said that the coordination between different agencies and fire fighting authorities was incredibly effective. The relatively new NSW RFS State Operations Centre at Homebush proved very successful as an overall operational centre.

This report aims to help NSW and Australia improve systems to be more ready for extreme fires. That said, it shows there are still lots of unknowns requiring continuing work, and many of the Inquiry's recommendations go to that point.

Some immediate fixes will improve things, for example, checking and auditing that processes that are supposed to be followed are actually happening, improving accountability processes, and improving safety equipment and systems for firefighters (truck cabin protection, aircraft, respiratory protection, sustenance, personal protection, etc.).

There are important fire fighting enhancements needed – more emphasis on getting fires out early; improved backburning protocols, training and information around heavy plant use; the right mix of aerial fire fighting assets; and increased aerial night fire fighting.

There is also a need for improved telecommunications, both to ensure the community can access the information it needs to make timely and appropriate decisions, and to enhance fire fighting capability. This varies from improving power backup arrangements, to expanding fire information apps, to improving firefighter access to radio public safety networks. When evacuations are required, there are more things we can do to ensure that the community, especially the more vulnerable, are appropriately looked after.

Over the longer term, some major changes are needed. We need to push available technologies harder, especially fire science, remote sensing, data science and artificial intelligence to equip us better to understand what happens during a bush fire and respond more quickly. Many government systems also need to be improved, especially strengthening cross-agency accountability and governance; training; being more strategic in our land use planning to account for bush fire; and better managing critical infrastructure including fire trails and roads to minimise property and asset damage.

Central to the way forward must be improving local preparedness and resilience. Fires of this kind are hard to suppress, regardless of how well-prepared fire authorities are, and the community needs to be physically and mentally prepared. At the centre must be individual responsibility for managing risk and making properties as safe as possible starting from the most local of levels. Enhanced community education and engagement and individual and community ownership of risk (informed by high-quality information) should be central to the Government's response.

Inquiries like this one are important, but they must not be the end of the examination of the 2019-20 bush fire season. No one yet fully understands exactly what happened in every location and under every variation in weather, terrain, vegetation type etc. In some ways, this Inquiry will be a success if it is superseded because further research, that was not possible in the timeframe, can bring important new insights that will better inform our approaches to

preparing for and responding to bush fires. A good example of this is the Royal Commission into the 2009 Black Saturday bush fires in Victoria. Lessons learned from that event, for example, the evolution of messaging to get people out quicker, appears to have been critical in saving lives during the 2019-20 season. But other issues, like recommendations for an area-based hazard reduction target on public land, have now been superseded by more strategic, risk-based approaches driven by much better data and modelling. We have also seen the understanding of what happened on Black Saturday evolve since that Royal Commission concluded. It was only several years later that further research identified the role of a fire-generated thunderstorm in the fire at Kinglake.

As Richard Thornton, CEO of the Bushfire and Natural Hazards Cooperative Research Centre, states, we need a quantum shift in our thinking and “to pursue the same path is tacitly to say that there is an acceptable number of deaths, injuries and property losses from bush fires in Australia each year”.¹

The NSW Inquiry thinks that it is inevitable that there will be future property losses, given the settlement patterns in NSW and legacy development issues. But loss of life is never acceptable, and firefighters’ lives should not be put at risk to defend property.

Recognising and accepting what can be defended and what can’t be during an extreme fire season may require a big cultural shift for both the fire services and the community. More trucks and more firefighters are not the answer to the scale of the challenge NSW and Australia was confronted with during the 2019-20 bush fire season. Ideally, technology will be harnessed to minimise the risk to first responders. We need to grab what is becoming possible in terms of unmanned aircraft and vehicles, and think big about what will make fire fighting, and living in the community with fire, safer.

¹ Thornton, Richard. (2020, 4 January). Doing more of the same on fires will not mitigate disaster impact, *The Australian*. Retrieved from <https://www.bnhcrc.com.au/news/blogpost/richard-thornton/2020/doing-more-same-fires-will-not-mitigate-disaster-impact>.

RECOMMENDATIONS

Recommendation 1

That, in order to ensure recommendations accepted by the Government are implemented in a timely and transparent manner, Government establish a central accountability mechanism to track implementation of recommendations from bush fire-related reviews and inquiries and consider expanding this to other policy areas.

Recommendation 2

That at the start of each fire season, based on advice from the Bush Fire Coordinating Committee, Government provide a public statement with an evaluation of the likely fire season risk and the effectiveness of the planning and preparation for the upcoming season. This should be based on sophisticated monitoring of the key risk factors and signals for an extreme fire season. It should form the basis for clear public communication about these risks on a regional basis and the actions that Government proposes in preparation.

Recommendation 3

That the NSW Government, along with other Australian governments, ask AFAC 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.

Recommendation 4

That, in order to improve capability to detect ignitions and monitor accurately all fire edge intensity and progression automatically across the State in near real time, Government establish a spatial technology acceleration program to maximise the information available from the various remote sensing technologies currently in use and to plan for inclusion of new remote sensing systems that can sense precisely and rapidly through heavy smoke, cloud, fog and dust. This will require work within the State and with partners nationally and internationally.

Recommendation 5

That Government establish NSW as a major world centre of bush fire research, and technology development and commercialisation. This should include:

- a) establishing a Bush Fire Technology Fund, modelled on the Medical Devices Fund, to assist with the rapid development of technologies and services to sense, fight, mop up after and protect from bush fires
- b) commissioning further research into extreme fire behaviour and building up the research and research training capacity in this field. This will improve our ability to understand, model and predict the likelihood of extreme fire behaviour in the landscape and enable targeting of fire fighting resources to areas where fires are likely to become most damaging.

Recommendation 6

That Government support training initiatives to increase the capacity of fire authorities to fight the kind of megafires seen in the 2019-20 season. The training initiatives should include:

- a) targeted training in local weather effects for fire behaviour analysts who are embedded in Incident Management Teams
- b) an increase in the number of trained fire behaviour analysts so that, should there be a repeat of the scale of these fires, all Incident Management Teams can have an embedded analyst and there is some redundancy under more normal conditions
- c) training of more meteorologists in fire behaviour so there are more expert resources available to embed within the NSW RFS State Operations Centre
- d) dedicated training for firefighters in extreme fire behaviour
- e) support for research training in challenging firefighting problems.

Recommendation 7

That the NSW RFS Commissioner consult with the Fire and Rescue NSW Commissioner and other emergency services to develop a protocol in the event that simultaneous emergency events necessitate the re-allocation of resources while a Section 44 declaration is in place.

Recommendation 8

That, to strengthen cross-agency accountability and deliver improved bush fire risk management outcomes:

- a) Bush Fire Coordinating Committee (BFCC) members from NSW government agencies are at the level of Coordinator General/Deputy Secretary/Agency Head/Deputy Commissioner (or equivalent)
- b) the BFCC ensures all Bush Fire Risk Management Plans, Operation Coordination Plans and Fire Access and Fire Trail (FAFT) Plans are compliant with the timeframes outlined in section 52 of the *Rural Fires Act* as soon as practicable
- c) the BFCC develops a risk-based performance auditing cycle to ensure Bush Fire Risk Management Plans, Operation Coordination Plans and FAFT Plans are fit-for-purpose and any opportunities for improvement are identified and actioned
- d) the NSW RFS considers the best way of enhancing the transparency of BFCC decision-making, for example by publishing BFCC membership and minutes on its website
- e) the BFCC endorses the annual statement to Parliament on the likely fire risk and the effectiveness of planning and preparation
- f) relevant agencies review Bush Fire Management Committee (BFMC) membership and confirm to the NSW RFS that members have sufficient discretion and authority to agree and implement risk mitigation activities at the local level
- g) the NSW RFS Commissioner amends the BFMC Policy to require BFMCs to refer unresolved issues to the BFCC for resolution.

Recommendation 9

That the NSW RFS work with AFAC to analyse the impact of changing fire seasons on inter-jurisdictional resource sharing agreements, both domestic and international, and determine any flow-on effects for NSW fire fighting personnel capacity.

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.

Recommendation 11

That, in order to strengthen the capability of local councils in future emergency events:

- a) Resilience NSW, in consultation with local government, develop specific training that focuses on the role, responsibilities and expected functions of the Local Emergency Management Officer (LEMO), including regular 'refresher' components
- b) Councils support their staff to participate in LEMO training on an ongoing basis, and ensure that staff who are LEMOs are appropriately senior and have the authority to commit resources.

Recommendation 12

That Government work with other Australian governments to provide long-term funding certainty to AFAC, including the National Resource Sharing Centre (NRSC) and the National Aerial Firefighting Centre (NAFC).

Recommendation 13

That, to ensure updated resource-sharing arrangements are in place, the NSW and Victorian Governments progress and finalise a multi-agency Memorandum of Understanding before the 2020-21 fire season commences.

Recommendation 14

That in order to provide greater consistency in public information and warnings, especially in border areas:

- a) the finalisation of the Australian Warning System be prioritised to provide greater consistency in public information and warnings
- b) the NSW State Emergency Management Committee, including the Public Information and Warnings Sub-Committee, prioritise the implementation of the Australian Warning System and data standards for relevant hazards within NSW.

Recommendation 15

That Government commit to:

- a) evaluating existing bush fire preparedness programs to determine the most effective and efficient approach given increased frequency of extreme fire seasons, and develop outcomes-based measures to monitor programs' impact over time
- b) post-evaluation roll out the most effective bush fire preparedness programs to all communities and at-risk cohorts in bush fire prone areas across NSW.

Recommendation 16

That, in order to ensure tourism businesses are prepared for natural disasters including bush fires, Resilience NSW work with NSW RFS and Destination NSW to develop bush fire preparedness support for tourism businesses, based on research into existing models. Over time, this support could be expanded to include other natural hazards.

Recommendation 17

That the NSW RFS identifies remote bush fire prone areas that do not already have an indoor Neighbourhood Safer Place (NSP) and upgrades the relevant NSW RFS Stations to meet NSP guidelines. These stations would require adequate Asset Protection Zones and active/passive protection systems to provide short-term protection.

Recommendation 18

That, in order to equip NSW RFS with comprehensive information on all structures and assets at risk of bush fire, Government ensures that:

- there is a single whole-of-government procurement and acquisition program for imagery and LiDAR and that Government accelerate the building of the State Digital Twin and associated Digital Workbench
- owners/managers of assets (apart from private home owners whose information will be provided through local councils) in bush fire prone land are required to provide to the Digital Twin at least the following information/metadata with quality control certification on an annual basis (with annual census at least two months before the start of the fire season):
 - precise geolocation
 - description of asset including picture
 - value level
 - fire treatment on asset
 - Asset Protection Zone (APZ) details and how it is maintained
 - access details
 - what redundancy is available if relevant
 - any metadata requirements specific to the asset class
 - emergency contact and instructions on how to access where more information is held
 - any restrictions on data access and sharing.

The Digital Twin must also be able to incorporate:

- information about the hazard reduction results for road verges, fire trails, APZs and other defensible space
- local information supplied by organisations such as local NSW RFS brigades.

Recommendation 19

That Government re-commit to the current, regionally based approach to planning and coordinating hazard reduction activities across all tenures through Bush Fire Management Committees but ensure that it is actually being implemented at a high-level of quality across NSW. Getting it to a high-level of quality requires:

- a) implementing the Inquiry's recommendation about performance auditing of Bush Fire Risk Management Plans
- b) prioritising implementation of revised processes for bush fire risk management planning that incorporate new modelling and methods for quantifying risk and the residual risk profile as a result of proposed hazard reduction works
- c) ensuring regional priorities for hazard reduction, and how they are determined, are communicated clearly to the community, and their implementation is reported on transparently. This will include being very clear about the objectives of hazard reduction activities and communicating that hazard reduction does not eliminate the risk of fire affecting properties
- d) the methodology for assessing and planning for risk reduction becomes an ongoing area of research and the frameworks are formally reviewed every three years.

Recommendation 20

That Government, noting that hazard reduction targeted in proximity to assets is on balance more likely to provide help than hinder, should:

- a) support local councils and partner agencies to implement more comprehensive hazard reduction at a local level around towns/cities, communities and local infrastructure assets, and provide incentives for communities to organise themselves to prioritise and implement local hazard reduction initiatives. This will involve a suite of hazard reduction techniques depending on the landscape including prescribed burning, clearing, mowing, and mechanical treatments, and easy disposal of green waste into processors turning it into bioenergy or biofuels

- b) beyond the local level priorities for hazard reduction, prioritise prescribed burning in parts of the landscape where fuel treatment may help reduce probability of fires escalating quickly and where terrain and potential atmospheric interactions are likely to escalate fires into fire-generated thunderstorms. This will likely involve a proactive program of treating ridge tops that are prone to dry lightning where reduced fuels may help reduce speed of spread when the fire first starts, or particular windward or lee-slopes that are susceptible to generating extreme fire behaviour and drive fire towards towns.

Recommendation 21

That, in order to improve understanding of optimal hazard reduction techniques and their application in the landscape:

- a) Government extend the recently introduced program of mitigation crews so that hazard reduction activities can be undertaken when conditions are optimal (throughout the week and potentially at night)
- b) all fire authorities review prescribed burning techniques and their implementation, and commission further research into optimal prescribed burning regimes and techniques. This should include research to understand critical thresholds that, when breached, may render fuel treatment ineffective (i.e. fuel moisture thresholds), and the short, medium and long-term outcomes of hazard reduction burning regimes
- c) Government commission research into a range of other hazard reduction techniques to understand better the cost versus benefit and effectiveness of different practices in various circumstances, including grazing.

Recommendation 22

That, as part of the spatial technology acceleration program, Government support deployment of remote sensing and picture processing technologies to monitor and audit how well Asset Protection Zones and defensible space are being maintained, especially around towns.

Recommendation 23

That Government amend the *Rural Fires Act 1997* so that all public land management agencies be required to forward complaints received about bush fire hazards to the Commissioner of the NSW RFS. As an interim measure, heads of agencies should commence this practice immediately.

Recommendation 24

That government agencies managing land (at all levels and through all agencies) be the best neighbours possible by considering their neighbours when undertaking activities related to bush fire preparation and having clear, two-way communication about these activities, with the aspiration that government landholders will be seen as highly desirable neighbours.

Recommendation 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.

Recommendation 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.

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 28

That Government, acknowledging that a strategic approach to planning for bush fire will take time, and in order to protect, prepare and build resilience into existing communities better, should immediately:

- prepare, in association with the insurance sector, a model framework and statutory basis for the establishment of an enforcement, compliance and education program which adopts a risk-based approach to routine inspection of local bush fire prone developments to ensure that every local development on bush fire prone land is prepared for future bush fire seasons in accordance with bush fire protection standards of the day, that account for worsening conditions
- ensure local government is resourced to enable effective audit, enforcement and compliance powers in respect of local developments and assets on bush fire land
- consider the introduction of subsidies for property owners to undertake site mitigation works to reduce bush fire risk and work with the Insurance Council of Australia to develop an agreed set of measures to insure against with a view to risk reductions resulting in lower insurance premiums
- review vegetation clearing policies to ensure that the processes are clear and easy to navigate for the community, and that they enable appropriate bush fire risk management by individual landowners without undue cost or complexity.

Recommendation 29

That, in order to maximise the protection of critical infrastructure in a bush fire, Australian governments revise the regulatory framework for the provision to government authorities of information about all critical infrastructure (public and private) including a possible change to compel the owners of critical assets to provide all needed metadata, updated annually, for appropriate planning, preparation and response for bush fire. This would include information about location, ownership, access, details of service the infrastructure supports, and fire treatments of building and surrounding zones.

Recommendation 30

That, in order to minimise communication outages and extend basic communication coverage during bush fires, the NSW Government work directly, or together with other Australian governments and/or their relevant power and telecommunications regulatory, policy and market bodies, to:

- ensure there are sufficient redundancy options available (e.g. backup diesel generators, deployed temporary telecommunications facilities, etc.) to supply power to essential telecommunication infrastructure or alternative telecommunications infrastructure
- ensure that the telecommunication entities' and electricity network providers' Bush Fire Risk Management Plans are updated annually and reported on in the NSW RFS Commissioner's annual statement to Parliament on the upcoming bush fire season and include details of all actions taken to mitigate those risks including maintenance of APZs and access roads

- ensure there is appropriate auditing of distributors' preparedness for risks arising from network assets being affected by bush fire, as well as the risk of networks initiating a bush fire
- facilitate cross-carrier roaming arrangements between carriers and the public for basic text, voice and data during the period of emergency in areas directly affected by fire
- enable NSW RFS to require carriers to provide regular information on the status of outages and areas affected by fire.

Recommendation 31

That, in order to improve bush fire planning and protection of road infrastructure and to ensure communities, freight movers and fire fighting agencies have appropriate access and egress in a bush fire event, Government, working with local government as needed:

- develop a formal bush fire risk assessment process for all State roads and bridges, to identify:
 - 'high-risk' communities where access and egress in the event of a fire will be affected, for example rural communities connected by a single road surrounded by bushland, and ensure community bush fire planning processes (i.e. Bush Fire Risk Management Plans (BFRMPs) or Community Protection Plans) include plans to 'leave early' or enforce mandatory evacuation orders
 - how waterways can be integrated better into the transport network as evacuation routes or places of shelter when road and rail transport is unavailable – waterways should be included in regional emergency management plans
 - route options for rapid identification of needed road closures in the event of fire
 - key sections of the State's road network for future upgrade to ensure whole corridors are resilient to fire impacts, regardless of who manages the asset
- audit, through the NSW RFS Audit Unit (to be established) the inclusion of critical road infrastructure in BFRMPs prepared by Bush Fire Management Committees (ensuring that appropriate transport representation is provided to BFMCs) and Local Emergency Management Committees across the State.

In support of these measures, it will be critical that the community is given early warning of bush fire events and has ample time to evacuate prior to or during an emergency.

Recommendation 32

That, in order to ensure outcomes-based roadside vegetation management to reduce roadside tree fall and grass ignitions in planning and preparing for bush fire, Transport for NSW, working with local government and NSW RFS, establish a consistent framework for roadside vegetation management that analyses road priority, utility, amenity, strategic value and risk. The framework should:

- take into consideration landscape characteristics like distance, slope, set back, vegetation maturity and type. Acceptable outcomes under this framework could include clear verges, or alternatives such as safe zones/pull-outs
- tie in formally with other strategic land use and biodiversity processes.

Recommendation 33

That as a matter of urgency, in order to accelerate and finalise a State-wide strategic fire trail network, the NSW RFS Commissioner and Bush Fire Coordinating Committee (BFCC):

- set a deadline for Bush Fire Management Committees to complete all outstanding Fire Access and Fire Trail (FAFT) Plans for submission to BFCC for approval, and a related deadline for BFCC consideration of these
- assess the completed suite of FAFT Plans to identify high-priority trails of relative strategic importance across the State for urgent construction or upgrades with particular reference to the needs of upcoming fire seasons

- enforce completion of annual fire trail condition assessment reporting by relevant landholders. Following this, the BFCC should, as part of its standard business, undertake an audit of all FAFT Plans and annual fire trail condition assessment reports
- develop a single asset management system to capture the outcomes of annual fire trail condition assessment reporting on a tenure-blind basis to support BFCC strategic and budgetary prioritisation and inform funding allocation to agencies for capital works programs
- commission a review of FAFT Plans, with particular assessment of containment line potential, following a significant bush fire event in their area, as part of the planned review of BFCC Policy and NSW RFS Standards in 2020-21.

Where it is not feasible to construct a fire trail completely on public land, and private landowners are not satisfied with proposed negotiated arrangements to construct the trail across their land, Government should negotiate acquisition of an easement interest, with appropriate compensation, over private land.

Recommendation 34

That, in order to capture and understand the impacts of bush fire smoke better, Government invest in operational air quality forecasting and alert systems, and public health research and policy development. This would involve investment to:

- develop a comprehensive system of forecasting and alerts for air quality incidents and all pollutants of concern, including but not limited to bush fire smoke, ozone and dust, and which is ideally nationally consistent
- investigate further the health impacts of bush fire smoke, based on improved data collection and including research on the long-term health impacts of poor air quality as a result of sustained exposure to severe bush fire smoke, particularly for vulnerable and at-risk segments of the community (children, elderly, firefighters, etc).

Recommendation 35

That, in order to improve the provision of evidence-based public health messaging about air quality during bush fire events, Government develop a public education campaign and supporting systems before the next bush fire season. This should include:

- a public education campaign (like sun exposure), to help people make their own decisions about exposure to bush fire smoke
- tailored messaging to target:
 - smoke-vulnerable cohorts of the community
 - general practitioners, particularly in rural and regional areas, so they can advise patients with relevant, susceptible comorbidities
 - employers, to support development of appropriate workplace health and safety guidance for outdoor workers
- an improved air quality alert system such as an enhanced Air Rater app.

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.

Recommendation 37

That, in order to ensure all firefighters understand how local situational awareness reflects (or may not reflect) the broader scale situation presented by a large/extreme bush fire and the implications this may have on asset protection and fire suppression strategies, the NSW RFS:

- a) develops information packages for all types of operating environments to improve out-of-area crews' understanding of the local terrain and fuels, and distributes information to out-of-area crew members from all fire authorities
- b) accelerates the roll out of Mobile Data Terminals into all fire fighting vehicles to improve delivery of briefings and incident information/intelligence to field commanders.

Recommendation 38

That, in order to ensure the safety of local landholders on firegrounds, the NSW RFS emphasises the importance of local landholders using protective clothing while fire fighting as part of the RFS' 'Farm Fire Unit Integration' priority for 2020-21.

Recommendation 39

That, in order to ensure frontline personnel have appropriate personal protective clothing during bush fires:

- a) FRNSW review the current design of its bush fire jacket, noting improvements that have been made since 2002 that meet AS/NZS4824:2006 Protective clothing for firefighters, and increase the allocation of bush fire coats to two jackets per member
- b) NSW RFS issue two sets of personal protective clothing to operational members, and others as appropriate.

Recommendation 40

That, in order to improve firefighter safety, Government fire authorities:

- a) ensure all light tankers used as part of active frontline bush fire fighting operations are fitted with a single point crew protection safety spray system and radiant heat protection blankets as a minimum standard across all NSW fire authorities
- b) ensure all medium/heavy tankers are fitted with radiant heat protection blankets, wheel and 'halo' sprays fitted as a minimum standard across all NSW fire authorities
- c) undertake additional research to determine the most appropriate cabin protection for the different frontline vehicles.
- d) provide ongoing investment for NSW RFS fleet upgrades.

Recommendation 41

That, in order to ensure all NSW RFS members can access the mental health support they need, the NSW RFS expands in-house mental health support for members.

Recommendation 42

That, to ensure firefighters can access mental health support through GPs, Government work with the Commonwealth Government to:

- a) provide a free mental health screen to firefighters post-fire event and waive any gap payments if additional treatment is required
- b) create a new Medicare Benefits Scheme item number to enable Governments to track demand for mental health services from firefighters over time and ensure an appropriate level of support is available.

Recommendation 43

That, in order to ensure firefighter sustenance is of sufficient volume and quality, the NSW RFS reviews food standards and procedures in consultation with volunteers. The review should include catering service standards, including food safety, as well as the viability of sourcing commercial contracts and providing 12-hour food packs to firefighters.

Recommendation 44

That, in order to ensure suitably skilled and experienced personnel operate as Divisional Commanders during major fire incidents, Bush Fire Management Committees identify appropriate personnel as part of their plan of operations.

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% is an appropriate KPI for the NSW RFS and NPWS
- b) NSW fire authorities deploy remote area fire fighting 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.

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.

Recommendation 47

That, in order to enhance fire fighting strategies in severe conditions, the NSW RFS implements 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 2019-20 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
- 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.

Recommendation 49

That, in order to maximise the efficiency and effectiveness of heavy plant used in dry fire fighting techniques, the NSW RFS expand and introduce the following in respect to heavy plant:

- a) increase the number of trained Heavy Plant Supervisors and Managers to ensure an appropriate level of supervision in future significant fire seasons
- b) expand ARENA software to include the Heavy Plant Register, including the introduction of GPS tracking for all agency and contracted plant, to improve contractual compliance

and to facilitate better the identification and tasking of appropriate localised heavy plant contractors; and review the feasibility of linkage to the SAP system for invoicing improvements. This should be introduced prior to the 2020-21 fire season

- c) review the existing contractual process to ensure all heavy plant is categorised into types, size and functionality along with exploring potential for a standardised hourly rate for that category of equipment
- d) work with Soil Conservation Service to ensure appropriate standards for the engagement and management of heavy plant to deliver safe and effective heavy plant service, including the delivery of standards and auditing.

Recommendation 50

That, in order to ensure Australia's fire fighting 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 fire fighting systems to provide the Australian Defence Force with the capacity to augment aerial fire fighting during major disasters
- b) work with states and territories through the National Aerial Firefighting Centre to review the current mix of aviation assets and determine whether it is fit-for-purpose, noting the current lack of mid-sized fire fighting aircraft.

Recommendation 51

That, in order to enhance NSW's ability to improve situational awareness, Government expand FRNSW's Remotely Piloted Aerial Systems (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.

Recommendation 52

That, in order to enhance NSW's fire fighting capacity, Government trial aerial fire fighting at night in the 2020-21 season with a view to full implementation if successful.

Recommendation 53

That Government develop and implement a policy on injured wildlife response, rescue and rehabilitation including:

- a) a framework for the co-ordination and interaction with emergency management structures
- b) guidelines for Incident Management Plans to include wildlife rescue and rehabilitation as a consideration
- c) a requirement for all vets and wildlife rescue volunteers to obtain the Bush Fire Awareness accreditation
- d) guidance for firefighters on handling injured wildlife.

Recommendation 54

That, to ensure mobile generators are sourced and distributed on a priority basis during natural disasters, the EUSFAC work with the NSW Telco Authority, relevant NSW government agencies and commercial stakeholders to develop a mobile asset deployment strategy. The strategy should reduce duplication in purchasing, maintaining and housing mobile generators and improve agility in deployment.

Recommendation 55

That, in order to improve fireground communications between NSW agencies and interstate personnel:

- a) Government ensure all NSW fire authority personnel and vehicles can access and utilise the Public Safety Network (PSN). This should include access to NSW RFS Private Mobile Radio networks where PSN coverage is not yet available.
- b) the NSW Telco Authority review cross-border communications availability and planning and advise NSW fire authorities on next steps to enable multi-state interoperability for wide area communications.

Recommendation 56

That, in order to ensure the State Emergency Operations Centre (SEOC) can maintain communications during emergencies, the Government provide the SEOC with independent Public Safety Network functionality.

Recommendation 57

That, in order to ensure emergency response agencies can communicate across state and territory borders, the Commonwealth Government allocate 10 + 10 MHz as a dedicated spectrum for Public Safety Mobile Broadband (PSMB) at no cost to states and territories.

Recommendation 58

That, in order to ensure all agencies have a clear understanding of cross-border communication channels during bush fires, all MoUs between state or territory agencies include an agreed protocol about how agencies will communicate across borders and that these are reflected in Incident Action Plans.

Recommendation 59

That, in order to improve response times to Triple Zero calls, the NSW RFS implements the integrated dispatch system before the 2020-21 fire season commences.

Recommendation 60

That, in order to ensure timely payment and maintain positive ongoing supplier relationships during large-scale bush fires, the NSW RFS implements an automated logistics solution, informed by the outcomes of the Emergency Logistics Project.

Recommendation 61

That, in order to improve cross-agency communication and coordination during bush fires, the NSW RFS review Fire Control Centres (FCCs) in areas that were heavily affected by fire. The results should be combined with the Emergency Operations Centre (EOC) Facilities Review to identify areas that would benefit from a purpose-built FCC, enabling co-location with the EOC.

Recommendation 62

That, in order to ensure State Emergency Operations Centre (SEOC) interoperability during all natural disasters, Resilience NSW review the current SEOC arrangements and location including responsibilities for ongoing resourcing and maintenance.

Recommendation 63

That, in order to ensure the guiding principles and approval processes are contemporary, streamlined and more flexible, the NSW and Commonwealth Governments review the Defence Assistance to the Civil Community (DACC) arrangements. This review should include the circumstances in which the State can request Commonwealth assistance, and the level of information provided by the ADF to the State on available resources and capabilities.

Recommendation 64

That, in order to expand the pool of trained personnel able to undertake the Public Information Functional Area Coordinator (PIFAC) role, Resilience NSW and the NSW Police Media Unit (PIFAC) develop and deliver a training package for Emergency Management Media Liaison Officers.

Recommendation 65

That, in order to improve information flows and increase public awareness of ABC emergency broadcasts, Government:

- a) include an ABC Manager in the Public Information Functional Area Coordinator (PIFAC) team within the State Operations Centre
- b) strategically place roadside signage with local/regional ABC station frequency band throughout the State.

Recommendation 66

That, in order to provide real-time information on evacuation doorknocking during emergency events, Government explore a shared data gateway for NSW agencies based on the NSW State Emergency Service Collector app and a common mapping and analytics platform.

Recommendation 67

That, in order to ensure people can access clear information on cross-border fires, the NSW RFS:

- a) incorporate information on fires in neighbouring states and territories into Fires Near Me NSW
- b) collaborate with other states and territories to develop a national app as part of the Australian Warning System being developed through the AFAC Warnings Group.

Recommendation 68

That the NSW RFS include the following priorities in the Fires Near Me improvements roadmap:

- a) text enlargement functionality
- b) a clear statement about the app's limitations and the importance of heeding public warnings and relying on personal observations
- c) fire spread prediction maps on extreme/catastrophic days
- d) update fire map information as technology improves.

Recommendation 69

That, in order to ensure evacuation arrangements can be scaled up when needed, Resilience NSW:

- a) ensure staff who are willing to be deployed to evacuation centres are trained as soon as possible to bolster evacuation centre staff surge capacity
- b) train council and NSW government regional staff in evacuation centre establishment and management, supported by a one-page 'start up sheet' for opening an evacuation centre
- c) enable interested community members to be trained to assist in evacuation centre establishment and management and provide an avenue for skilled volunteers to register their interest
- d) develop an exercise for the management of multiple evacuation centres dealing with large numbers of people for a protracted period over a widespread area.

Recommendation 70

That, in order to ensure evacuation centres are fit-for-purpose, Resilience NSW work with Local Emergency Management Committees (LEMCs) to:

- a) update the guidelines for LEMCs identifying evacuation centres to require a risk assessment of potential locations, which should include identifying alternate sources of power for use by evacuation centres and recording these appropriately
- b) review existing evacuation centre locations to assess compliance with updated LEMC guidelines and report to the State Emergency Management Committee on their suitability.

Recommendation 71

That, in order to ensure people only need to tell their story once to access government agency support following an emergency, Resilience NSW and Service NSW jointly design an inclusive, person-centred approach to information collection at evacuation centres. This should be supported by an opt-in scheme enabling personal information to be shared between NSW government agencies, local councils and non-governmental organisations administering support services for disaster-affected people.

Recommendation 72

That, in order to ensure Aboriginal people can access appropriate support during evacuation, Resilience NSW work with Local Emergency Management Committees and Aboriginal Affairs to ensure:

- a) local Aboriginal communities are included in emergency planning and preparation
- b) all staff involved in evacuation centres and support services are culturally competent.

Recommendation 73

That, in order to ensure the safety and wellbeing of vulnerable people during an evacuation, Resilience NSW:

- a) identify aged care facilities in fire and flood prone areas, and ensure that emergency plans are in place and comply with the *Evacuation Decision Guidelines for Private Health and Residential Care Facilities*
- b) develop/refresh evacuation centre protocols to specifically address the needs of vulnerable people.

Recommendation 74

That, in order to ensure equitable access to evacuation centres and associated support services for people in border communities, Resilience NSW ensure cross-border access arrangements are reflected in evacuation centre management guidelines.

Recommendation 75

That, in order to improve support for people evacuating with animals, the Department of Primary Industries:

- a) work with Resilience NSW to develop evacuation protocols and procedures to ensure appropriate supports are provided for both people and animals (informed by the findings from Project Ohana), including a process for animal registration at evacuation centres and mutually agreed naming conventions, and provide this information to Local Emergency Management Committees (LEMCs)
- b) work with LEMCs to identify overflow sites that can be used for evacuated animals when preferred sites are full
- c) further develop the domestic pets evacuation protocol.

Recommendation 76

That Resilience NSW review existing functional area arrangements to ensure they are closely aligned to agencies responsible for direct service delivery.

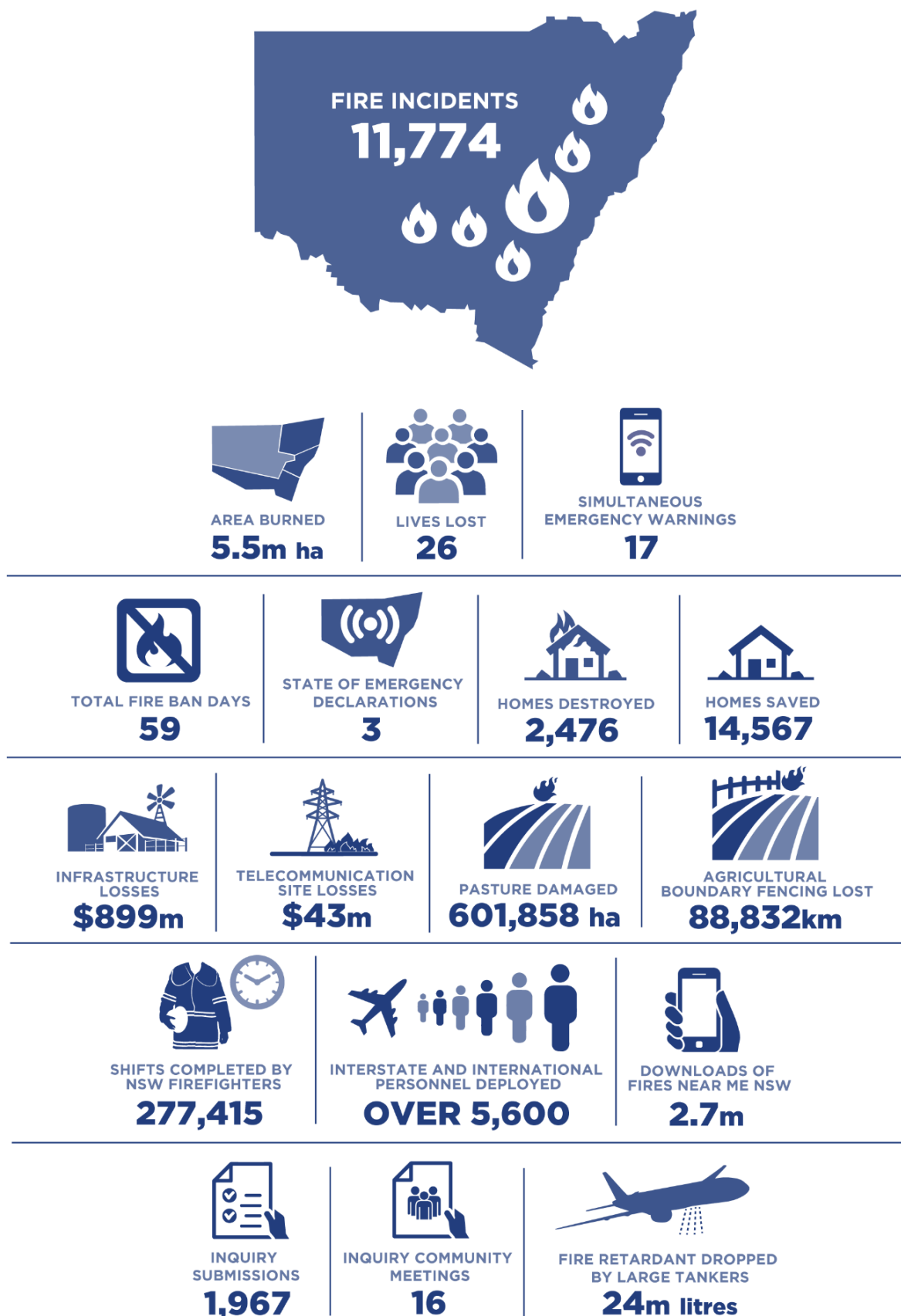


Figure 0-1: Bush Fire Impact Data 2019-20 NSW.

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ACRONYMS

ACFR	Australian Centre for Field Robotics
ADF	Australian Defence Force
AFAC	Australian and New Zealand National Council for Fire and Emergency Services
AMM	NSW RFS Area Management Model
APZ	Asset Protection Zone
AQI	Air Quality Index
ARRB	Australian Road Research Board
BAL	Bush Fire Attack Level
BBCA	Bushfire Building Council of Australia
BFA	Bush Fire Awareness
BFDP	Bush fire Danger Period
BFCC	Bush Fire Coordinating Committee
BFMC	Bush Fire Management Committee
BFRMP	Bush Fire Risk Management Plan
BICC	Bush Fire Incident Co-ordination Centre
BoM	Bureau of Meteorology
BNHCRC	Bushfire and Natural Hazards Cooperative Research Centre
BPM	Bush Fire Protection Measures
BRIMS	Bush Fire Risk Information Management System
CCEP	Critical Communications Enhancement Program
CFA	Victorian Country Fire Authority
CFU	Community Fire Unit
CISS	Critical Support Service
CLO	Community Liaison Officer
CPP	Community Protection Plan
CRCSI	Cooperative Research Centre for Spatial Information
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DACC	Defence Assistance to the Civil Community
DCJ	Department of Communities and Justice
DCS	Department of Customer Services
DEA	Digital Earth Australia
DPC	Department of Premier and Cabinet
DPIE	Department of Planning Industry and Environment
EAP	Employee Assistance Program
EMA	Emergency Management Australia
ENSO	El Niño/Southern Oscillation
EOC	Emergency Operations Centre
ESO	Emergency Services Organisation
EUSFAC	Energy and Utility Services Functional Area Coordinator
FAFT	Fire Access and Fire Trail
FCC	Fire Control Centre
FCNSW	Forestry Corporation NSW
FDR	Fire Danger Rating
FEZ	Fire Exclusion Zone
FFDI	Forest Fire Danger Index

FOPS	Falling Object Protection System
FRNSW	Fire and Rescue NSW
GA	Geoscience Australia
IAC	Incident Action Plan
IC	Incident Controller
ICMI	Incident Controller Major Incident
IGEM	Inspector General of Emergency Management
IMT	Incident Management Team
IOD	Indian Ocean Dipole
JOSS	Joint Operations Support Staff
LAT	Large Air Tanker
LEMC	Local Emergency Management Committee
LEMO	Local Emergency Management Officer
LEOCON	Local Emergency Management Operations Controller
LiDAR	Light Detection and Ranging
LGA	Local Government Area
LVIN	Latrobe Valley Information Network
MDT	Mobile Data Terminal
MOU	Memorandum of Understanding
NAFC	National Aerial Firefighting Centre
NEPM	National Environment Protection Measure
NPWS	National Parks and Wildlife Service
NRSC	National Resource Sharing Centre
NSP	Neighbourhood Safe Place
NSWPF	NSW Police Force
NSW RFS	NSW Rural Fire Service
NSW SES	NSW State Emergency Service
NVD	Night Vision Devices
OEM	Resilience NSW, former Office of Emergency Management
OpsCen	State Operations Centre
PBP	NSW RFS <i>Planning for Bushfire Protection</i>
PIFAC	Public Information Functional Coordinator
PPC	Personal Protective Clothing
PPE	Personal Protective Equipment
PSN	Public Safety Network
pyroCb	Pyrocumulonimbus (fire-generated thunderstorm)
pyroCu	Pyrocumulus
RAFT	Remote Area Fire Fighting Teams
RART	Rapid Aerial Response Team
REMO	Regional Emergency Management Officers
RFFF	The Rural Fire Fighting Fund
RLO	Rural Liaison Officer
ROPS	Roll Over Protection System
RPAS	Remotely Piloted Aerial Systems
RTO	Registered Training Organisation
SAD	State Air Desk
SAM	Southern Annular Mode
SAPS	Stand Alone Power Systems

SARA	State Archives and Records Authority
SCS	Soil Conservation Service
SEMC	State Emergency Management Committee
SERM Act	<i>State Emergency and Rescue Management Act 1989</i>
SEOC	State Emergency Operations Centre
SEOCON	State Emergency Operations Controller
SFAZ	Strategic Fire Advantage Zone
TELCOFA	Telecommunications Services Functional Area
TEMU	Telecommunications Emergency Management Unit
TfNSW	Transport for NSW
VLAT	Very Large Air Tanker
WELFAC	Welfare Services Functional Area Coordinator

1 INTRODUCTION AND OVERVIEW

1.1 BUSHFIRE INQUIRY ESTABLISHED

On 30 January 2020 the Premier announced an inquiry into the 2019-20 bush fire² season to make recommendations in relation to bush fire preparedness and response ahead of the 2020-21 bush fire season. The Terms of Reference for this Inquiry were as follows.

The Inquiry is to consider, and report to the Premier on, the following matters.

1. *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.*
2. *The preparation and planning by agencies, government, other entities and the community for bushfires in NSW, including current laws, practices and strategies, and building standards and their application and effect.*
3. *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*
 - *equipment and communication systems.*
4. *Any other matters that the inquiry deems appropriate in relation to bushfires.*

AND to make recommendations arising from the Inquiry as considered appropriate, including on:

5. *Preparation and planning for future bushfire threats and risks.*
6. *Land use planning and management and building standards, including appropriate clearing and other hazard reduction, zoning, and any appropriate use of indigenous practices.*
7. *Appropriate action to adapt to future bushfire risks to communities and ecosystems.*
8. *Emergency responses to bushfires, including overall human and capital resourcing.*
9. *Coordination and collaboration by the NSW Government with the Australian Government, other state and territory governments and local governments.*
10. *Safety of first responders.*
11. *Public communication and advice systems and strategies.*

The Inquiry is required to report to the Premier by 31 July 2020.

1.2 CONTEXT

1.2.1 Overview of the 2019-20 bush fire season

The 2019-20 bush fire season ran for eight months – between 1 July 2019 and 31 March 2020. The last fires were extinguished on 2 March 2020 after 240 consecutive days of burning. As noted many times throughout this report, and in various media reports, this season was unprecedented in its intensity and scale.

² This report spells bush fire as two words, as used in the *Rural Fires Act 1997*, except when it is part of a formal name (as with the Inquiry itself) or quoted text.

One of the major challenges in the 2019-20 bush fire season was the large number and size of bush fires running simultaneously. In a 'normal' fire season, fires generally move from north of the State to south through the season. This season, while fires were burning in northern NSW and Queensland, fires also started in the centre of the State and were burning simultaneously. The south of the State started to experience fires earlier than in a normal season. This meant that resources, which could usually be deployed as fires moved from north to south, were stretched across the State.

The fires in NSW overlapped with fires in the ACT, Queensland and Victoria, while there were also fires burning simultaneously in South Australia and Western Australia. This meant that resource sharing between jurisdictions was not available to the same extent it would be in a 'normal' season.

The losses from the 2019-20 fires have been significant. Tragically 26 lives were lost, including three NSW RFS members and three international aerial fire fighting crew.

The community suffered huge losses. Not only the loss of lives and homes, but there was also significant loss of property, wildlife, farming equipment, fencing and agricultural land, stock and crops.

The fire burnt over 5.52 million hectares of land, destroyed 2,476 houses, 3 schools, 284 facilities and 5,559 outbuildings. In addition to the losses, there were 1,034 homes, 196 facilities and 2,017 outbuildings damaged.³

Faced with fires of this magnitude, ferocity and scale, the fire fighting efforts were impressive. The Inquiry acknowledges all firefighters who worked tirelessly to protect people and properties across NSW and all those who supported them. The commitment and courage of the members of all our fire authorities throughout NSW is without question. The Inquiry has made recommendations to help ensure we are prepared, to the greatest extent possible, for another season of this scale to occur again.

1.3 PROCESS OF THIS INQUIRY

1.3.1 Approach of the Inquiry

The Inquiry's timeframe was six months to provide a report to the Premier, explaining the causes of these bush fires and making recommendations in relation to bush fire preparedness and response ahead of the 2020-21 bush fire season. Given the tight timeframes, the Inquiry initially moved quickly to meet with key stakeholders, researchers and experts to establish the scope of the Inquiry and the key issues to be examined.

It became clear from these initial discussions that, while the 2019-20 season was extreme in nature and the impact on communities and the environment was extraordinary, fire authorities responded remarkably well under very difficult circumstances. The Inquiry's intention was therefore to review the causes, preparedness and response to the 2019-20 bush fires in order to make recommendations to improve the response to bush fires in future seasons. The Inquiry did not set out to apportion blame where things did not go to plan or were not as successful as intended.

³ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 21 July 2020* [figures correct as at 21 July 2020].

Given the scale of the fires and the sheer number of people affected, the Inquiry prioritised hearing from the community about their experiences. Public submissions were called for and community meetings were arranged to ensure the Inquiry could hear from as many people as possible.

The Inquiry also reviewed previous bush fire reports, inquiries and coronial investigations to understand the response to previous bush fires in NSW and Australia more generally, and examined recommendations from these and their implementation status.

1.3.1.1 Site visits

During the early stages of the Inquiry, the Inquiry leads met several times with the NSW Rural Fire Service (NSW RFS), Fire and Rescue NSW (FRNSW) and other State fire agencies, namely the National Parks and Wildlife Service (NPWS) and the Forestry Corporation NSW. The Inquiry was invited to the NSW RFS Headquarters to tour the facilities and view the State Operations Centre in person. The Inquiry was also invited to FRNSW Headquarters and the Emergency Services Academy, which was invaluable in providing the Inquiry with an overview of the FRNSW operations and assets available to fight fires. The Inquiry would have conducted more site visits as they provided excellent insights into operational issues, but further visits were curtailed by the COVID-19 restrictions.

The Inquiry also conducted helicopter flyovers of fire-impacted areas throughout the State. This provided a critical insight into the magnitude of the fires and the significance of the damage caused across the State. The Inquiry is grateful for the assistance of the NSW RFS in arranging flyovers of the following areas:

- Cooma/Snowy Mountains – ACT fire (Orroral), Bug Town, Doubtful Gap, part of the Dunns Rd Fire, Good Good, Calabash and Clear Range fires
- Hawkesbury/Lithgow – Gaspers, Grose Valley and Three Mile fires
- Southern Highlands/Blue Mountains – Green Wattle, Ruined Castle and Morton fires
- Shoalhaven/South Coast – Currowan, Forest Rd Comberton, Clyde Mountain and Badja fires
- Northern Tablelands – Gulf Rd, Kildare Rd, Sunnyside Loop, part of Long Gully, Mt Mackenzie, and Coopers Rd fires.

1.3.1.2 Incident Management Teams

The Inquiry met with 10 Incident Management Teams (IMTs)⁴ from across the State to understand how the operational response to the fires was managed, the strategies used, and how these were adapted during extremely challenging conditions – some of which had never been experienced before. The insights provided by the IMT members were invaluable to the Inquiry, as they gave first-hand accounts of how the fires progressed over the course of the season and the lessons learnt along the way. Every meeting with the IMTs demonstrated how well agencies worked together over the season, pooling resources and sharing years of experience and complementary expertise.

1.3.1.3 Fire and technology experts

In addition to hearing from those directly involved in fire fighting operations, the Inquiry also met with a range of fire experts and researchers to gain a better understanding of the extreme weather conditions and unusual fire behaviour that characterised the 2019-20

⁴ An Incident Management Team (IMT) is a multi-agency team established when a Section 44 declaration (discussed in Chapter 3) is made, to organise the response to major fires. The IMT role is discussed in Chapter 5.

season. NSW is fortunate to host (at the University of NSW) the headquarters of the Australian Research Council Centre of Excellence for Climate Extremes⁵ and its Director, Professor Andy Pitman AO, whom the Inquiry consulted early on, acted as a guide to the very considerable fire and climate expertise in NSW and Australia. It became clear there was a need for ‘deep dives’ into particular research questions, both to aid the Inquiry’s understanding of what happened during the 2019-20 season and to address current gaps in knowledge. For this purpose, the Inquiry commissioned a set of 19 projects from the NSW Bushfire Risk Management Research Hub (Appendix One). The Hub was established by the NSW Government in 2018 as “a partnership between researchers at the University of Wollongong, Western Sydney University, the University of NSW, the University of Tasmania, supported by the NSW Department of Planning, Industry and Environment and the NSW Rural Fire Service”,⁶ and is directed by Professor Ross Bradstock at the University of Wollongong.

The Inquiry also drew on material from and met with representatives and researchers from the Bureau of Meteorology, the Bushfire and Natural Hazards Cooperative Research Centre and CSIRO. It also met with relevant researchers from the University of NSW, the University of Sydney, Macquarie University, University of Wollongong, the University of Newcastle, the University of Adelaide, the Australian National University, the University of Tasmania and the University of Melbourne. As well, it met with retired Fire Commissioners from NSW and Victoria and research companies including Risk Frontiers and FrontierSI.

1.3.1.4 Government agencies and other organisations

The Inquiry met with a wide range of individuals and organisations to ensure a diverse range of perspectives was heard and considered. Most meetings were initiated by the Inquiry but in some instances stakeholders approached the Inquiry for a meeting. In total, the Inquiry held over 200 meetings with government stakeholders, researchers, fire fighting personnel and experts. A full list of meetings held is included at Appendix Two.

Stakeholders consulted included:

- NSW, interstate and international fire fighting agencies
- NSW government departments (Department of Planning, Industry and Environment, Department of Regional NSW, Department of Communities and Justice, Department of Customer Service). Also the Inquiry consulted the following agencies and State-owned corporations several times: the NSW Rural Fire Service, Fire and Rescue NSW, National Parks and Wildlife Service, Forestry Corporation of NSW, Resilience NSW, Environment Protection Authority, Transport for NSW, the Office of the NSW Chief Scientist & Engineer, Spatial Services and the Telecommunications Authority
- NSW Government Ministers including the Deputy Premier, and Minister for Regional NSW, Industry and Trade; the Minister for Regional Transport and Roads, the Attorney General and Minister for the Prevention of Domestic Violence, the Minister for Planning and Public Spaces, the Minister for Customer Service, the Minister for Transport and Roads, the Minister for Police and Emergency Services, the Minister for Water, Property and Housing, the Minister for Energy and Environment, the Minister for Agriculture and Western NSW, the Minister for Local Government, the Minister for Mental Health, Regional Youth and Women and the Minister for Families, Communities and Disability Services

⁵ Australian Research Council Centre of Excellence for Climate Extremes. Retrieved from <https://climateextremes.org.au/>.

⁶ The Bushfire Hub. Our Team. Retrieved from <https://www.bushfirehub.org/team/>.

- National organisations including the Australasian Fire and Emergency Service Authorities Council (AFAC), the Australian Road Research Board (ARRB) and the Insurance Council of Australia
- Commonwealth government agencies including the Department of Defence, the Australian Space Agency as well as the ones mentioned above
- Agencies in other states including the Queensland Department of Natural Resources, Mines and Energy; the ACT Emergency Services Agency and, in Victoria, the Country Fire Authority and Emergency Management Victoria.

1.3.1.5 Roundtables

The Inquiry held expert roundtables on:

- cultural land management, which included a range of Aboriginal land management practitioners and community members
- findings produced by the NSW Bushfire Risk Management Research Hub.

1.3.1.6 Caveat

The Inquiry did not have powers to compel witnesses to attend interviews, or to require agencies to produce documents. All meetings with stakeholders were carried out and information was provided by agencies in an open and cooperative way.. Agencies and stakeholders were asked to provide information and/or answer specific questions in an informal manner, and where required, further information or clarification was sought.

1.3.1.7 Material consulted

The Inquiry consulted a wide range of source material to understand the scientific causes and factors of the 2019-20 season, how government agencies had prepared and how they responded once the season commenced. This material included journal articles and research literature, operational guidelines, NSW Government policies and procedures, media reports and publications from experts in the field.

1.3.1.8 Public submissions

The Inquiry started to accept submissions on 10 February 2020. The deadline for submissions was initially extended from 27 March to 17 April 2020 to allow additional time for people and organisations who may have been affected by the COVID-19 situation. The Inquiry further extended the submissions deadline to Friday 22 May 2020 to align with the period of online community meetings.

To ensure as many people as possible could have their say, the Inquiry made sure the submissions process was as inclusive as possible, and that people who did not have internet access could still make submissions to the Inquiry. The Inquiry accepted submissions by post, email, in person and by phone (through Service NSW) and through the Inquiry website.

A total of 1,967 submissions was received. Each submission has been read, reviewed and catalogued by the Inquiry. The submissions varied greatly in length and included a range of attachments such as photographs, maps and personal stories. All those who gave explicit permission to have their submissions made public, had their submissions published on our website on 31 July 2020.

1.3.1.9 Community meetings

A critical part of the Inquiry was to meet with community members who were affected by the 2019-20 bush fires and hear directly about their experiences and views, and the Inquiry moved quickly to set up public meetings as soon as possible. The Inquiry travelled to bush fire affected communities and held community meetings in:

- Lithgow (25 February 2020)

- Tenterfield (8 March 2020) and
- Glen Innes (9 March 2020).

The community meetings were well attended, with approximately 45-60 attendees at each meeting, and further meetings were planned across the State. However, in mid-late March the emerging COVID-19 situation prevented the Inquiry from continuing to visit communities to hold face-to-face meetings. The Inquiry quickly adapted to the COVID-19 restrictions and arranged community meetings via video and telephone conference facilities to ensure it could continue to hear stories directly from community members. The Inquiry welcomed the NSW Advocate for Children and Young People to attend community meetings to ensure she could hear first-hand about issues affecting youth.

Community meetings were advertised locally as well as on the Inquiry website, and there was appropriate IT support available to assist community members with technical issues. In the initial online meetings a cap was set at a maximum of 50 participants, with a waitlist function if those numbers were exceeded. In some communities the cap was exceeded very early, and the Inquiry expanded the numbers to accommodate all those community members who wanted to participate. All participants were invited to speak at these meetings, and their contributions were of great value to the Inquiry.

Consultations via video conference were held for the following communities:

- Lake Conjola/Fisherman's Paradise (16 April 2020)
- Mid North Coast (17 and 23 April 2020)
- Snowy Monaro (29 April 2020)
- Snowy Valley (29 April 2020)
- Shoalhaven (1 May 2020)
- Northern Rivers and Clarence Valley (4 May 2020)
- Far South Coast (6 May 2020)
- Wollondilly and Southern Highlands (7 May 2020)
- Hawkesbury (11 May 2020)
- Blue Mountains (12 May 2020)
- Capital to Coast - the region from Queanbeyan–Palerang Regional Council to Eurobodalla (13 May 2020)
- Snowy Valley (25 May 2020).

The number of registered attendees varied between meetings, with some smaller meetings, such as Snowy Valley with 28 registered attendees, and some larger ones such as Wollondilly which had 71 registered attendees and the Blue Mountains with 93.

Overall 612 community members registered to attend the online meetings. Combined with the estimated 155 people at face to face meetings, the Inquiry met with over 760 people across the State from fire-impacted communities.

1.3.2 Out of scope

Issues were raised during the Inquiry that were not covered by the Terms of Reference and that were therefore deemed out of scope.

1.3.2.1 Recovery

The Inquiry notes that recovery starts with response, so there will inevitably be some overlap between these two phases. However, the recovery process is outside the Terms of Reference and has therefore not been considered by the Inquiry.

The Inquiry acknowledges that the enormous recovery effort is still underway, and many communities are still rebuilding.

The information received in relation to the recovery process, including relevant submissions and information from the public, has been forwarded with permission to the Disaster Recovery Office within Resilience NSW for information and action where required.

1.3.2.2 Economic impact

The Inquiry received some submissions about the economic impact of the fires but notes that this was also out of scope. The Inquiry acknowledges the adverse economic impact on communities of the fires and the floods that followed and notes the economic recovery will likely be slower due to the impacts of the COVID-19 restrictions.

1.3.2.3 Coronial inquiry

Pursuant to section 30 of the *Coroners Act 2009* the coroner has jurisdiction to hold an inquiry into the specific cause and origin of any fire that the coroner is satisfied has destroyed or damaged any property within the State, as well as the jurisdiction to hold a general inquiry exploring all of the circumstances concerning the fire where the State Coroner has so directed. This inquiry has therefore limited its analysis to factual observations in relation to the causes of the bushfires, and as not attempted to make a determination as to the exact cause and origin of any specific fire.

1.4 COMMUNITY VIEWS

The Inquiry appreciated the openness and willingness of the community to share their experiences, which in some instances involved reliving a lot of the pain and trauma. The stories could be hard to hear, but rewarding, and the Inquiry hopes that the telling of these stories, and the publication and acknowledgement of the submissions and photos, will help with the healing process for communities.

1.4.1 Written submissions

As noted above, the Inquiry received a total of 1,967 written submissions. The Inquiry appreciates the many thoughtful and constructive submissions it has received. Hearing from those who have been directly affected by the fires has been critical in order to understand the nature of the impact of the 2019-20 fires on the people of NSW. The submissions illustrated the wide range of opinions on some of the Inquiry's Terms of Reference and presented valuable insights on key issues.

People who submitted their feedback through the website were asked to identify which of the Inquiry's Term of Reference was addressed in their submission. Many submissions covered more than one issue. The three themes that were covered most were climate change (ToR 1), hazard reduction (ToR 6) and operational response – including RFS resources and equipment (ToR 3).

Outlined below is an overview of the major themes covered in the submissions; a detailed overview is at Appendix Three.

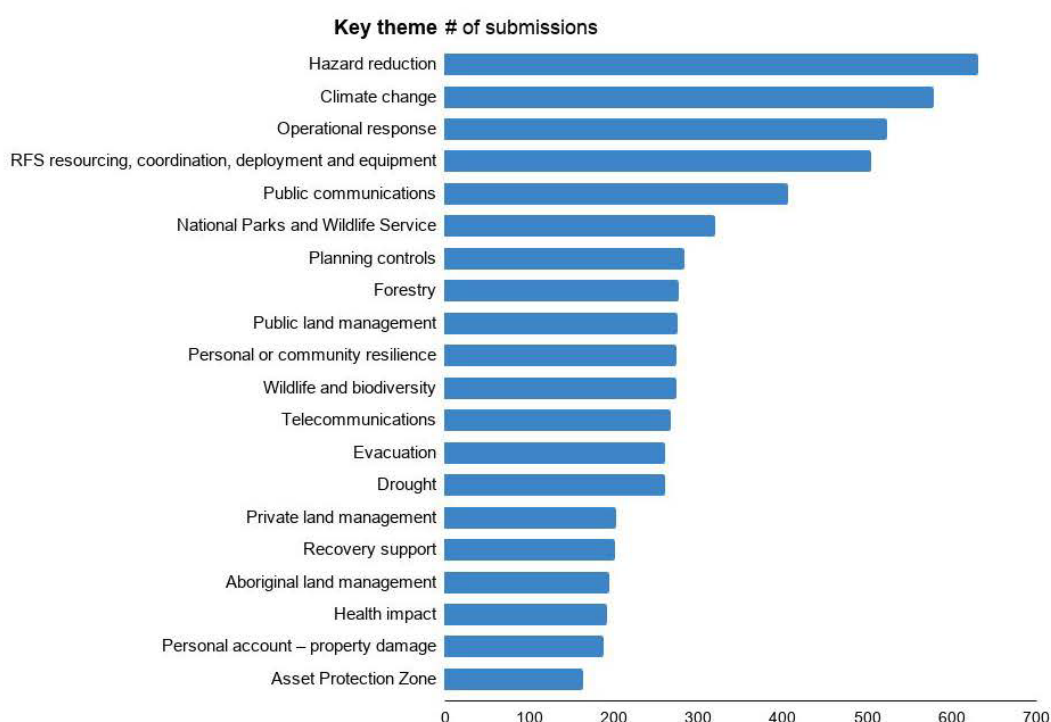


Figure 1-1: Graph of Submissions received by major theme.

There are extracts from submissions included throughout this report to illustrate what the Inquiry heard from the community. Included below is a snapshot of what the Inquiry heard directly from those affected.

1.4.1.1 Key themes from submissions

A large number of submissions stated that a contributing cause of the fires was climate change and encouraged governments to take further action to address the impact and effects of climate change. Many submissions identified the prolonged drought and extreme weather as contributing to the scale and ferocity of the fires. For example,

... bushfires increase in their geographic range, frequency and ferocity with climate change ... countries that have most means to address climate change but are internationally viewed as failing to pull their weight against it while indisputably contributing most per capita to it – countries that clearly have so much to lose from bushfires and other climate change damage and so much to gain from a more rapid transition to a renewable energy economy – must do more. Countries like Australia, and within them leading states like NSW.⁷

The severity of drought and climate change-induced bushfires makes our mitigation and preparation efforts so important. Without a science based approach and government action these climate impacts will continue to endanger our lives, damage our native forests and fauna, waterways and agricultural land, our homes and livelihoods.⁸

⁷ Gwen and David Jagger, Submission to the Inquiry.

⁸ Bronwyn Walker, Submission to the Inquiry.

Many submissions reinforced the evidence gathered by the Inquiry which suggested that in some instances the fires were so severe, no amount of planning and preparation could have stopped them.

I witnessed fires burn through open paddocks with no grass, through areas which had hazard reductions two years earlier, through areas where wildfire had passed only one year previous and watched ancient Gondwana rainforest which has never burnt reduced to blacked debree [sic]. I saw houses burn in open paddocks with no fuel around them for hundreds of metres. Nothing could of changed the outcomes due to the dryness of the landscapes and the prevailing weather conditions.⁹

The Inquiry received many submissions from people who told of their personal experiences of the fires. These accounts were often harrowing and provided the Inquiry with an insight into the extraordinary actions many people had to take to escape the fires and survive. There were stories of great loss and pain, and the Inquiry acknowledges the trauma still being felt by many affected communities.

We were not burnt out, so we're ok, right? Not really. We remain in grief over the deaths of friends, one by fire and several post-fire. Many of our friends lost their homes, their livelihoods and their health. Keeping our animals and ourselves alive through the drought was difficult and the work and attention required with the constant threat of fire was exhausting. There was no option to stay indoors with the air con, we had to just keep working outdoors in dense smoke. Our health has been impacted. Seeing the destruction of enormous areas of irreplaceable habitat whilst knowing we have wasted decades in addressing climate change confers an overwhelming and very deep sense of grief.¹⁰

The Inquiry received a large number of submissions praising the actions of the NSW RFS and the volunteers who selflessly fought fires for days without breaks, and who sometimes had to leave their own homes undefended to fight to save other people's homes. For example:

The RFS volunteers did a magnificent job, above and beyond anything that could have been expected. A bad situation could have been a whole lot worse.¹¹

Our firefighters and community volunteers were superhuman in response to these fires.¹²

There was also a small number of submissions from people who were critical of the RFS or felt that not enough was done to protect their homes.

The RFS response was terrible. This was not the fault of the local resources, but of coordination, regional and state planning. It was an extreme weather event yet all local resources were sent hours away to other fires leaving no local resources.¹³

The Inquiry also received a high number of submissions in relation to resourcing and equipment used by the NSW RFS and other fire fighting agencies to fight the fires. Generally, submissions acknowledged that no amount of resources could have made an

⁹ Philip Maughan, Submission to the Inquiry.

¹⁰ Catherine Eggert, Submission to the Inquiry.

¹¹ Martin Darling, Submission to the Inquiry.

¹² Catherine Eggert, Submission to the Inquiry.

¹³ Dr Denis Gascoigne, Submission to the Inquiry.

impact given the scale and ferocity of the fires, but that there were some improvements that could be made. For example:

*... after 6 months of constant use, [our Cat 1 tanker] was in extremely poor condition and riddled with defects requiring significant repairs. We have deep concerns as to the reliability of our Cat 1 primary firefighting appliance going into the next fire season.*¹⁴

While acknowledging that a complete fleet upgrade is not feasible in the short term, the Inquiry received submissions recommending:

*that the RFS undertake a comprehensive program to retrofit older RFS firefighting appliances with rollover protection, drop down fire screens and halo bar fire protection sprinkler systems as a matter of urgency.*¹⁵

The Inquiry received many submissions in relation to backburning. Some submissions suggested there was not enough backburning to protect properties adequately, and other submissions said that it was overused and not monitored adequately. However, the Inquiry notes that many people frequently used the term 'backburn' when they were actually referring to 'hazard reduction' being conducted in cooler months. Generally, submissions acknowledged that backburning can be a useful technique, but a number raised concerns about it being used inappropriately on catastrophic fire days. For example:

*The back-burning technique has been over-used, often inappropriately. It can be a valuable tool but should be used judiciously, not indiscriminately.*¹⁶

The sheer number of submissions indicates just how many people across the State have been affected by these devastating fires. The Inquiry thanks all those who took the time to make submissions.

1.4.2 Photos

Many submissions had photos attached which provided an insight into people's personal experiences of the fires. Some of these photos have been included in the report, and a small sample is included below. Where photos included in the report have been provided by an agency, such as the NSW RFS, the location and source is recorded. Photos that were received by way of individual submissions have also been included to illustrate a cross-section of the community experience, but specific details of the location and source are not provided.

Many photos were confronting and included burning homes or critically injured wildlife. The Inquiry has chosen not to publish these distressing photos, but notes they provided an insight into the pain and trauma felt by individuals and communities.

All these photos are a powerful reminder of the significant impact of the 2019-20 bush fires throughout NSW. In order to highlight the importance of this photographic record of these fires, the Inquiry has liaised with the State Archives and Records Authority (SARA) to arrange sharing of the photos received by the Inquiry during the submissions process. SARA has advised that once the records from the Inquiry are transferred to the State Archives

¹⁴ Darren Rodrigo, Submission to the Inquiry.

¹⁵ Katoomba/Leura Rural Fire Brigade, Submission to the Inquiry.

¹⁶ John Stein, Submission to the Inquiry.

Collection, work will begin to arrange an online display of a section of photographs to share with the community.



Photo 1-1: Source: Jimmy Malecki, Submission to Inquiry.



Photo 1-2: Bilpin. Source: Nick Moir, The Sydney Morning Herald.



Photo 1-3: Source: Andrew Elks, Submission to Inquiry.

1.4.3 Community meetings

The Inquiry thanks the community members who gave up their time to attend the meetings. The Inquiry learnt so much from each and every community meeting. While each of these had unique insights to offer, general themes and messages were heard across all 16 community meetings held. These are summarised as follows:

- As outlined in Chapter 2, the community confirmed that these fires occurred in extraordinary conditions, during a prolonged drought, with low humidity and high winds. Many members of the community attributed these severe conditions to **climate change** and told the Inquiry that they felt these events would become more common.
- There was wide ranging community perception that **fuel loads** were high and **hazard reduction** before the fire season could be improved.
- The Inquiry heard from all communities about the problems with **communications**, power failures and telecommunications outages. Communications often failed at critical moments, leaving people feeling vulnerable and isolated with no means of calling for help, receiving emergency warnings or contacting family and friends.
- The Inquiry heard that generally the community felt the **operational response** to the bush fires was well managed. However, the extreme weather conditions during the event meant that there was no amount of resourcing that would have been able to contain the bush fires. In almost all community meetings the Inquiry heard high praise and thanks for the firefighters and community members who worked together to save lives and protect homes. There was a small number of community members who were not happy with the NSW RFS response, or who felt not enough was done to protect their homes.
- The Inquiry heard many positive stories about evacuations that went well. However, in some communities it was clear that evacuation messaging could be improved. It was clear that resources were stretched across the State, and many evacuation centres were not equipped for the numbers of evacuees and the length of time the evacuation centres needed to operate.

- The Inquiry heard about the many stories of loss, trauma and pain. It was clear that the impact of the fires on the community will be long-lasting, and that ongoing support is needed to aid community recovery.
- The Inquiry heard from some communities that they didn't see the point in sharing their views with the Inquiry and were deeply sceptical that change would occur, highlighting the number of previous reviews and inquiries and the perception that little has changed as a result.

As outlined above, the information received from the community, both in submissions and from community meetings, has been invaluable. The strength of the community voice is evident not just throughout this report, but also in the recommendations from this Inquiry. As stated in Chapter 6, the Inquiry recommends some short-term and some longer-term actions that are intended to improve outcomes for the community in future bush fire events.

1.5 PREVIOUS REVIEWS AND INQUIRIES

There has been a substantial number of previous reviews and inquiries into bush fires across Australia. This includes state and federal parliamentary inquiries, COAG reports, royal commissions, agency reviews and coronial inquests.

There have been 114 bush fire related reviews and inquiries since 1927, 99 of these since 1990. There have been five reviews since 2017. In addition to this Inquiry, the following bush fire related reviews, inquiries and royal commissions are ongoing or completed:

- The Royal Commission into National Natural Disaster Arrangements, established by the Commonwealth, due to report on 31 August 2020
- Independent Inquiry into the 2019-2020 Victorian Fire Season, due to report 31 July 2020
- Queensland Bushfire Reviews Report 2: 2019-20, reported on 10 February 2020
- Independent Review into South Australia's 2019-20 Bushfire Season, which delivered its report to the Minister for Police, Emergency Services and Correctional Services on 25 June 2020
- NSW Legislative Council Inquiry on the Health impacts of exposure to poor levels of air quality resulting from bush fires and drought
- The Office of the NSW Advocate for Children and Young People, Children and Young Peoples Experience of Disaster, launched on 17 July 2020.

The Inquiry held consultations with each of these ongoing or recently-completed reviews.

An important part of the Inquiry deliberations was to examine the recommendations from previous reviews and inquiries. In reviewing these, this Inquiry observed that each event was described as being different, worse or more extreme than the last. This sentiment is expressed in multiple successive inquiries, especially ones into the 2002-03, 2006-07 and 2008-09 fire seasons. While each inquiry acknowledged that bush fires are a part of Australian life, the unusualness of the seasons appears to be increasing. Most inquiries were established in response to significant bush fire events, so by their very nature would be focussed on severe bush fires, and not necessarily 'normal' seasons unless something went awry in the response. As Tom Griffiths points out,¹⁷ "there are enough Black days in modern

¹⁷ Griffiths, Tom (2012). The language of catastrophe: Forgetting, blaming and bursting into colour, *Griffith REVIEW*, Issue 35 (Autumn). Retrieved from <https://www.griffithreview.com/articles/the-language-of-catastrophe/>.

Australian history to fill up a week several times over”, yet each successive fire event seems to have unique aspects that somehow make it, and its effects, more severe.

In reviewing previous reviews, it was difficult to establish the implementation status of the recommendations, and it was clear that there was no central point within government that audited the implementation of recommendations.

There are recurring themes, in both findings and recommendations, across previous inquiries. These themes broadly include:

- organisational structure of fire agencies and related organisations – this is the most significant area of findings and recommendations in previous inquiries, including clarifying roles and responsibilities of government agencies and jurisdictions, improving coordination and strengthening cost sharing and funding models
- bush fire response – findings and recommendations focusing on coordination, communications and community safety
- infrastructure and assets – findings and recommendations relating to the use, sharing and deployment of fire fighting assets and technologies (with aircraft being a particular focus over the last 20 years)
- bush fire preparedness – most recommendations relate to the identification and management of fire trails, risk assessments, cross-agency and jurisdictional collaboration, access to water supply, and hazard reduction. The focus tends to be on public land management, and any recommendations aimed at individual preparedness are mostly focused on education
- research and technology – most findings and recommendations relate to coordinating research across jurisdictions or supporting a national research centre. A smaller number of inquiries featured improving research and the ability to predict megafires, risk modelling and spatial mapping.

The lack of any overarching implementation monitoring of recommendations from previous reviews and inquiries made it challenging to understand what had already been actioned and, if not, why not. Similar frustrations were voiced by community members, many of whom commented that numerous inquiries have been undertaken but nothing ever seems to change. In order to ensure recommendations accepted by the Government are implemented in a timely and transparent manner, and to inform any future inquiries into similar issues, the Inquiry recommends the Government establish a central accountability mechanism to track implementation of recommendations from bush fire-related reviews and inquiries.

Recommendation 1: That, in order to ensure recommendations accepted by the Government are implemented in a timely and transparent manner, Government establish a central accountability mechanism to track implementation of recommendations from bush fire-related reviews and inquiries and consider expanding this to other policy areas.

1.6 STRUCTURE OF THE REPORT

The Report of the Inquiry is structured according to the major Terms of Reference. Chapter 1 provides an overview of the Inquiry, the consultation process, submissions and the structure of the report. Chapter 2 addresses ToR 1, Chapters 3 and 4 address ToR 2, Chapter 5 addresses ToR 4 and Chapter 6 is a conclusion which includes a note on the likely 2020-21 season and a table of the recommendations, noting which are short term or which need to start now but will take longer to finalise.

1.6.1 Chapter 2 – Causes and factors contributing to the fires

Chapter 2 examines the causes and factors which led to the devastating 2019-20 fire season and also includes a summary and timeline of the fires that occurred throughout the season. It notes that there is still a lot to learn about megafires such as these but the scale and impact of the fires and the fact they are likely to happen again in some form also creates an opportunity for NSW to be a major centre of bush fire research, development, technology advancement and training.

1.6.1.1 Why the fires burned like they did

The Chapter describes the large areas burnt by the fires, the long season, the many fires running at the same time, the severity of the fires and the extreme fire behaviour experienced. It explains that multiple factors together contributed to such an unusual and unrelenting fire season.

A key determinant of the large size of the fires was that the available fuel was extremely dry through the forested areas of NSW stretching from Queensland to Victoria. This was the result of prolonged and widespread drought conditions, the influence of several large-scale climate drivers (a positive Indian Ocean Dipole event, and a combined negative Southern Annular Mode and Sudden Stratospheric Warming event), reduced cool season rainfall and other long-term climate trends.

The dryness of the fuel load made it all too ready to be ignited, most often, in the case of the largest fires, by lightning. Once lit, the largest and most damaging fires were propelled by record-breaking fire weather conditions.

An important feature of this season was a record number of fire-generated thunderstorms – extremely dangerous phenomena.

1.6.1.2 People were not prepared but trends suggest they need to be

While there was widespread anticipation that the risk of fire would be high in the 2019-20 season, the scale of the actual fires took most – from fire fighting and land management agencies, to local councils, to members of local communities – by surprise. Consequently, 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. A range of evidence considered by the Inquiry indicates that extreme fires and fire seasons are likely to become more frequent, and therefore that the State as a whole needs to do much more to ensure its people and communities are prepared.

1.6.1.3 Technology and training opportunities

While noting that the 2019-20 fires were unlike anything seen in NSW before, the Inquiry also notes that modern day technology and research advances have made us more capable of responding to them than at any time before. But we need to push our technological and our research capabilities much harder so that we can make massive improvements in fire and fire risk interpretation and response. Remote sensing technology was used before and during the fires but was not used as extensively as it could have been given technological advances. It is now timely for NSW, which has a long history in this field, to establish a spatial technology acceleration program. The challenges of the 2019-20 season also present the State with a unique opportunity – to harness our significant research and technology strengths to become a world leader of bush fire research, including technology development and commercialisation, with a particular focus on extreme bush fire behaviour.

An enhanced focus on research and technology development must be accompanied by an emphasis on training, and the Inquiry has also identified a series of initial priorities for training – fire behaviour analysts, meteorologists, firefighters and research students – to ensure that fire fighting practice keeps up with new and emerging research.

1.6.2 Chapter 3 – Preparation and planning – emergency management

Chapter 3 provides an overview of the legislative and governance framework in relation to disaster preparedness, including the responsibilities of the Commonwealth, State and local governments. This Chapter also provides an overview of the Fire Danger Ratings and warnings systems and how they are used to inform fire fighting agencies and the community to respond appropriately; and examines the current community support measures in place to ensure communities are prepared for the bush fire season.

1.6.2.1 Legislative and governance frameworks

The Inquiry found that the current emergency management framework was appropriate, and that legislative amendments (apart from some minor ones) are not required to improve the bush fire planning and preparation processes in NSW. While the 2019-20 season was exceptionally long, with fires burning from July 2019 to March 2020, the Inquiry concluded that the current risk-based assessment for varying the Bush Fire Danger Period is appropriate and that no legislative change (is required to extend it. Similarly, the Inquiry concluded that the legislative mechanisms in place to enable coordinated fire fighting arrangements and trigger a State of Emergency are sufficient and were used extensively throughout the season, with more States of Emergency declared in the 2019-20 bush fire season than ever before.

However, the Inquiry considers there is an opportunity to strengthen governance and accountability frameworks at both the State and local level, to ensure all NSW government agencies are held accountable for meeting their bush fire preparedness responsibilities and there are clear escalation mechanisms to resolve cross-agency issues.

1.6.2.2 Fire fighting resources

This Chapter examines whether there were enough firefighters, fire trucks and aerial appliances to fight fires during the 2019-20 season. The Inquiry found that NSW was well prepared for a 'normal' fire season, but the extreme nature of the 2019-20 season stretched resources across the State. The Inquiry found that fire fighting agency funding and personnel numbers have either remained stable or increased over the past decade.

While it heard that in some areas additional resources may have been required, there were clearly days where fire fighting resources were available but could not be deployed due to dangerous weather and fire conditions. The Inquiry concluded that fire fighting agencies were aware the 2019-20 season would potentially be a severe fire season, and they took appropriate action to prepare for the season. While fire fighting agencies were well prepared and resourced, as the Inquiry heard many times, 'all the firefighters in Australia' couldn't have stopped some of the fires in the 2019-20 season due to their frequency, size, speed and ferocity.

1.6.2.3 Community preparedness

The Inquiry heard that the community was generally aware of the potentially severe fire season forecast for 2019-20. The Inquiry examined the NSW RFS community engagement programs and found that, while anecdotal feedback has been positive, there has been no formal evaluation and there is currently no objective measure of the programs' effectiveness.

There is also a lack of tailored support for tourism businesses, who were severely affected during the 2019-20 season as it coincided with the peak holiday season.

The Inquiry also found that Fire Danger Ratings, alerts and warnings are generally well understood, but the lack of consistency between the fire alerts in Victoria and NSW caused confusion in fire impacted areas close to the borders.

1.6.3 Chapter 4 – Preparation and planning – land and assets

Chapter 4 looks specifically at planning and preparation of land and assets for bush fires. It notes that the first task in preparation is knowing what we value and want to save from bush fires and then goes on to discuss methods of planning and preparing these assets including through hazard reduction, traditional Aboriginal land management, extending the strategic aspects of the planning system, and critical infrastructure protection. It then discusses preparation of our access routes (roads and fire trails) to assets and the fire itself. After that, it addresses the problems of smoke from bush fires. The final section discusses some of the potential implications for landscapes and ecosystems of changing fire regimes and what may be needed to adapt.

1.6.3.1 Knowing what assets we value and where they are

In order to determine priorities when multiple valued assets are threatened by fire, we need to know what we value. These sections discuss the importance of developing a system for assigning a relative value level to these assets and then note that we need to ensure that these values, along with other essential information on assets, such as their precise geolocation and access details, are comprehensively collected and stored by the State. The Inquiry proposes that be done in the new State Digital Twin, with extensions.

1.6.3.2 Planning and preparing land and assets for bush fire

The hazard reduction section recognises the strong community views expressed on hazard reduction. It looks at: the frameworks that apply to hazard reduction in NSW; the latest research, including from the 2019-20 season, about the effectiveness of hazard reduction activities especially under extreme fire weather conditions; and explains the likely benefits of hazard reduction activities being more strategically planned, targeted and coordinated at the local level with a focus on better quantifying the reduction in risk that can realistically be achieved. It outlines some specific options for improving current approaches, including further research into alternatives to prescribed burning, and ways to improve the relationship between government agencies that manage public lands and their neighbours.

The traditional Aboriginal land management section points out that cultural burning is part of a broader cultural practice of caring for country, with much broader objectives beyond hazard reduction, and that opportunities for pursuing traditional Aboriginal land management practices should be encouraged in a respectful and collaborative way with this wider focus.

The section examining bush fire and the planning system spells out a number of limitations in the planning system in this regard. While changes since 2002, including the introduction of bush fire prone land zones and related building standards, have resulted in newer developments being far better prepared for bush fire, a great many legacy issues limit the system's impact on bush fire preparedness. A more strategic planning approach is required, drawing on the example of NSW's *Flood Prone Land Policy* and its implementation, along with improved education about bush fire standards, improved compliance, auditing and enforcement of these standards, and a review of existing vegetation clearing policies.

This section on critical infrastructure notes the heavy reliance placed on telecommunications by the community, and the level of distress and anxiety when this was cut off because of

power failures. It looks at options for building greater resilience into the networks, and recommends better asset identification and some mechanisms, in conjunction with other governments and regulatory, policy and market entities, for ensuring power outages are minimised and communications coverage maintained.

1.6.3.3 Getting to and from what needs protection

The section on roads and roadside vegetation acknowledges that road closures caused a great deal of stress. It discusses what makes a road bush fire resilient; acknowledges the impracticality of ‘fire-proofing’ all NSW roads; the importance of bush fire planning processes incorporating comprehensive access and egress options; and the absolute necessity of good public communications systems to enable communities to make timely and informed decisions about evacuation. On roadside vegetation management, there is discussion of the complexities involved, and a call for an outcomes-based approach that could tie in with existing strategic land use and biodiversity processes.

The section on fire trails emphasises the urgent need for a well maintained and strategic State-wide fire trail network. It concludes that the state of fire trails in NSW was inadequate, and recommends acceleration of implementation of 2017 legislation that provides a framework for a State-wide fire trail network and improved auditing, accountability and public reporting in respect of the fire trail network.

1.6.3.4 Bush fire smoke

One of the most identifiable impacts of the 2019-20 fire season was smoke. This section looks at the public health impacts and implied costs of smoke. It recommends greater investment in operational smoke forecasting and modelling, and public health research and policy development; and calls for a much expanded public education campaign to help people make their own informed decisions about exposure to bush fire smoke.

1.6.3.5 Landscape adaptation

The final section addresses the Term of Reference to “make recommendations ... on appropriate action to adapt to future bush fire risks to communities and ecosystems”. It provides a snapshot of the ecosystem impacts of the fires, and observes that more species and ecosystems are now at increased risk of decline than before the fires. It looks at some of the potential risks to NSW ecosystems from changing fire regimes and climate change, as well as the implications of the 2019-20 fires for how we may need to adapt to a changed landscape. The main focus is on identifying the key unknowns (and consequently research questions) that will lead to an in-depth understanding of what has happened, what might happen in the future, and what options there might be over the coming years and decades.

1.6.4 Chapter 5 – Operational response

Chapter 5 examines the operational response by local, interstate and international firefighters throughout the season, the fire fighting strategies that were implemented, how agencies communicated with each other and how information was provided to the public, and the experience of evacuation.

1.6.4.1 Coordinated fire fighting arrangements

NSW RFS members worked alongside firefighters from NPWS, FRNSW and Forestry Corporation, and were supported by crews from both interstate and overseas. The scale and length of the 2019-20 season tested coordinated fire fighting arrangements during the season, and the Inquiry found that whilst extraordinarily stretched, these arrangements worked well. The Inquiry found that agencies demonstrated a ‘badge off’ approach at all

levels – on the fireground, in Incident Management Teams and at the NSW State Operations Centre in Homebush.

1.6.4.2 Safety of first responders

The safety of firefighters is paramount and the Inquiry examined this issue in detail, led by the issues that were raised by firefighters themselves as well as the community. Respiratory protection for firefighters was a key focus, and the Inquiry supports the review currently underway by the NSW RFS to determine the most effective form of respiratory protection for bush fire firefighters. The Inquiry was concerned that NSW fire fighting vehicles have varying standards of protection, particularly in the context of fast-moving and intense bush fires, as sometimes a fire truck is the only form of shelter and safety. Beyond physical safety, mental health is also a critical component of first responder safety and there must be a focus over the medium to longer term as the impact of the 2019-20 season on firefighters will be felt for years to come.

1.6.4.3 Fire fighting strategies

The extraordinary nature of the 2019-20 season highlighted the need to review traditional fire fighting methodologies to ensure they were able to be used in extreme conditions. Early suppression of fires played a critical role; however, weather conditions sometimes hampered the ability to deploy remote fire fighting crews which meant some fires grew quickly. The Inquiry found that fire authorities were acutely aware of the limited supply of water due to the drought and adapted 'dry' fire fighting strategies accordingly, including using heavy plant to actively support fire suppression. In light of how geographically spread out the fires were this season, aviation also played a crucial role in fire fighting, personnel and resource movement as well as surveillance and reconnaissance missions.

Backburning was by far the most controversial issue in this area, and the Inquiry heard polarising views from firefighters and community members. Some people considered far too much backburning was done during the season which exacerbated the existing fire threat, while others thought that much more should have been done as a method of containing the fires.

1.6.4.4 Communication systems, infrastructure and public warnings

Fire authorities sometimes had difficulty communicating with each other on the fireground. This was an issue for both NSW agencies as data was unable to be easily shared across systems, as well as fire authorities communicating across borders.

The fires caused extensive damage to power lines, which led to power outages. As communications towers did not have sufficient backup power, the loss of power led to widespread communications failures in some areas. This left many people feeling vulnerable in an already traumatic situation, as they were unable to contact family and friends or receive Emergency Alerts. ABC Radio played a critical role in delivering emergency broadcasts and was often a last resort option when other forms of communication were lost. Overall, there were high levels of engagement with information issued by the NSW RFS, and the bluntness of communications from the NSW RFS Commissioner and fire agencies. There was a high degree of reliance on the Fires Near Me app, which at times exposed gaps in the information available on the app.

1.6.4.5 Evacuation

The scale of evacuations during the 2019-20 season has not been seen before in NSW. Across the State, evacuation centres were operating at 88 sites for over 100 days. While there are surge arrangements in place, these were insufficient to cope with the level of

demand in some areas. People in evacuation centres reported feeling frustrated in having to tell their story multiple times, and improvements are needed to ensure everyone feels welcome, safe and supported during evacuation.

1.6.5 Chapter 6 – Next steps and conclusion

Chapter 6 outlines how NSW can best prepare for the 2020-21 season, and the next steps required over the medium to long term to ensure NSW is prepared for future extreme fire seasons.

1.7 ACKNOWLEDGEMENTS

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- Fire and Rescue NSW
- Forestry Corporation of NSW
- Local Land Services (including Soil Conservation Service)
- Ministry of Health
- National Parks and Wildlife Service
- NSW Rural Fire Service
- Resilience NSW
- Transport for NSW.

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- Professor Sandy McFarlane AO
- Mr Greg Mullins AO AFSM
- NSW Bushfire Risk Management Research Hub
- Professor Andy Pitman AO
- Mr Peter Saville
- Professor Jason Sharples
- Emeritus Professor Mark Westoby.

2 CAUSES AND FACTORS CONTRIBUTING TO 2019-20 BUSH FIRE SEASON

This Chapter addresses the first component of the Terms of Reference which asks the Inquiry to consider and report 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”.

The Terms of Reference specifically ask the Inquiry to comment on the role of climate change in contributing to the 2019-20 bush fire season. Early on, the Inquiry consulted Professor Andy Pitman AO from the University of NSW and Director of the Australian Research Council Centre of Excellence for Climate Extremes.¹⁸ 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. For example, it cannot be said with certainty that the extent and severity of the drought leading into the fire season was caused by climate change, but it is also not possible with the available evidence to say that it wasn't. In this Chapter we tease apart the causal and contributing factors for these fires with a view both to understanding what we do and do not know in this area and, as discussed in later Chapters, to informing practice in preparing for and responding to fires of this kind.

As Professor David Bowman from the University of Tasmania told the Inquiry, there was a ‘constellation of factors’ that together contributed to an extremely unusual bush fire season.¹⁹

2.1 CHARACTERISTICS OF 2019-20 FIRES

This section seeks to describe in some detail the key characteristics of the 2019-20 bush fire season in NSW. It also considers how this season was similar to, different from, or worse than what has been experienced before and describes the characteristics of the fires in terms of their frequency, intensity, timing and location.

The 2019-20 bush fire season has been variously described as bad, terrifying, unprecedented and devastating, among other things. Some fires have also been described as ‘megafires’.²⁰ While the term ‘megafire’ is somewhat informal, it is commonly used to describe “explosive, very large, intense and uncontrollable fires”.²¹

¹⁸ Meeting with Professor Andy Pitman on 7 February 2020.

¹⁹ Meeting with the NSW Bushfire Risk Management Research Hub on 17 June 2020.

²⁰ Nolan, R, Boer, M, Collins, L, Resco de Dios, V, Clarke, H, Jenkins, M, Kenny, B, & Bradstock, R. (2020) Causes and consequences of eastern Australia's 2019–20 season of mega-fires. *Glob Change Biol*, 26: 1039-1041. doi:10.1111/gcb.14987; and Boer, M, Resco de Dios, V, & Bradstock, R. (2020) Unprecedented burn area of Australian mega forest fires. *Nat. Clim. Chang.* 10, 171–172. doi: 10.1038/s41558-020-0716-1.

²¹ Tedim, F, Leone, V, Amraoui, M, Bouillon, C, Coughlan, M.R, Delogu, G.M, Fernandes, P, Ferreira, C, McCaffrey, S, McGee, T, Parente, J, Paton, D, Pereira, M, Ribeiro, L, Viegas, D, Xanthopoulos, G.

As an overall summary, many fires were spatially very large, and often very intense and hard to suppress. Large areas of the State were burning at the same time, as the fires progressed from north to south, with December 2019 marking the peak in the number of active fires running simultaneously.

In terms of area burnt, these fires were some of the largest fires in forested regions in the world. California provides a useful comparison. Recent major fires there resulting from a single ignition point in forests and shrublands have been around 50,000-130,000 hectares: for example, the 2013 Rim fire burnt almost 105,000 hectares, the 2017 Thomas fire burnt almost 110,000 hectares and the 2018 Camp fire burnt 62,052 hectares.²² Some of the individual fires from the 2019-20 season in NSW were three to four times the size of these fires. Though there have been other serious bush fires in south-eastern Australia in recent history (including the 2002-03 fires in the alpine region that burned into Canberra and the Black Saturday bush fires in Victoria), this bush fire season was extraordinary.

The season was also characterised by the large number of fire-generated thunderstorms (pyro cumulonimbus) – dangerous events which can escalate fire spread and make conditions very hazardous for firefighters.

Notably, the major population centres of Sydney, Newcastle, Wollongong and Canberra were not directly affected by fire. Larger regional centres were also relatively untouched, for example, Armidale, Tamworth, Bathurst and Port Macquarie (although the surrounding local government areas of Armidale and Port Macquarie were certainly affected).

However, many smaller towns and communities were quite badly affected. The five Local Government Areas that lost the greatest total number of houses were Eurobodalla Shire Council (510 houses lost), Bega Valley Shire Council (465), Shoalhaven City Council (286), Snowy Valleys Council (193), and Clarence Valley Council (168).²³

Also, many places not directly affected by fire, including major population centres, were affected by accumulated exposure to bush fire smoke. On 10 December 2019, an estimated 7.4 million people (or approximately 94% of the NSW population) experienced an estimated mean daily fine particulate exposure (PM2.5) that exceeded the national daily air quality standard.²⁴

An important observation is that we do not yet know everything we need to know about the 2019-20 bush fire season. There is a huge amount of data that must be examined in detail before we can understand in depth exactly what happened, and how what happened varied across the State and throughout the season. The Inquiry has been told of numerous examples where key lessons from previous fire 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.

(2018) Defining Extreme Wildfire Events: Difficulties, Challenges, and Impacts. Fire, 1, 9. doi:10.3390/fire1010009.

²² National Interagency Fire Centre. 100,000-acre Fires. Retrieved from https://www.nifc.gov/fireInfo/fireInfo_stats_lgFires.html.

²³ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 21 July 2020*.

²⁴ NSW Bushfire Risk Management Research Hub (2020) 'Smoke and human health'.

2.1.1 Major fires

There were 11,774 fires across NSW during the 2019-20 season which ran from July 2019 to March 2020.²⁵ Table 2-1 lists some of the fires identified by NSW RFS as the most significant fires of the season based on their size, scale and/or impact, along with details of area burnt, location and suspected starting causes.

²⁵ NSW RFS (Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

	LOCATION (LGA)	FIRE	IGNITION			AREA BURNT (by tenure)					BURNT UNTIL
			Date	Cause	Tenure	Total (Ha)	Private	State Forest	National Park	Other	
NORTH REGION	Armidale	Carrai Creek	17/10/19	Lightning	National Park	238,601	61,249	15,392	160,110	1,850	15 January 2020
	Armidale	Stockyard Flat	27/10/19	Lightning	National Park	72,248	22,927	18,060	30,943	317	11 November 2019*
	Clarence Valley	Bees Nest	31/8/19	Lightning	National Park	113,705	27,641	22,354	63,069	640	13 November 2019
	Clarence Valley	Liberation Trail	4/11/19	Lightning	National Park	183,652	63,877	72,039	46,753	983	24 December 2019
	Glen Innes	Kangawalla	27/10/19	Lightning	Private property	22,008	8,731	4,089	9,129	57	4 November 2019
	Kempsey	Carrai East	17/10/19	Lightning	National Park	150,758	68,646	16,464	62,319	3,329	19 January 2020
	Nambucca	Kian Road	17/10/19	Lightning	Private property	31,574	13,935	8,043	9,318	144	27 December 2019
	Richmond Valley	Busbys Flat Road, Busbys Flat	4/10/19	Shredded tyre	Private property	51,826	36,446	13,692	898	789	4 December 2019*
	Richmond Valley	Myall Creek Road, Bora Ridge	8/11/19	Debris burning	National Park	121,323	50,087	34,137	36,135	965	10 February 2020
	Tenterfield	Gulf Road, Tenterfield	27/10/19	Undetermined ²⁶	Private property	74,238	41,438	1,666	29,653	1,481	30 November 2019
	Tenterfield	Long Gully Road, Drake	5/9/19	Lightning	Private property	138,475	81,173	53,001	3,542	754	27 October 2019
	Tenterfield	Mt Mackenzie	6/9/19	Power lines	Private property	2,771	2,595	---	131	44	18 September 2019
EAST REGION	Blue Mountains	Grose Valley	20/12/19	Debris burning	National Park	19,920	1,897	---	17,157	867	4 February 2020
	Blue Mountains	Ruined Castle	27/11/19	Lightning	National Park	17,058	1,185	---	15,623	250	6 February 2020
	Central Coast	Three Mile	26/11/19	Lightning	National Park	45,944	5,359	6,271	31,703	2,609	13 January 2020
	Hawkesbury	Gospers Mountain	26/10/19	Lightning	National Park	512,626	42,837	49,273	416,253	4,261	10 February 2020
	Mid Coast	Bills Crossing, Crowdy	26/10/19	Lightning	National Park	13,366	3,001	1,231	8,986	148	26 December 2019
	Mid Coast	Failford Road, Darawank	26/10/19	Power lines	Council lands	2,972	1,581	---	1,175	216	13 November 2019*
	Mid Coast	Hillville Road, Hillville	7/11/19	Debris burning	State Forest	31,268	16,431	6,422	7,923	491	28 December 2019
	Mid Coast	Rumba Complex	18/10/19	Lightning	National Park	153,167	98,142	26,069	27,150	1,806	24 January 2020
	Wingecarribee	Morton ²⁷	4/1/20	Lightning	National Park	23,004	4,602	4,340	13,175	887	3 March 2020
	Wollondilly	Green Wattle Creek	27/11/19	Lightning	National Park	278,199	33,933	984	238,849	4,433	10 February 2020
SOUTH REGION	Bega Valley	Border Fire	31/12/19	Lightning	(from Victoria)	192,489	17,765	11,102	62,923	777	4 March 2020
	Bega Valley	Werri Berri	29/12/19	Lightning	National Park	27,789	7,244	190	20,176	179	25 January 2020*
	Eurobodalla	Badja Forest Road, Countegany	27/12/19	Lightning	State Forest	315,512	63,346	62,809	187,292	2,065	4 March 2020
	Eurobodalla	Clyde Mountain	26/11/19	Lightning	National Park	98,816	23,237	40,897	33,643	1,038	16 February 2020
	Greater Hume	Green Valley, Talmalmo	29/12/19	Lightning	Private property	208,275	187,728	2,073	18,367	107	19 February 2020
	Shoalhaven	Currowan	26/11/19	Lightning	National Park	314,598	42,415	47,869	203,782	20,531	8 February 2020
	Snowy Valley	Dunns Road	28/12/19	Lightning	Private property	333,940	113,829	92,241	125,882	1,989	15 February 2020
	Snowy Monaro	Good Good	29/12/19	Lightning	National Park	42,563	26,703	6,720	8,548	592	2 March 2020
W	Mid Western	Upper Turon, Palmers Oaky	4/12/19	Equipment ²⁸	Crown Land	17,413	14,324	564	1,740	786	31 January 2020
	Muswellbrook	Kerry Ridge	23/11/19	Lightning	National Park	191,574	22,670	11,757	150,345	6,802	10 February 2020

Table 2-1: Details of significant fires from the 2019-20 season (data provided by NSW RFS).

* amalgamated with another fire.

²⁶ Undetermined – no suspected cause has been identified by crews or fire investigation.

²⁷ Currowan fire North of Kangaroo River.

²⁸ Equipment – Equipment use is a standard ignition type. In this instance, investigation is ongoing.

Many fires named separately in Table 2-1 merged together during the season and effectively became one fire. Conversely, many extremely large fires on the ground were broken into smaller segments and given different names by NSW RFS so that they could be managed effectively by fire authorities. In other instances, a number of fires resulted in the creation of one large burnt area, even though they were not always burning at the same time.

For example, in the north of the State many large fires ultimately joined each other. Whilst not always burning at the same time, the total burnt area was 1,564,920 hectares with a perimeter of 8,017 km. This created a burnt area extending from the Queensland border to the Barrington Tops and from the Pacific Ocean to Glen Innes.²⁹

The Gospers Mountain fire provides another example. While it was accurately reported as burning 512,000 hectares, the total area burnt by fires that joined with it became some 908,231 hectares with a perimeter of 1,944 km. The amalgamating fires included the Kerrys Ridge, Grose Valley, Gospers, Little L Complex, Stockyard Creek and Three Mile fires.³⁰

In south-eastern NSW, again a number of large fires joined which resulted in 960,419 hectares burning with a perimeter of 2,271 km. The burnt area ultimately extended from the Southern Highlands of NSW almost to Bega.³¹

2.1.2 What burnt where?

Best estimates show that the total area of NSW burnt during the 2019-20 bush fires was approximately 5.5 million hectares – about 7% of NSW's total land area – between July 2019 and March 2020.³² Figure 2-1 shows the total area affected, and the monthly progression of the fires from July 2019 to March 2020.

²⁹ NSW RFS (Rural Fire Service). (2020). *Advice to the Inquiry provided 9 June 2020*.

³⁰ Ibid.

³¹ Ibid.

³² NSW RFS (Rural Fire Service). (2020). *Advice to the Inquiry provided 2 April 2020*.

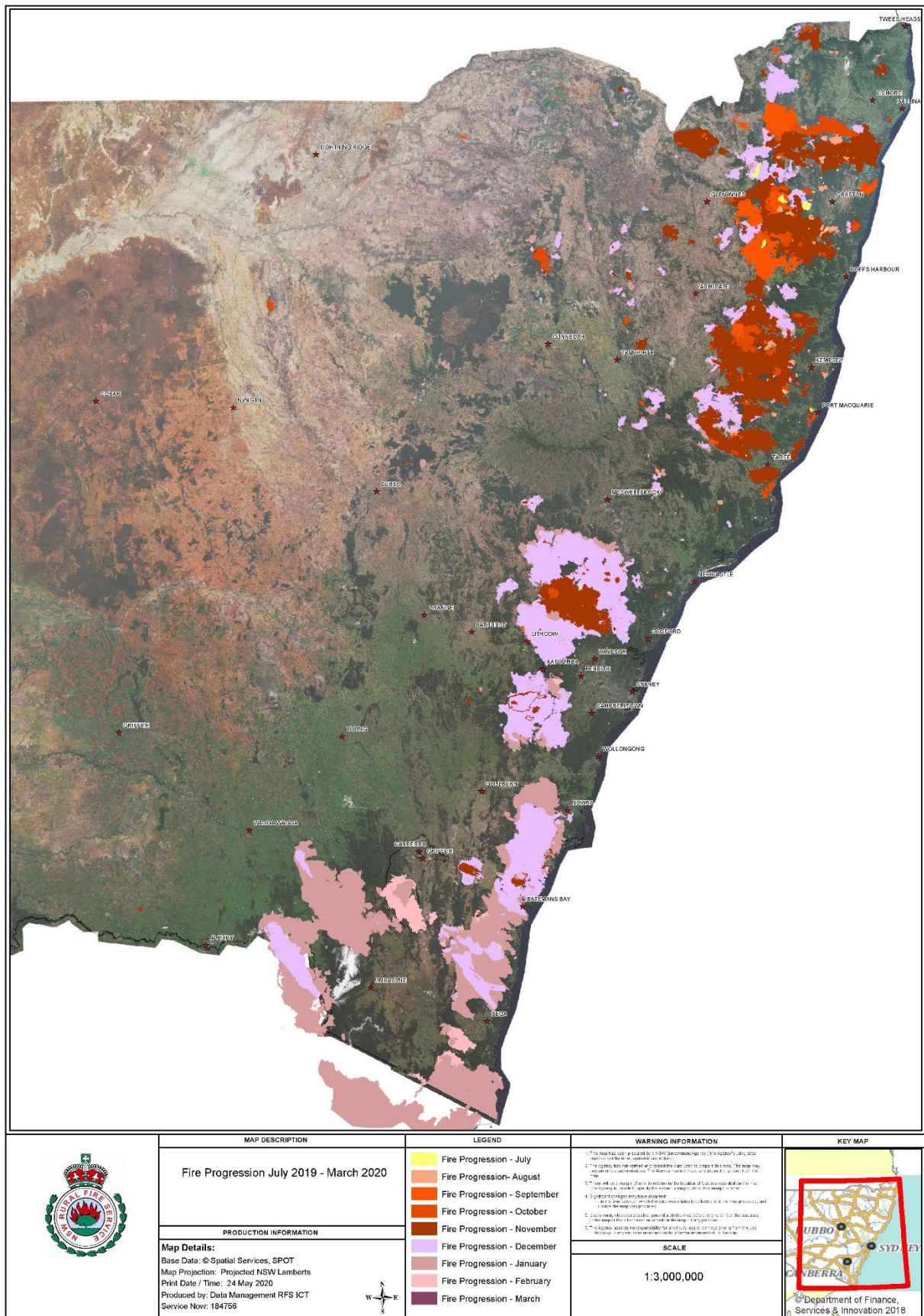


Figure 2-1: Monthly fire progression from July 2019 to March 2020 (prepared by NSW RFS).

The extent of burnt area is significantly larger than in previous recorded bush fire seasons in NSW.

The 2004 National Inquiry on Bushfire Mitigation and Management³³ identified some previous large bush fire seasons in forested regions of NSW, for example, over 2 million hectares in 1926-27, over 2 million hectares in 1957-58, over 2 million hectares in 1968-69 and over 1 million hectares in 1979-80.

Table 2-2 compares the 2019-20 season with bush fire seasons from more recent history that resulted in significant area burnt and loss of life and homes.³⁴

Year	Hectares burnt	Homes destroyed	Lives lost
1993-94	800,000	225	4
2001-02	744,000	135	0
2002-03	1,500,000	112	0
2012-13	1,400,000	62	0
2013-14	574,557	227	2
2017-18	260,000	74	0
2018-19	288,000	37	0
2019-20	5,520,000	2,476	26

Table 2-2: Area burnt, homes destroyed and lives lost during previous serious fire seasons in NSW.³⁵

The area affected in neighbouring states and territories in the 2019-20 season provides further context: in Victoria 1.5 million hectares were burnt, in the ACT 86,000 hectares, and in Queensland 7.7 million hectares.³⁶

The size of individual fires was also historically large for south-eastern Australia. Individual fires ranged from smaller than 10 hectares through to over 500,000 hectares, and many individual fires were larger than 100,000 hectares. Further, as discussed in section 2.1.1, when fires that merged together are taken into account the size is even greater: for example, around the Gaspers Mountain fire, the total size of what was effectively one contiguous burnt area was almost 1 million hectares.

As an international comparison, analysis by Boer, Resco de Dios and Bradstock (2020) shows that the 2019-20 fires across eastern Australia (including NSW and Victoria) burnt a globally unprecedented percentage of any continental forest vegetation community type (or biome).³⁷ In this case, it was mainly temperate, broadleaf forest that burned.³⁸

As Figure 2-1 shows, the fires burned along the Great Dividing Range and made runs to the coast, and also burned into the alpine mountain areas. However, the preceding drought was so prolonged that there was not much grass fuel available west of the ranges, so there was limited fire activity there.

³³ Ellis, S, Kanowski, P & Whelan, R 2004, National Inquiry on Bushfire Mitigation and Management, Commonwealth of Australia, Canberra.

³⁴ Updated figures for number of homes destroyed provided on 21 July 2020. NSW RFS (Rural Fire Service). (2020). *Advice to the Inquiry provided 21 July 2020*.

³⁵ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

³⁶ AFAC (Australasian Fire and Emergency Service Authorities Council). (2020). *Advice to the Inquiry provided 25 June 2020*.

³⁷ Boer et al (2020) 171-172.

³⁸ Ibid.

The season also saw fires burning in areas that are usually too damp to carry fire, for example areas of rainforest, and there were also several fires in peat including a fire underneath a peat wetland near Port Macquarie (Lindfield Park Road) that burned for 209 days from 18 July 2019 until 12 February 2020.

The fires burned across both public and privately-owned land, as shown in Figure 2-2.³⁹

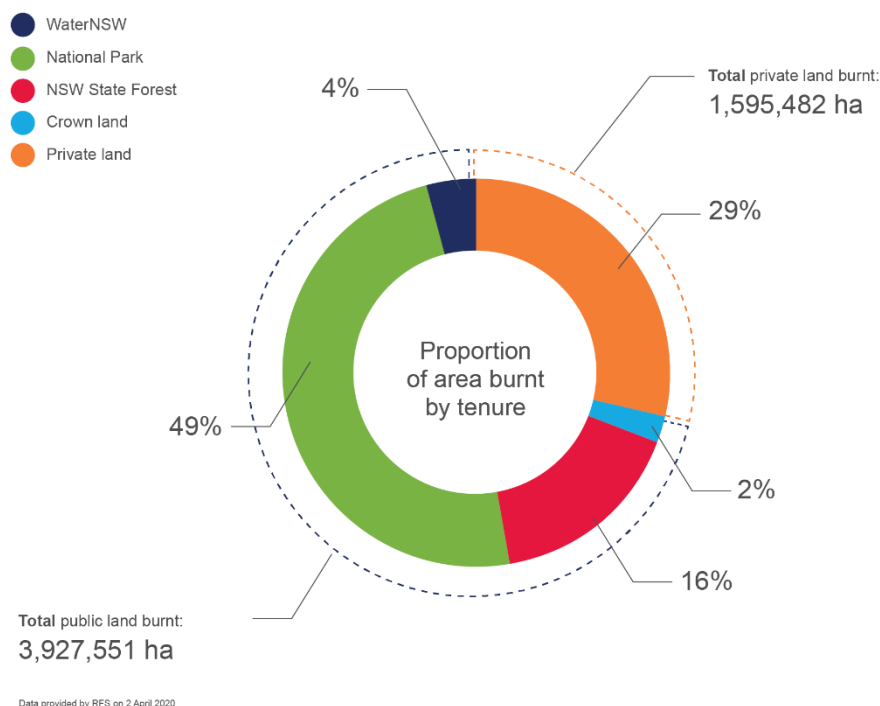


Figure 2-2: Proportion of area burnt by tenure.

It is also important to look at what didn't burn. Notably, the large fires didn't directly have an impact on major population centres (Sydney, Illawarra, greater Newcastle). It has been generally agreed among the experts the Inquiry spoke to that this was a combination of effective response, perhaps more favourable antecedent conditions, and fewer ignitions.

Very few whole rural towns and villages were completely consumed by fire. Rather, fire tended to make runs into towns and consume or damage several places, but not generally the whole town. Of course, large sections of communities in several places such as Cobargo, Mogo, and Conjola Park in the south, Rappville, Nymboida and Wyaliba in the north, Bilpin and Balmoral in the Hawkesbury and Southern Highlands areas, and Batlow in the alpine region, were directly affected.

2.1.3 How did the fires start?

Lightning was the suspected, immediate cause of ignition for the vast majority of the largest and most damaging fires across NSW in the 2019-20 season.⁴⁰ The dryness of the landscape due to prolonged and widespread drought meant that lightning 'caught' well to start fires and provided suitable conditions for them to spread once they were alight.

³⁹ NSW RFS (Rural Fire Service). (2020). *Advice to the Inquiry provided 2 April 2020*.

⁴⁰ NSW RFS (Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

Also, some new fires started as a result of other fires through ember spotting. For example, the Morton fire started as a result of significant activity on the Currowan fire and it is suspected that either embers or a fire-generated thunderstorm caused spot fires over the Shoalhaven River on the evening of 4 January 2020. This ultimately burned over 23,000 hectares and affected communities in the Southern Highlands.⁴¹

NSW RFS has also reported that power lines were a suspected cause of a few of the larger, damaging fires listed in Table 2-1.⁴²

Some fires were also started by people – either deliberately or by accident. For example, early in the season in northern NSW, many early fires were suspected to be due to private burns that started on private land.

Some fires were suspected to have started by machinery. For example, the Orroral Valley fire in January 2020 is thought to have started by the heat from lights on an Army MRH-90 helicopter. While this fire started in the ACT, it spread into NSW.⁴³

There were also instances of suspected arson during the 2019-20 season, but these were a very small proportion of the area burnt. Strike Force Tronto reported to the Inquiry that there were 63 offences under the *Crimes Act 1900* under the category of ‘intentionally cause fire and be reckless to its spread’ from 1 July 2019 to 3 Feb 2020. Fifty-nine of these fires were deliberately lit and, of those, 11 were lit with intention to cause a bush fire.⁴⁴

2.1.4 When did it burn?

The 2019-20 fire season ran for eight months – between 1 July 2019 and 31 March 2020. The last fires were extinguished on 2 March 2020 after 240 consecutive days of active bush or grass fires.⁴⁵

Box 2-1 includes a brief chronology of the fire season prepared by the NSW RFS for the Inquiry, which clearly highlights the long duration, complexity and rolling, relentless nature of the bush fire threat as it moved southwards through the State.

The season started earlier than usual in northern NSW. There were 1,000 bush and grass fires during July 2019, mostly in northern NSW.⁴⁶ This followed on from unseasonably late fires in northern NSW at the end of the previous season. There were 62 bush/grass fires in the Tenterfield local government area in February 2019 which burned some 50,094 hectares.⁴⁷ The Inquiry heard at community meetings that only having a short reprieve between fires occurring in February and then the fire season starting again in July was hugely challenging.

The NSW RFS has explained that the fire season generally moves from north to south through the season, allowing resources to follow. But in the 2019-20 season, fires started in

⁴¹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 24 June 2020*.

⁴² RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

⁴³ Burgess, K. (2020, 29 January). How a landing light from a Defence MRH-90 Taipan helicopter sparked the Orroral Valley fire, *Canberra Times*. Retrieved from <https://www.canberratimes.com.au/story/6603221/how-a-mission-to-save-canberra-from-bushfires-sparked-the-worst-fire-threat-since-2003/>.

⁴⁴ NSW Police Force. (2020). *Advice to the Inquiry provided 14 May 2020*.

⁴⁵ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

⁴⁶ Ibid.

⁴⁷ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 23 June 2020*.

the centre of the State while those up north were still active, and the southern areas likewise started to experience fire earlier than usual. In the north, the result was an unusually long period of time with active fire (about five months).

A major challenge was the large number and size of fires running simultaneously. For example, on 8 November 2019 an unprecedented 17 fires were at Emergency Warning level.⁴⁸ December 2019 was the most active month, with over 2000 bush and grass fires, of which 120 had been active since November.⁴⁹

The fires in NSW and the ACT also overlapped significantly with fires in Queensland and Victoria, and also simultaneous fires in South Australia and Western Australia, which put a great strain on resources that are shared between jurisdictions (interjurisdictional resource sharing is discussed further in Chapter 5). In its submission, the Australasian Fire and Emergency Service Authorities Council (AFAC) noted that, as fire activity escalated across Australia in late December, domestic capacity to support the scale of the fires became stretched and occasionally requests for specialist resources could not be filled domestically. Also, the ability to sustain such large-scale movements of resources for such a long period of time became challenging.⁵⁰

Box 2-1: Chronology of the 2019-20 fire season (prepared by the NSW RFS)⁵¹

The season started early with over 1,000 bush and grass fires during July 2019, primarily in northern NSW. The fire that started on Lindfield Park Road, Port Macquarie, on 18 July became the season's longest running fire – it burned for 209 days until it was finally extinguished on 12 February 2020.

In August 2019, there were approximately 1,800 bush and grass fires, including five active fires still burning from July. August saw a number of fires escalated to Emergency Warning level. Four s44 Declarations were made in August in the local government areas of Kempsey, Nambucca, Clarence, Richmond Valley, Kyogle, Lismore, Mid Coast and Port Macquarie Hastings.

In September 2019, there were approximately 1,300 bush and grass fires recorded, with 31 active fires still burning from August. From early September, observed fire danger levels across the State were in the Extreme and Catastrophic categories and fires developed particularly in the Tenterfield, Glen Innes, Armidale and Clarence Valley local government areas and surrounds. Total Fire Bans first came into effect in September with four declared in the areas of New England, Northern Slopes, North Western, Central Ranges, Far North Coast, North Coast, Greater Hunter and Greater Sydney. Four s44 Declarations were made including for the local government areas of Armidale, Glen Innes, Inverell, Tenterfield, Uralla, Walcha and parts of Clarence Valley.

In October 2019, large and destructive fires impacted communities in Tenterfield and Richmond Valley, including the villages of Rappville and Ewingar. Throughout October, there were approximately 1,300 bush and grass fires, including 20 active fires still burning from September. Six s44 Declarations were made, and eight Total Fire Bans issued. The Long Gully Fire in the Tenterfield region, which started on 5 September, took another significant run in October and claimed the first two lives of the season. A lightning strike caused another fatality in October in Arcadia, northern Sydney when a resident was attending to a bush fire outside a property. On 26 October, the Gaspers Mountain Fire in the Hawkesbury started and

⁴⁸ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

⁴⁹ Ibid.

⁵⁰ AFAC (Australasian Fire and Emergency Service Authorities Council), Submission to the Inquiry.

⁵¹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

it remained active until 10 February 2020, burning 512,626 hectares and accounting for almost 10% of the total area burnt across the State.

In November 2019, there were over 1,900 bush and grass fires across the State, of which 81 were active fires since October. November saw the highest concentration of s44 Declarations (23), and days of Total Fire Bans (15), including three days of State-wide Total Fire Bans. An unprecedented 17 fires were at Emergency Warning level on 8 November 2019. A State of Emergency was declared on 11 November 2019. On 12 November 2019, catastrophic fire danger was predicted for Greater Sydney, Greater Hunter and Illawarra/Shoalhaven. During November there were five fatalities directly associated with the fires.

In December 2019, over 2,000 bush and grass fires were recorded, making it the most active month of the season, with 120 fires active since November. Five s44 Declarations were made and there were 22 days of Total Fire Bans, including four days of State-wide Total Fire Bans. A second State of Emergency was declared on 19 December ahead of catastrophic fire danger predictions for Greater Sydney, Illawarra/Shoalhaven and Southern Ranges. Seven fatalities were recorded in December, including three NSW RFS volunteer fire fighters. New Year's Eve saw significant losses in southern NSW, particularly in the Shoalhaven, Eurobodalla and Bega local government areas.

A third State of Emergency was declared on 2 January 2020. However, only one additional s44 Declaration was made during the month and there was an overall reduction in the total fires to approximately 1,500 bush and grass fires, with 128 fires active since December. Eleven Total Fire Bans were issued, including three days of State-wide Total Fire Bans. January also recorded the highest number of fatalities of 11, including three American aerial fire fighting personnel fatally injured during water-bombing operations in southern NSW.

In February 2020, there was one Total Fire Ban and the total number of fires dropped significantly to over 350, with 14 active fires since January. There were two active fires from February that burnt into March, but there were no active fires from 2 March 2020, marking the end of more than 240 days of fire activity for NSW.

2.1.5 How often do these areas usually burn?

Boer et al (2020) note that major fires in eastern Australia's temperate broadleaf forests – dominated by eucalypts – are relatively common. However, usually only a small percentage of this forest biome burns annually, typically less than 2%, even in more extreme fire seasons.⁵² As noted previously, an unprecedented proportion of this biome was burnt in the 2019-20 the season, almost 20%.⁵³

To give some further insight into fire frequency, the NSW Bushfire Risk Management Research Hub (Research Hub), a body launched by the NSW Government in 2018 and directed by Professor Ross Bradstock of the University of Wollongong, examined the 'ecological fire interval status'⁵⁴ of vegetation across NSW before the 2019-20 season, and its state after the fires.

⁵² Boer et al (2020) 171–172.

⁵³ Ibid.

⁵⁴ This analysis used the Fire Tools algorithm for biodiversity thresholds, which outline a minimum and maximum number of years between fires in order to maintain the ecological state of the community. **Long Unburnt** vegetation has not been burnt in a long time, past the recommended maximum burn interval, and may have elevated fuel loads or be transitioning to a fire-intolerant vegetation type. **Too Frequently Burnt** vegetation may be transitioning to a new vegetation community due to an excess of frequent fire. **Vulnerable** vegetation has been frequently burnt, and is in danger of transitioning to a **Too Frequently Burnt** state if burnt again soon, while **Within Threshold** vegetation has not been

This work found that, before the 2019-20 bush fire season, there was a mix of fuel ages (or time since the last fire) across the fire affected areas, including areas classified as ‘long unburnt’ (see Figure 2-3). But the fires burned across all categories of fuel age, including large areas that had been recently burnt.⁵⁵

The Research Hub’s analysis shows that large areas are now vulnerable to ecological state change if burnt by subsequent fires in the near term, and there is also a greater area of vegetation classified as too frequently burnt. This means that fire managers will need to be aware of the sensitive ecological status of much of the vegetation, which will remain vulnerable if it experiences fire in the short-term. However, there are still areas of long unburnt vegetation throughout the State (see Figure 2-4). Further examination of the ecological effects of the fires and future management implications is covered in Section 4.7.

The Research Hub noted some challenges in preparing this analysis, in that it relies on accurate fire history mapping, and the available fire history dataset available is incomplete and declines in accuracy and coverage further back in time. It also notes that the ecological thresholds used for the analysis are subject to contention, and don’t account for the severity of fire experienced. The Research Hub notes that research to improve these thresholds is ongoing.

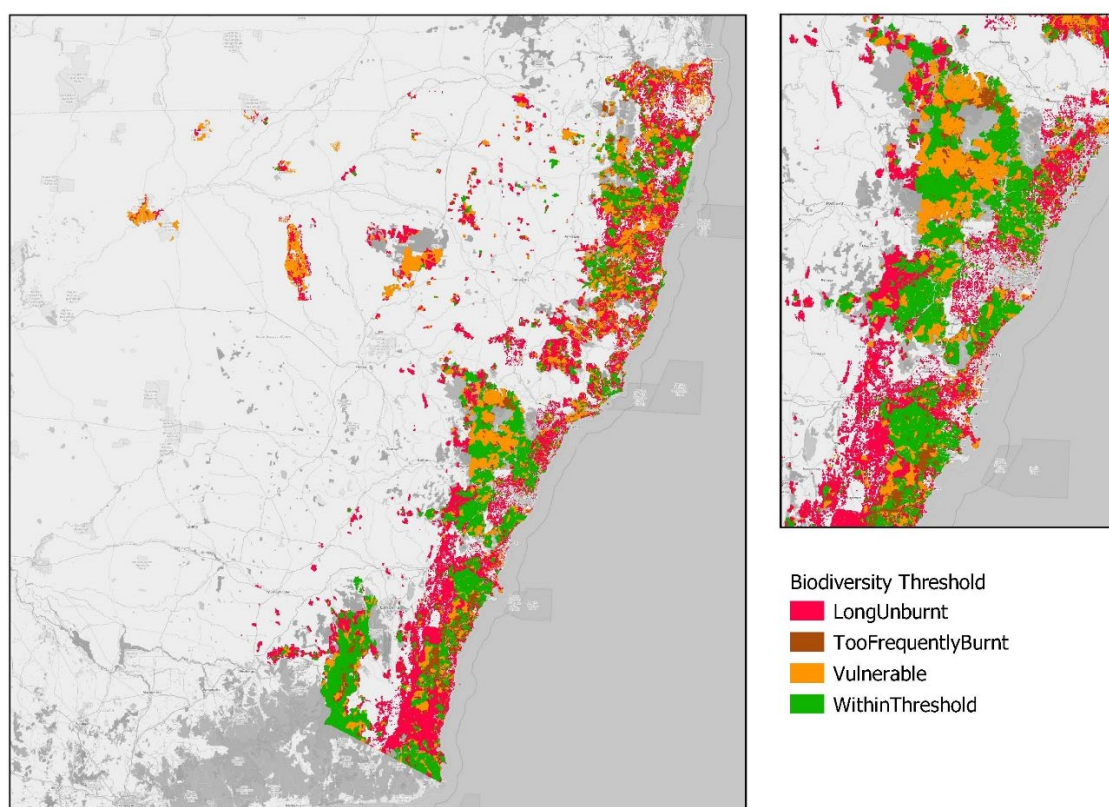


Figure 2-3: Vegetation biodiversity threshold status for available vegetation types before the 2019-20 fire season (prepared by NSW Bushfire Risk Management Research Hub).⁵⁶

burnt too frequently, its fire interval is currently between the recommended minimum and maximum time since fire and an additional fire will not leave it too frequently burnt. NSW Bushfire Risk Management Research Hub (2020) ‘Fire threshold analysis’.

⁵⁵ NSW Bushfire Risk Management Research Hub (2020) ‘Fire threshold analysis’.

⁵⁶ Ibid.

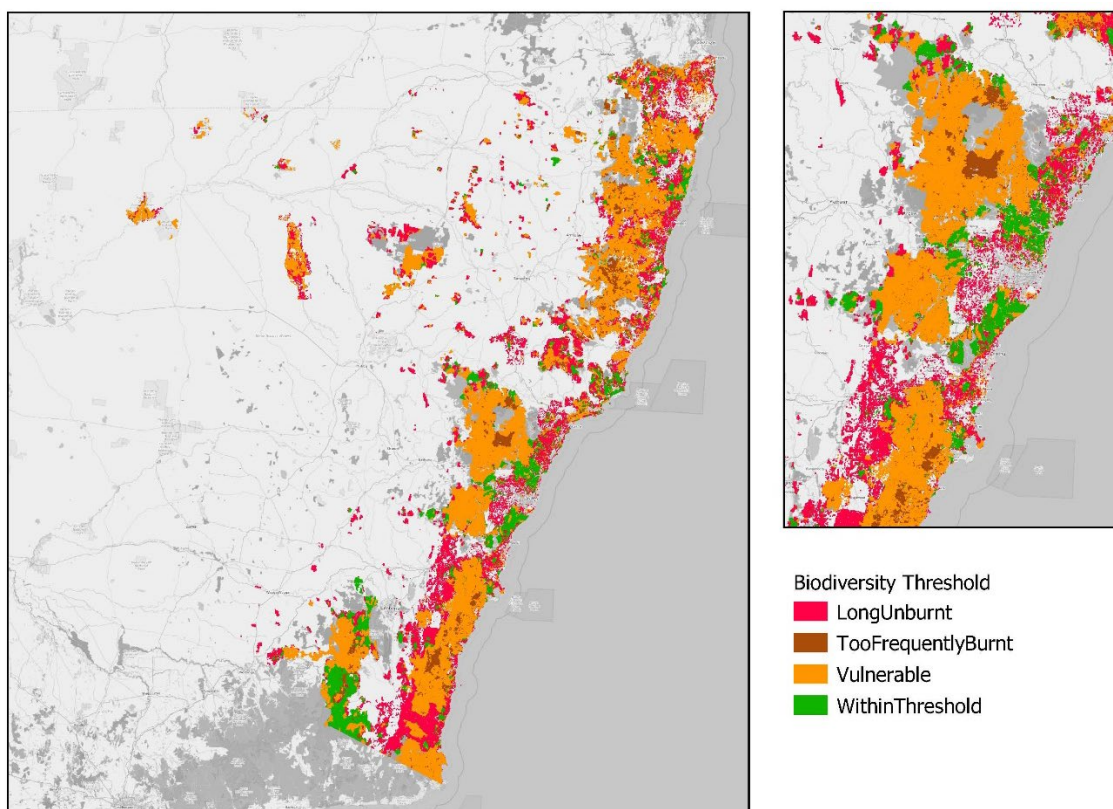


Figure 2-4: Vegetation biodiversity threshold status for available vegetation types after the 2019-20 fire season (prepared by NSW Bushfire Risk Management Research Hub).⁵⁷

2.1.6 How did they burn?

Many of the fires have been described as ‘monster’ fires – large and fierce. When we talked with people in the community the fires were often described as living things. They take runs, put out a finger, stooge around, race through, creep about, wake up, pop their heads up – and are commonly described as living and breathing.

In response to a list of questions posed by the Inquiry, the Research Hub prepared a number of analyses of data from the 2019-20 bush fire season.

One of these projects was an analysis of fire severity. Fire severity is a measure of the ecological and structural impact of a fire on vegetation.⁵⁸ This work showed that fire severity varied between and within fires.⁵⁹ Across NSW, 800,600 hectares (almost 15% of the total area burnt) were burnt in high or severe categories, which indicates partial or complete canopy consumption.⁶⁰

The Hub examined three fire complexes in detail and found:

⁵⁷ Ibid.

⁵⁸ NSW Bushfire Risk Management Research Hub (2020) ‘Fire severity and past fire impact’.

⁵⁹ Ibid.

⁶⁰ Severity categories used are **unburnt** - representing an unburnt surface with green canopy, **low** - indicating an understorey fire that did not impact the canopy, **moderate** - indicating partial canopy scorch, **high** - indicating full canopy scorch and partial canopy consumption, and **severe** - indicating full canopy consumption. NSW Bushfire Risk Management Research Hub (2020) ‘Fire severity and past fire impact’.

- in the Gospers Mountain fire, fire severity was mostly moderate and high indicating extensive, consistent canopy damage across the entire area of predominantly dry sclerophyll forest, with unburnt areas generally found in wet sclerophyll forest in valleys
- in the South Coast fire complex (Bega through to Nowra), most vegetation formations experienced high and severe fire categories, including large areas of wet sclerophyll forest which burnt in the canopy-consuming severe fire class and areas of fire-sensitive rainforest which burnt in high or severe classes
- in the Bees Nest fire in the north of NSW, both wet and dry sclerophyll forests experienced significant areas of high fire severity, as well as the canopy-consuming severe class of fire.

Many stakeholders and firefighters also remarked on unusual or unexpected fire behaviour they observed, for example:

- fires spreading much more quickly than expected during the night, when typically it would be expected that fires would self-extinguish or burn with lower intensity
- ease of new ignitions by lightning and embers
- fires spreading in all directions at the same time, or advancing into the wind
- frequent 'blow up' days
- a large number of fire-generated thunderstorm events
- fires running straight through recently hazard-reduced areas, areas that had been burnt earlier in the season, across mown grass, sheets of water, or even bare soil with no grass
- fires making a scary, roaring noise
- embers spotting far ahead of the fire front to start new fires (for example, the Clear Range fire spotted up to 7.4 km ahead of the main fire at around 4 am on 1 February)⁶¹
- fires spotting over large water bodies or other features that would otherwise have contained a fire
- large or heavy fuels like dead trees and logs being more available to burn and burning for longer and creating new risks.

Widespread and persistent smoke was another key feature of this season. The smoke also created additional challenges for fire fighting. For example, it made it difficult for aircraft with linescanners to fly to track the fire edge, made it difficult to launch weather balloons, and complicated forecasting as the smoke layer prevented local heating and atmospheric mixing.⁶² Poor visibility due to smoke also significantly impeded aircraft access to firegrounds for aerial attack, remote area fire fighting team (RAFT) operations and reconnaissance.

These fire behaviours and their causes and contributing factors are described in the following sections.

⁶¹ NSW RFS (Rural Fire Service). (2020). *Advice to the Inquiry provided 22 July 2020*.

⁶² NSW RFS (Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

2.2 WHY DID THE FIRES BURN LIKE THIS IN THE 2019-20 SEASON?

This section examines the causes and contributing factors to the large area burnt by the fires, the long season, the large number of fires running at the same time, the intensity of the fires and the extreme fire behaviour experienced.

Key points

In summary, these fires were so large, intense, simultaneous and hard to suppress because:

- the available fuel was extremely dry due to prolonged and widespread drought
- the dryness of the fuel meant that lightning was very effective in starting new fires, often in remote areas
- NSW experienced repeated, extremely bad fire weather days, and nights were often hot with low humidity
- many fires exhibited extreme, dynamic behaviours and there was an unprecedented number of fire-generated thunderstorms
- ember spotting was very intense and embers were thrown a long way causing more fires to start
- it was at times challenging to detect and extinguish new ignitions quickly in remote areas where they started
- as fires took hold there was a lot of smoke and consequently it often became impossible to know where the fire edge was with precision because linescanner aircraft could not fly and alternate infra-red scanning was of low resolution or unavailable. This made fire fighting more difficult, and so fires got bigger
- as more fires took hold up and down the State, resources were more stretched, so there were fewer fire fighting resources available for each fire and they got worse
- there was very limited capacity to fight fires at night and many of the fires took big runs at night and in the early morning.

It is important to understand the dimensions of what made this season different to what we have seen before. As described in the previous section, the key characteristics of this fire season that added up to it being so serious were:

- the extremely large scale of the area that burnt
- the intensity of the fires in some areas, and the rapid and sometimes unpredictable way that they spread during 'blow up' days (and nights in some cases)
- the unusual number of fire-generated thunderstorms
- the large number of fires burning simultaneously across NSW (and Victoria and Queensland) over a long fire season that started early in the north of the State
- the large number of ignitions that occurred in remote, rugged terrain, some of which were very challenging to extinguish early.

The Inquiry has examined the causes and contributing factors that led to this happening. This section examines the four key ingredients for serious fire, all of which were present this fire season. These ingredients are:⁶³

- spatially continuous fuel
- the dryness of the fuel and its availability to burn
- weather conducive to fire spread (high temperatures, low humidity, wind)
- ignition sources.

Multiple factors all simultaneously acted in the same direction to amplify risk during the 2019-20 season.⁶⁴ The following sections cover each of these four ingredients in more detail.

2.2.1 The available fuel was very dry

Key points

- The available fuel was extremely dry and spatially contiguous through the forested regions of NSW stretching from Queensland to Victoria as a result of prolonged drought conditions.
- However, the severity of the drought meant that there was little grass fuel west of the divide, which reduced the risk in that part of the State.
- Several large-scale climate drivers may have contributed to this dryness which intensified in 2019 in the lead up to summer, in particular a strong and long-lived positive Indian Ocean Dipole and negative Southern Annular Mode.
- The dryness of the landscape was also influenced by reduced cool season rainfall and other long-term climate trends.

Nolan, Boer, Collins, Resco de Dios, Clarke, Jenkins and Bradstock (2019) explain that in ecosystems like the temperate Australian forests that dominate eastern NSW, there are always spatially continuous areas of fuel (vegetation), except for a few years after fire or other changes where the fine fuel loads (like leaf litter) may be reduced.⁶⁵

Therefore, the second ingredient of serious fire – fuel dryness – is a key determinant of whether large bush fires occur in this region in a given year.⁶⁶

2.2.1.1 The NSW landscape was incredibly dry in the lead up to the season

Most of NSW was into its third year of severe drought. Therefore, vegetation and soil were very dry across most of NSW. The Bureau of Meteorology (BoM) has advised the Inquiry that the drought leading up to the 2019-20 fire season was exceptional in terms of its:

- severity as indicated by extreme rainfall deficiencies
- spatial extent which covered almost all of NSW
- duration of multiple years of low rainfall without relief.⁶⁷

⁶³ Nolan et al (2020) 1039-1041.

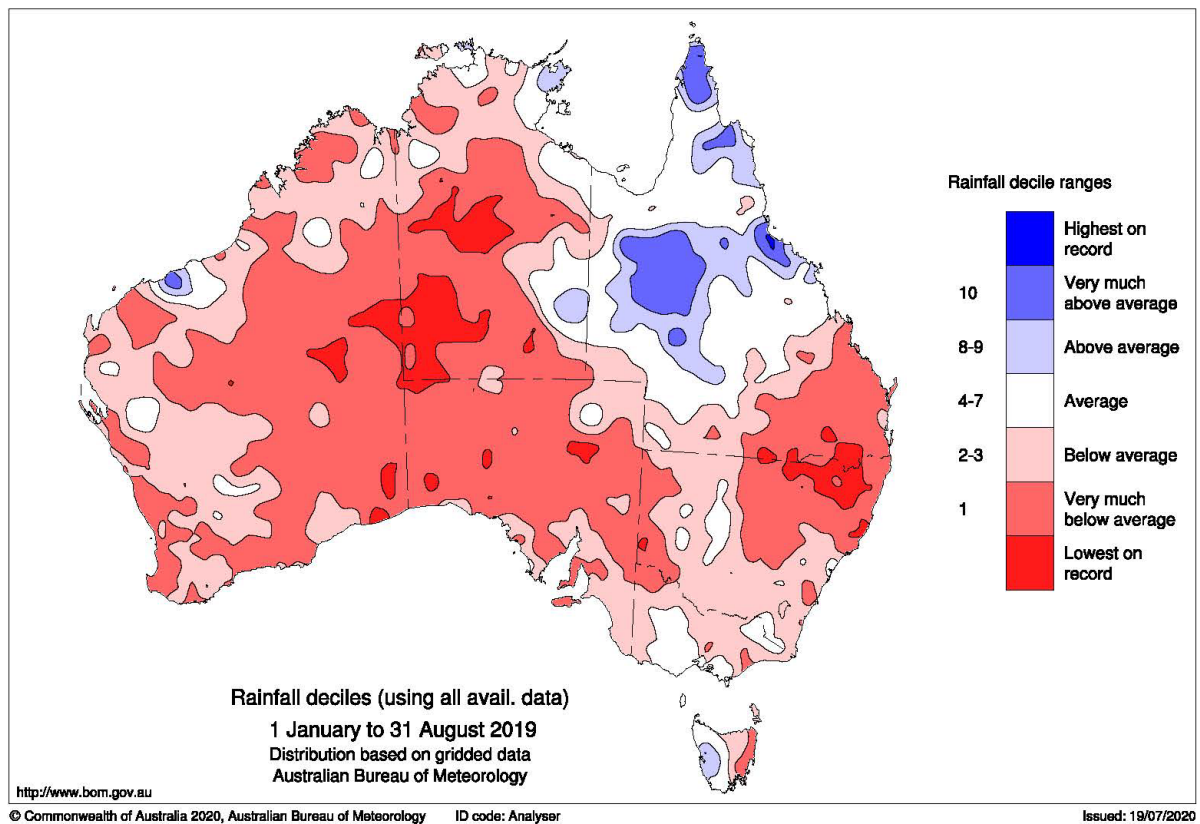
⁶⁴ Meeting with Professor Andy Pitman on 7 February 2020.

⁶⁵ Nolan et al (2020) 1039-1041.

⁶⁶ Ibid.

⁶⁷ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 25 May 2020*.

NSW experienced both its hottest and driest year on record in 2019.⁶⁸ Figures 2-5 and 2-6 show that the conditions immediately leading up to and during the 2019-20 fire season exhibited very low rainfall and higher than average temperatures.



⁶⁸ Ibid.

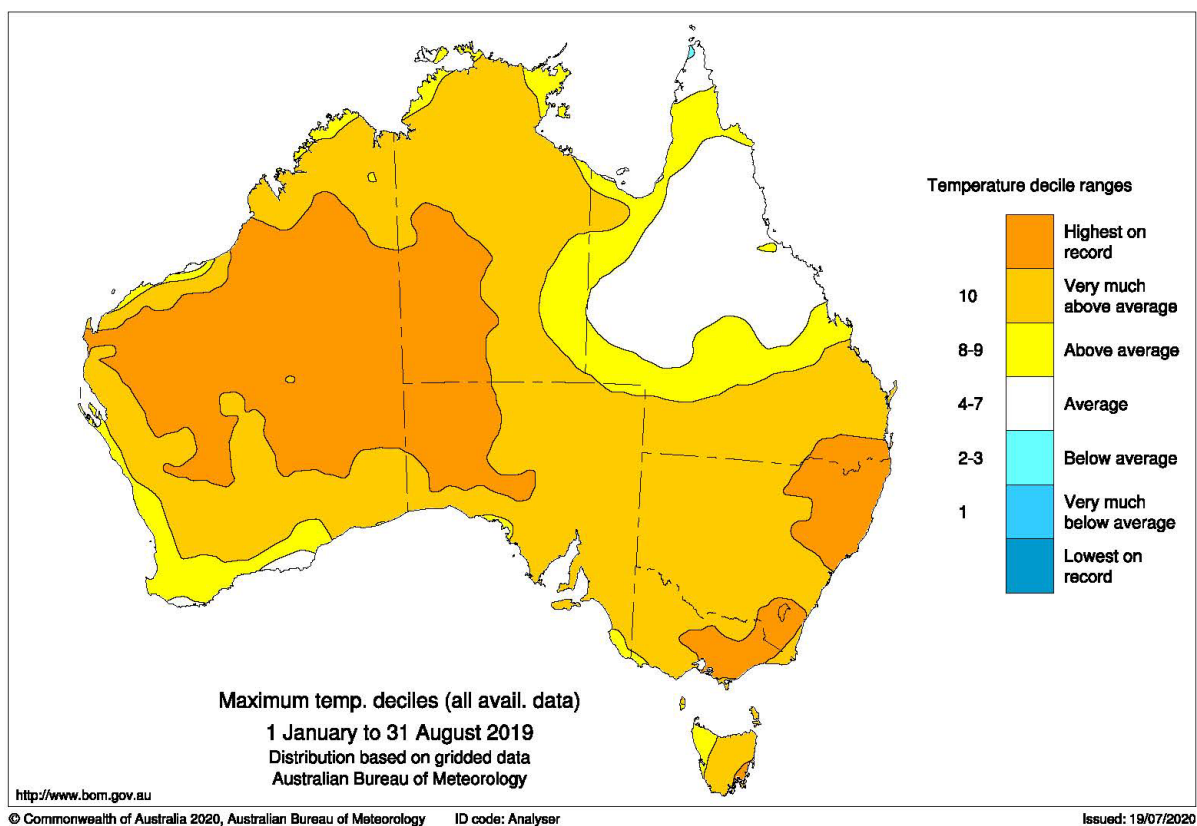
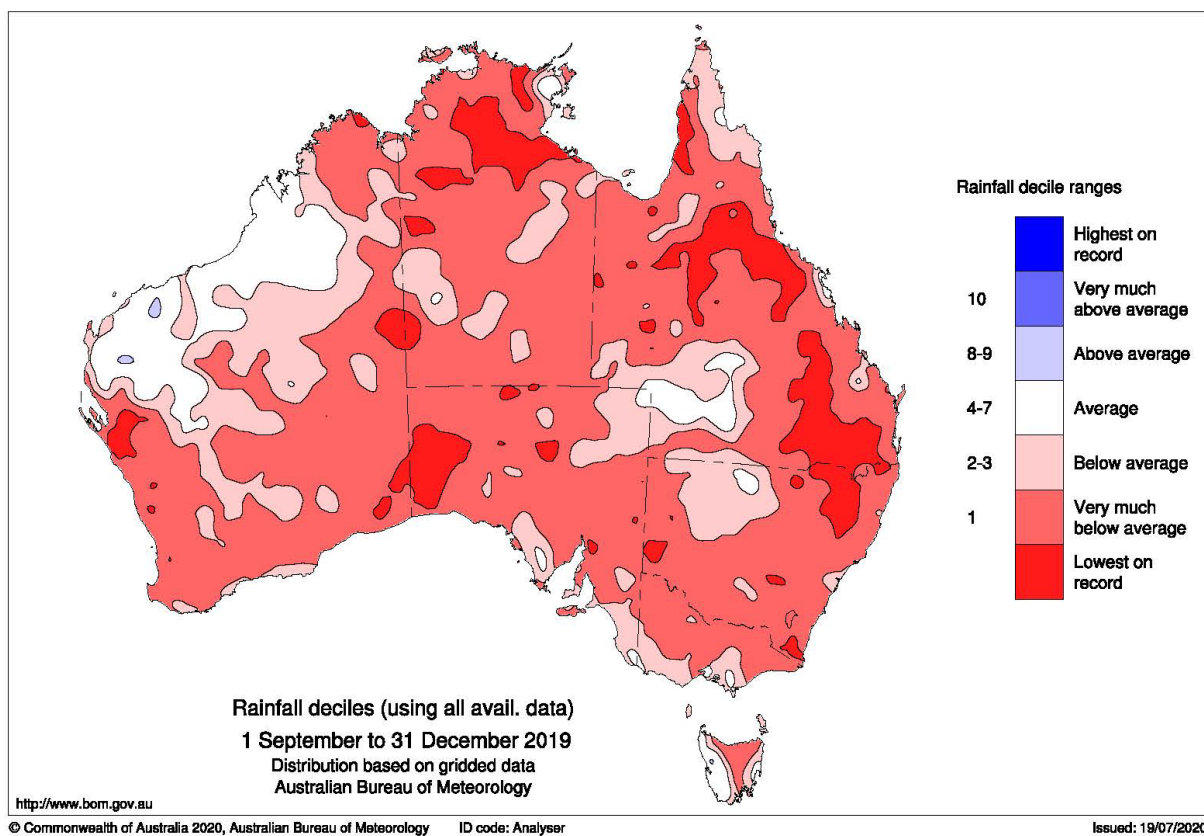


Figure 2-5: Rainfall and temperature deciles from January-August 2019 (prepared by BoM).



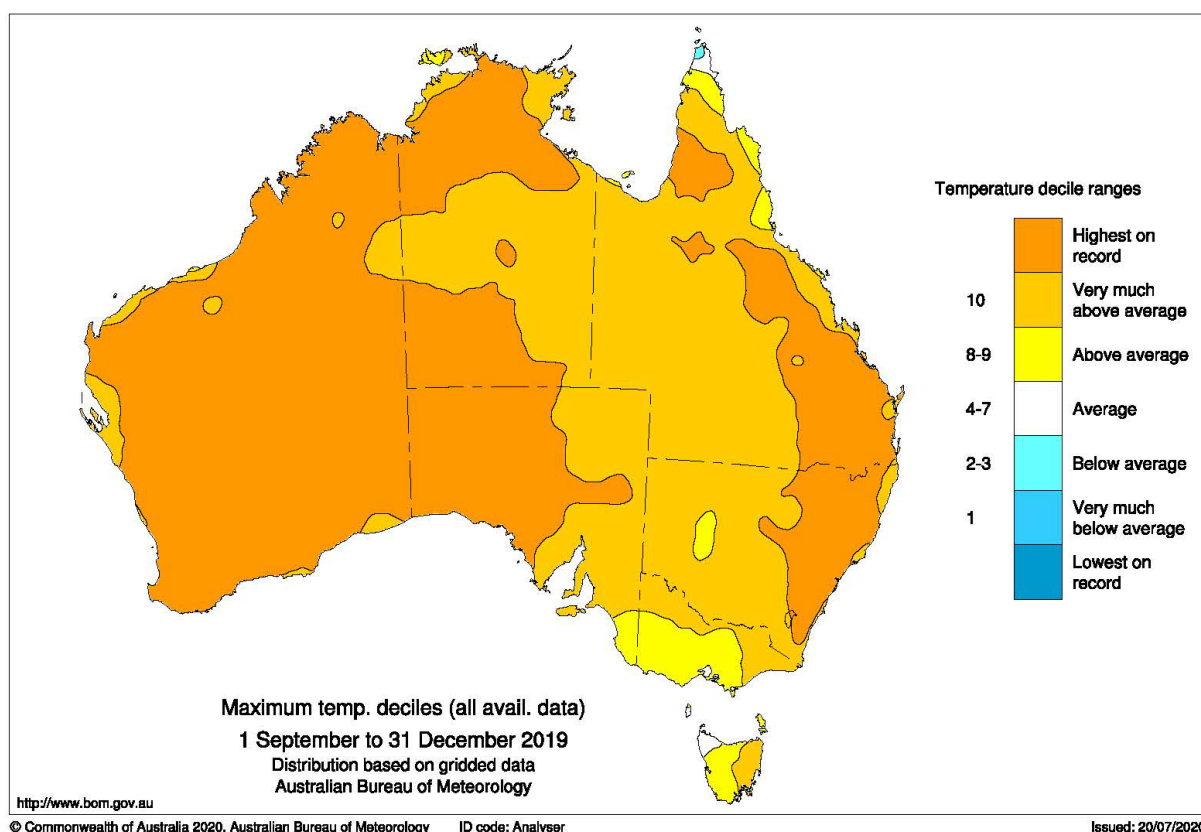


Figure 2-6: Rainfall and temperature deciles from September-December 2019 (prepared by BoM).

For historical context, the BoM indicated that the rainfall deficiencies of the recent drought are comparable with the multi-year Federation and World War II droughts. But the BoM also pointed out that the recent drought coincided with the warmest period on record.

The BoM has highlighted that the combination of rainfall and maximum temperatures for NSW in 2019 makes that year a significant outlier for high temperature and low rainfall and that the combination of record low rainfall and high temperatures resulted in “prolonged and record-breaking 12-month drought factors”.⁶⁹

The BoM analysed the Keetch-Byram Drought Index (KBDI) as a function of the daytime maximum temperatures over a calendar year for NSW (Figure 2.7). The Keetch-Byram Drought Index provides an estimate of soil dryness.⁷⁰ This analysis shows 2018 and 2019 as significant outlier years for heat and low rainfall.

⁶⁹ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 25 May 2020*.

⁷⁰ The Keetch Byram Drought Index estimates moisture deficiency and indicates the amount of rainfall needed to return soil to saturation.

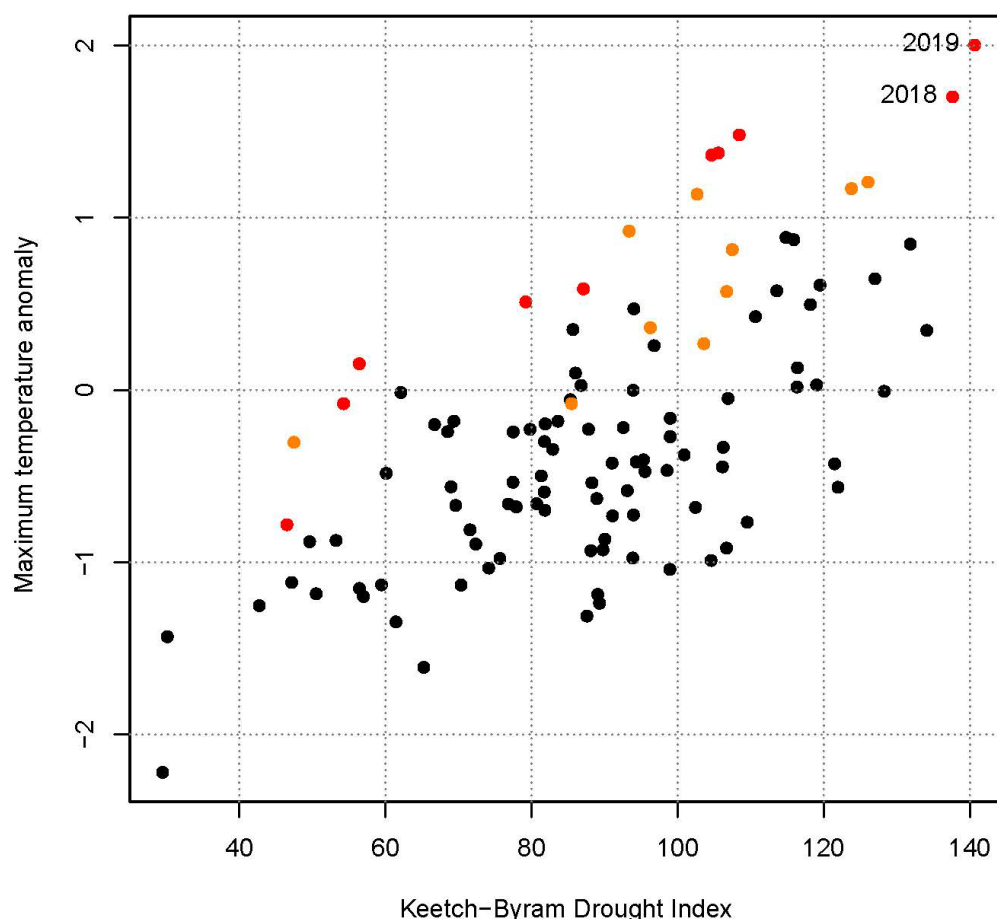


Figure 2-7: Scatter plot of annual Keetch-Byram Drought Index (KBDI, horizontal axis) versus annual maximum temperature anomaly (vertical axis, anomaly base period 1981-2010) with 2000 to 2009 shown in orange and 2010 to 2019 in red (prepared by BoM).⁷¹

2.2.1.1.1 Has the landscape been this dry before?

The Research Hub examined the question of whether fuel dryness in NSW was unprecedented leading up to and during the 2019-20 bush fire season. Looking at three metrics of fuel dryness – (i) vapour pressure deficit, (ii) dead fuel moisture content, and (iii) live fuel moisture content – this study showed that, across the fire affected areas of NSW leading up to and during the fire season, conditions were either very much drier than average, or the driest on record.⁷²

The study concludes that it is likely the unprecedented fuel dryness across eastern NSW, particularly in December 2019, contributed to the large extent of area burnt in the 2019-20 bush fire season. It also supports other observations that the 2019-20 bush fire season started earlier, as 2019 had more days where dead fuel moisture content was in a critically dry state than at any time since 1950.

The broad, landscape-scale dryness meant that the ‘wet barriers’ in the landscape were generally dry too. Boer et al (2020)⁷³ have written about the 2019-20 fires, observing that fires in eucalypt forests propagate primarily through the litter layer, and it is the dryness of

⁷¹ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 25 May 2020*.

⁷² NSW Bushfire Risk Management Research Hub (2020) ‘Fuel dryness’.

⁷³ Boer et al (2020) 171–172.

this fuel that effectively acts as the ‘on/off switch’ for fire. They also observe that this season, the naturally occurring firebreaks – often referred to as ‘soft breaks’ among fire fighters – such as moist gullies, swamps or south-facing slopes, that normally break up the forest landscape, were dry because of the severe drought, which greatly increased the probability of “mega forest fire events”.

The Inquiry’s discussions with fire authorities confirmed this on the ground. Areas that would have usually been used to ‘pull up’ a fire because they were wetter, for example a water course or moist gully, were dry and couldn’t be used as a containment option as they usually would have been.

The analysis from Boer et al (2020) shows that predicted litter moisture content (i.e. dead fuel moisture content) across the temperate broadleaf forests was at record low levels and the total area exceeding critical flammability thresholds was larger and more prolonged than at any time in the last 30 years.

2.2.1.2 Limited grass fuel west of the divide confined high risk areas to the forested regions on and east of the range

The prolonged and extensive drought had the effect of reducing the available grass load west of the divide. This reduced the bush fire risk in the west of the State compared with the forested regions of the NSW Great Dividing Range through to the coast. This can be seen in the Bushfire and Natural Hazards CRC pre-season outlook map from August 2019 which showed ‘normal fire potential’ risk for most of the western parts of the State – noting that “while grassy vegetation is cured, it is below average in quantity or load”.⁷⁴

From a fire management perspective this season, it was fortunate that fire authorities and communities were not battling grass fires across western NSW at the same time as they were confronting the rolling series of fires running north to south down the divide and east towards the coast.

2.2.1.3 Rainfall in early spring around Sydney may have reduced risk to the cities

As already noted, major population centres were spared from direct bush fire threat, although there were significant health impacts from persistent smoke.

Generally, urban areas and their surrounds are better monitored because there are more people, so that new ignitions are detected early. Fire and Rescue NSW resources are available throughout the cities to respond quickly, and resources from other agencies are more concentrated in and around urban areas. There are also generally fewer ignitions from lightning closer to the coast.⁷⁵

There were significant rain events around and north of Sydney on 30-31 August and 17-19 September 2019 which may have reduced the fire risk in those areas through September and October, typically the peak of the Sydney-region fire season.⁷⁶ However, the BoM notes that the August and September rainfall is unlikely to have made much difference to fire

⁷⁴ Bushfire & Natural Hazards CRC. (2020). Australian Seasonal Bushfire Outlook: August 2019 Hazard Notes. Retrieved from <https://www.bnhcrc.com.au/hazardnotes/63>.

⁷⁵ Penman, T, Bradstock, R & Price, O. (2013) Modelling the determinants of ignition in the Sydney Basin, Australia: Implications for future management. *International Journal of Wildland Fire* 22: 469-478. doi 10.1071/WF12027.

⁷⁶ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 25 May 2020*.

weather in December, which is evidenced by major fires occurring in the Blue Mountains in December after experiencing above average rainfall in September.⁷⁷

2.2.1.4 Some large-scale climate drivers contributed to this dryness, which intensified in the lead-up to summer

As the BoM informed the Inquiry, there are several climate variables that increase the risk of a bad fire season. Two phenomena – or modes of climate variability – in particular have been highlighted as key contributors to the intensifying dry conditions in the lead-up to the 2019-20 fire season: a strong and long-lived positive Indian Ocean Dipole and a negative Southern Annular Mode associated with a sudden stratospheric warming event.

2.2.1.4.1 Positive Indian Ocean Dipole

The Indian Ocean Dipole (IOD) is a key driver of Australia's climate. The IOD refers to changes in sea surface temperatures between the western and eastern Indian Ocean, which influence temperatures and rainfall patterns in Australia.⁷⁸ A positive IOD tends to bring drier and warmer than average conditions to central and south-eastern Australia during winter and spring, and the IOD in its negative phase typically brings wetter than average conditions.⁷⁹

There was a strong positive, relatively long-lived Indian Ocean Dipole (IOD) from May-December 2019. The IOD was also positive in 2018, and at near record intensity in 2019 (see Figure 2-8).

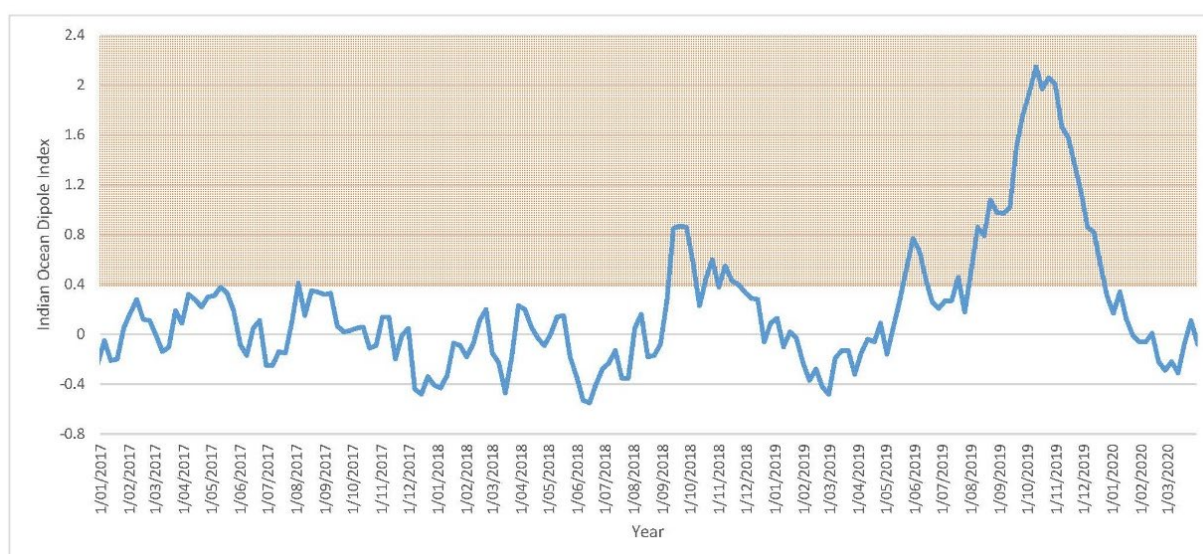


Figure 2-8: Status of Indian Ocean Dipole through 2017- early 2020. This shows a weak/marginal positive IOD in 2018, followed by a very strong and long-lived positive IOD in 2019. A positive IOD phase is indicated by a sustained period of index values above +0.4 (prepared by BoM).⁸⁰

IOD events typically end (decay) when the monsoon arrives in the southern hemisphere at the end of spring. The BoM advised that the 2019 event was very long-lived. The event was

⁷⁷ Ibid.

⁷⁸ BoM (Bureau of Meteorology). (2020). Indian Ocean influences on Australian climate. Retrieved from <http://www.bom.gov.au/climate/iod/#tabs=Indian-Ocean-climate-drivers>.

⁷⁹ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 25 May 2020*.

⁸⁰ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 12 March 2020*.

so strong that it acted to delay the retreat of the monsoon from India and into the southern hemisphere by about four weeks.⁸¹ The arrival of the Asian monsoon into the area around and south of the Indonesian archipelago typically reverses the winds and breaks down the IOD circulation.⁸²

There has been research into the relationship between positive IOD events and fires in Victoria. Black Saturday 2009 and Ash Wednesday 1983 were both preceded by a positive IOD event.⁸³ Cai, Cowan and Raupach (2009) showed that 11 of 21 significant bush fire seasons across Victoria since 1950 were preceded by a positive IOD (out of a total of 16 positive IODs in the same period). Both Ash Wednesday and Black Saturday occurred amid serious droughts, and Black Saturday was preceded by severe and prolonged drought, rainfall deficits and an unprecedented string of positive IOD events.⁸⁴

While the IOD is certainly not the direct cause of the 2019-20 fires, it is quite possible that it played a role in preparing the landscape for fire.

2.2.1.4.2 Sudden Stratospheric Warming and negative Southern Annular Mode

There was a combination of negative Southern Annular Mode (SAM) and a Sudden Stratospheric Warming event from October to December 2019.⁸⁵

A negative SAM is a large-scale mode of weather and climate variability associated with a shift in the atmospheric pressure patterns across the Southern Hemisphere. A Sudden Stratospheric Warming is a more irregular phenomenon where temperatures in the stratosphere above the south pole heat rapidly. The effect of both these events, individually, is to push the westerly winds that circle the Antarctic continent over the Southern Ocean further towards the equator. In general, this leads to a greater predominance of westerly winds over the southern half of Australia. When these two phenomena are combined, they can cause a prolonged northward shift in the belt of westerly winds. A negative SAM event alone usually only lasts a couple of weeks.⁸⁶

SAM in a negative phase in spring and summer generally leads to a decrease in rainfall and increase in westerly winds from inland Australia. These conditions can greatly increase fire danger ratings in NSW and south-east Queensland.⁸⁷

The Sudden Stratospheric Warming event that began in August 2019 was the strongest in the southern hemisphere since 2002, and contributed to a prolonged negative SAM event lasting from October to December 2019 inclusive.⁸⁸

The resulting predominance of westerly winds over Australia throughout spring, combined with a very dry interior of eastern Australia as a result of protracted drought, played a crucial role in further drying the landscape and increasing fire danger over eastern regions of

⁸¹ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 25 May 2020*.

⁸² Ibid.

⁸³ Cai, W, Cowan, T, & Raupach, M. (2009), Positive Indian Ocean Dipole events precondition southeast Australia bushfires, *Geophys. Res. Lett.*, 36, L19710, doi:10.1029/2009GL039902.

⁸⁴ Cai et al (2009).

⁸⁵ BoM (Bureau of Meteorology). (2019). The air above Antarctica is suddenly getting warmer – here's what it means for Australia. Retrieved from <http://www.bom.gov.au/climate/updates/articles/a035.shtml>.

⁸⁶ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 22 July 2020*.

⁸⁷ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 12 March 2020*.

⁸⁸ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 25 May 2020*.

NSW.⁸⁹ The BoM advised that the two phenomena combined “produced an intense period of low rainfall and above average temperatures with consecutive heatwaves over parts of eastern Australia in late 2019”.⁹⁰

Lim, Hendon, Bosch, Hudson, Thompson, Dowdy and Arblaster (2019)⁹¹ have shown that the likelihood of conditions that contribute to fire risk in central NSW was significantly higher in years with a Sudden Stratospheric Warming event (including the previous strongest event in 2002). Further, Harris and Lucas (2019)⁹² have also shown that, for the central coast, the negative SAM is the primary influence of elevated fire weather (as measured by the Forest Fire Danger Index (FFDI))⁹³ in late winter and spring, and has a greater influence in that region than the IOD (or the El Niño/Southern Oscillation).⁹⁴

However, the BoM explained that, when multiple phenomena that are associated with drier conditions across eastern Australia are coincident (or in phase), they can reinforce the effects.⁹⁵

2.2.1.4.3 Other drivers

In addition to the IOD and the SAM, the El Niño/Southern Oscillation (ENSO) is a third key climate phenomenon that influences rainfall in NSW.

As well as experiencing the climate modes that are associated with below average rainfall, we were also (and still are) experiencing a long period of time without seeing the climate modes that are associated with wetter than average conditions – a negative IOD or a La Niña – both of which are associated with wetter conditions in south-east Australia.⁹⁶

In the lead-up to the bush fires, the El Niño/Southern Oscillation (ENSO) was neutral – which means we were not experiencing either El Niño (generally drier) or La Niña (generally wetter) conditions.

So, in the lead-up to the 2019 fires, we experienced climatic drivers that increase likelihood of dry conditions (i.e. the positive IOD and negative SAM), as well as a long period of time since a negative IOD phase or a La Niña which would be associated with wetter conditions. As observed by Professor Andy Pitman “neither the IOD or ENSO are hard core predictors of Australian rainfall but they do weight the dice to change the probability of significant rainfall”.⁹⁷

King, Pitman, Henley, Ukkola and Brown (2020)⁹⁸ highlight the importance of accurate projections of future frequency of La Niña and negative IOD events (the events that should

⁸⁹ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 12 March 2020*.

⁹⁰ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 25 May 2020*.

⁹¹ Lim, E, Hendon, H, Bosch, G, Hudson, D, Thompson, D, Dowdy, A, & Arblaster, J. (2019). Australian hot and dry extremes induced by weakenings of the stratospheric polar vortex. *Nature Geoscience*. doi 10.1038/s41561-019-0456-x.

⁹² Harris, S, & Lucas, C (2019) Understanding the variability of Australian fire weather between 1973 and 2017. *PLOS ONE* 14(9): e0222328. doi: 10.1371/journal.pone.0222328.

⁹³ Explained at 2.2.3.1.1 below and also in Chapter 3.

⁹⁴ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 25 May 2020*.

⁹⁵ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 22 July 2020*.

⁹⁶ King, A, Pitman, A, Henley, B, Ukkola, A, & Brown, J. (2020). The role of climate variability in Australian drought. *Nat. Clim. Chang.* 10, 177–179. doi: 10.1038/s41558-020-0718-z.

⁹⁷ Professor Andy Pitman. (2020). *Advice to the Inquiry provided 2 July 2020*.

⁹⁸ King et al (2020) 177–179.

bring rain to break dry conditions) to understand risks of climate change to future bush fire risk.

2.2.1.5 We are seeing trends of reduced cool season rainfall and higher temperatures

The variables described in the previous sections were acting on top of longer-term observed background trends of higher temperatures in Australia and reduced cool season rainfall. The BoM indicates that long-term trends in key climate variables (rainfall and temperature) have increased the tendency for dry and warm winter and spring conditions over south-east Australia.⁹⁹

CSIRO reports that Australian's mean annual temperature has increased by almost 1.5C since 1850,¹⁰⁰ along with reduced rainfall across the southern half of the continent. This warming is predominantly due to changes in climate associated with increased greenhouse gases in the atmosphere.¹⁰¹ The *State of the Climate 2018* report shows a decline of around 11% in April-October rainfall in the south-east of Australia since the late 1990s.¹⁰²

Overall higher temperatures acting over a long time period (not just during the fires) also have the effect of increasing the growing season due to warmer winters with clearer skies, which all increases evaporation. This increases the risk that we begin spring with a drier landscape.¹⁰³

These trends, combined with the positive IOD and negative SAM in the lead-up to the 2019-20 fire season, provided the antecedent conditions for very high fire danger by drying out the landscape.

2.2.1.6 Were conditions similar in the lead up to other bad fire seasons?

As explained through this section, the conditions in the lead-up to the 2019-20 season were influenced by a long and widespread drought, long-term trends towards drier conditions in winter and spring in south-east Australia, variability in key climate drivers (the IOD and SAM), and a sudden stratospheric warming event which all acted to dry the NSW landscape.

The BoM noted that each of those factors alone would increase fire risk in any season, and in combination they amplified the chances of a high-risk fire season in 2019-20.¹⁰⁴

The BoM explained that the common factor leading into most severe fire seasons is low rainfall, and that this is the driving factor independent of the key variables like sudden stratospheric warming events, or record-breaking IOD/El Niño Southern Oscillation.

The BoM noted that in 2009, ahead of the Black Saturday bush fires, seasonal drivers had a weak influence, but antecedent conditions were very dry due to the prolonged Millennium

⁹⁹ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 25 May 2020*.

¹⁰⁰ CSIRO (Commonwealth Scientific and Industrial Research Organisation) (2020). Response to Notice to Give Information 21 April 2020 for the Royal Commission into National Natural Disaster Arrangements. Retrieved from <https://naturaldisaster.royalcommission.gov.au/system/files/exhibit/CSI.500.001.0001.pdf>.

¹⁰¹ Ibid.

¹⁰² BoM (Bureau of Meteorology) and CSIRO (Commonwealth Scientific and Industrial Research Organisation). (2018). *State of the Climate 2018*. Retrieved from <http://www.bom.gov.au/state-of-the-climate/State-of-the-Climite-2018.pdf>.

¹⁰³ Professor Andy Pitman. (2020). *Advice to the Inquiry provided 7 February 2020*.

¹⁰⁴ BoM (Bureau of Meteorology). (2020). *Advice provided to Inquiry 25 May 2020*.

Drought.¹⁰⁵ It explains that the closest analogue to the 2019-20 fire season occurred in 2002-03, when long term drought, an El Niño event and a sudden stratospheric warming event were precursors, and this was the season of the disastrous Canberra fire of January 2003.

¹⁰⁵ Ibid.

2.2.2 Was there too much fuel?

Key points

- The Inquiry heard significant concern from the community that too much fuel had been allowed to accumulate in the landscape, and that there was inadequate hazard reduction burning undertaken to manage fuels.
- Recent analysis shows that fuel loads were generally high across most of the fire affected areas of NSW. However, fuel levels were on average no higher than they have been for the last 30 years. The dryness of the fuel and therefore its availability to burn appears to have been the dominant contributing factor.
- In some circumstances, areas that had been recently burnt for hazard reduction purposes were helpful to buy more time and create other options for containment, while in others the fuel reduction treatments had no influence over the spread or intensity of the bush fire.
- The results of initial analyses of data from the 2019-20 season indicate that more work is needed to understand fully the role that fuel amount and structure played in the 2019-20 season, and the extent to which some traditional assumptions may need to be re-examined.

It is clear to the Inquiry that many in the community hold the view that high fuel loads and a perceived lack of hazard reduction activities to reduce fuel loads over decades were major contributing factors to the number of fires, their ability to spread and their intensity.

To inform the Inquiry on this issue, the Research Hub prepared estimates of fuel load across the fire affected areas of NSW, based on fire history datasets and fuel accumulation curves. This work examined different fuel layers – surface fuels (e.g. leaf litter), elevated fuels (e.g. shrubs) and bark fuels.

This analysis found that fuel loads at the start of the 2019-20 season were generally similar to the average fuel loads since 1990, with the exception of the Australian Alps bioregion where fuel loads had been reduced by the large bush fires in 2003 (Figure 2-9). The work also examined fuel loads within the ‘wildland urban interface’ – the areas between native vegetation and communities. This showed a similar trend to fuels across the regions more broadly, and that fuel loads within the interface zones were similar, or slightly higher, than those estimated across the larger region.¹⁰⁶

¹⁰⁶ NSW Bushfire Risk Management Research Hub (2020) ‘Fuel hazard’.



Figure 2-9: Mean estimated a) surface fuels, b) elevated fuels, c) bark fuels for 1 July each year across the fire affected regions (prepared by NSW Bushfire Risk Management Research Hub).¹⁰⁷

This research also categorised the state of the fuel hazard from 'low' to 'extreme' (using an indicative classification)¹⁰⁸ finding that:

- surface fuel hazards were on average categorised as 'high' to 'very high'
- elevated fuel hazards were on average categorised as 'moderate' to 'high'
- bark fuel hazard ratings were on average categorised as 'moderate' to 'very high'.¹⁰⁹

Similar ratings were found to apply in the wildland urban interface zones.

The Inquiry notes that these analyses provide an insight into likely fuel loads in the lead-up to the 2019-20 season at a broad spatial scale, and therefore cannot account for particular observations community members may have made about the state of local forests in their

¹⁰⁷ Ibid.

¹⁰⁸ NSW Bushfire Risk Management Research Hub citing Hines, F., Tolhurst, K.G., Wilson, A.A.G. and McCarthy, G.J., 2010. Overall Fuel Hazard Assessment Guide, 4th edition, Fire and Adaptive Management Report no. 82. In: Department of Sustainability and Environment (Editor), East Melbourne.

¹⁰⁹ NSW Bushfire Risk Management Research Hub (2020) 'Fuel hazard'.

area. The analysis also does not examine the role of fuel on fire behaviour for any particular fire.

However, it does allow us to see that fuel loads were, in general and on average, no higher than for other seasons since 1990, which suggests that the large scale of the fires was likely influenced more heavily by the dryness of the fuel and its availability to ignite and burn (discussed in section 2.2.1) and other factors including weather.¹¹⁰

2.2.2.1 Fuels on different types of land

Another common theme in the feedback to the Inquiry has been that fuel is managed better (or worse) on different types of land, with national parks in particular being criticised for 'locking up' land and allowing fuel to accumulate putting other landowners at risk, and that activity such as grazing should have been allowed in the parks to manage fuel loads.

The Research Hub examined this question using the Bees Nest fire in northern NSW as a case study to see whether aspects of fuel structure in forests – in terms of its cover and vertical connectivity – differed between different tenures: conservation estate (national park and State conservation area), State forest and privately owned land.¹¹¹ These aspects of fuel cover and vertical connectivity are the factors considered likely to influence the likelihood of high intensity crown fires occurring.

The analysis used airborne LiDAR imagery to look at vegetation cover of the understorey (0.5-5 m height), lower canopy (5-15 m height) and upper canopy (greater than 15 m height).

In summary, this analysis showed that fuel cover and vertical connectivity between fuel levels were similar across different land tenures, and that there was no clear influence from inferred different management practices (for example, logging in State forests or grazing on private land) on the fuel properties of the forests on different land tenures. Therefore, in this case study area in northern NSW, the resultant bush fire hazard may have been similar across land tenure and the forest flammability (represented by measures of fuel structure) did not appear to have been significantly influenced by different land management regimes.

The Inquiry notes that this work is only one case study and, as noted in the Research Hub's report, relies on certain assumptions about management practices on the different tenures, and does not exclude the possibility that variations in logging and livestock grazing practices (e.g. different harvesting treatments, stocking rates etc.) could result in different results, or that different forest types might respond differently.¹¹²

However, as an initial case study, this points to some important issues that should be examined further in a more detailed investigation of the information generated from the 2019-20 fires across NSW.

2.2.2.2 Would more hazard reduction have helped?

Related to this is the issue of hazard reduction, which was a very clear theme in discussions with the community and in the media during and after the bush fire season. There was a

¹¹⁰ Ibid.

¹¹¹ NSW Bushfire Risk Management Research Hub (2020) 'Influence of tenure on forest vegetation structure'.

¹¹² Ibid.

strong sentiment in many communities that not enough had been done to reduce fuels in the landscape through hazard reduction, and prescribed burning in particular.

Generally, hazard reduction can be described as any activity to reduce the amount of or change the structure of fuels in order to alter and diminish the rate of spread, intensity and severity of unplanned fires, and increase opportunities for safe and effective suppression.

The Inquiry looked at the question of whether hazard reduction had an influence on the progression of fires in the 2019-20 season. A more detailed examination of this topic is in Chapter 4; this section describes the issues at a high level.

The Inquiry discussed the question with Incident Management Teams across the State, and the feedback was similar:

- when the weather conditions were moderate, previously hazard-reduced areas helped to slow the fire, gave time to get other options in place, and were useful 'tie in' points for other containment options such as backburns or mechanical breaks.
- when the weather conditions were extreme, the fire ran straight through previously hazard-reduced areas and the amount or age of fuel did not have much influence on the fire spread.

For example, the National Parks and Wildlife Service (NPWS) and NSW RFS both referred to the case study of the Mount Solitary and Pitts Amphitheatre hazard reduction burns which were regarded as important in preventing the Ruined Castle Fire reaching villages in the Blue Mountains (see Box 2-2).

Box 2-2: Case study – hazard reduction and the Ruined Castle Fire (prepared by NPWS)¹¹³

The Ruined Castle fire burnt over 17,000 ha, including 15,000 ha of Blue Mountains National Park. Started by lightning, it burnt for 72 days between November 2019 and February 2020, threatening the Blue Mountains townships of Katoomba, Leura and Wentworth Falls as well as Sydney's drinking water catchment.

The Ruined Castle fire posed a significant threat to important tourism attractions such as Scenic World and Echo Point in Katoomba. Both places were closed for an extended period, significantly reducing tourist numbers over what would normally be the busy Christmas holiday season.

As part of its strategic hazard reduction program, NPWS completed two hazard reduction burns south of the townships – Pitts Amphitheatre (800 ha) in May 2016, and Mount Solitary (3,500 ha) in June 2018. Those hazard reduction burns were deliberately situated in known fire paths to protect community values and assets.

The objectives of the Pitts Amphitheatre hazard reduction were to:

1. reduce the spread of wildfires which may impact townships of Katoomba, Leura and Wentworth Falls
2. reduce the risk of wildfires affecting catchment raw water supply
3. reduce fuel loads along ridge lines down to mid slopes from high-very high to low-moderate.

Without those burns effectively reducing fuel in the fire's path, the Ruined Castle fire would most likely have impacted on residential properties and tourism infrastructure. The hazard reduction burns were used as part of the containment strategy that successfully prevented asset impacts, reduced firefighting requirements and decreased the risk to firefighters.

¹¹³ NPWS (National Parks and Wildlife Services). (2020). *Advice to the Inquiry provided 1 April 2020*.

Post-fire analysis of the Ruined Castle fire indicated the location of the hazard reduction burns (as shown in Figure 2-10) proved crucial in suppressing the fire and protecting property and tourism assets. It shows that whilst the Ruined Castle fire burnt into the fuel reduced area in places, these areas were largely rainforest that does not burn in the hazard reduction burns.

The Mount Solitary hazard reduction contributed to decreasing the fire's intensity and also protected environmental values of the national park, leaving a small but significant area of unburnt refugia. When the fire burnt into the hazard reduction area the fire behaviour and subsequent rate of spread was significantly reduced, providing firefighters with a strategic advantage in suppression efforts.

Without the suppression advantages provided by the hazard reduction, the Ruined Castle fire would have most likely continued to burn east and would have impacted on villages from Wentworth Falls to Glenbrook.

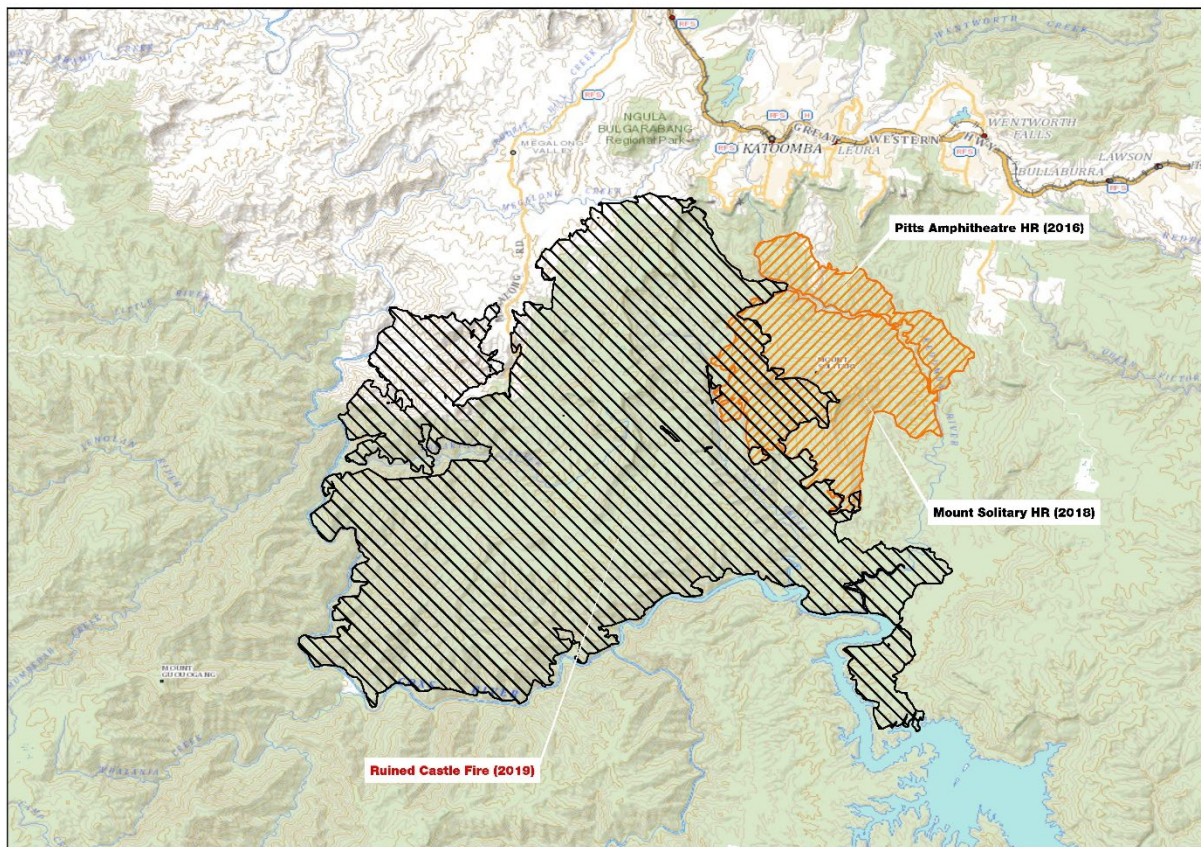


Figure 2-10: Ruined Castle fire in 2019 and hazard reduction burns in 2016 and 2018 (prepared by NPWS).¹¹⁴

On the other hand, firefighters also provided examples where recently burnt areas did little to slow the spread or severity of fire. For example, the area of the State Mine fire that burned very severely in 2013 reburned this season. While the State Mine fire was an unplanned fire (rather than an area treated with prescribed burning), the 2013 fire had the effect of significantly reducing fuel load due to the severity of the fire at that time. Under the conditions this season, the previous reduction in fuel did not slow or reduce the severity of

¹¹⁴ Ibid.

the subsequent fire six years on to the extent expected, given the size and severity of the previous fire.

Extensive literature also supports the observations of firefighters in the 2019-20 season – effectively, that over a certain level of fire weather, fuel load and fuel age does not have a significant influence on fire intensity or spread.

For example, analysis of the 2009 Black Saturday bush fires in Victoria showed that weather was the primary influence on fire severity and risk to property. The analysis also showed that, while low fuel ages reduced fire intensity in moderate fire weather conditions, it had no influence when the fire weather was Catastrophic, Very High or, the other end of the spectrum, Low.¹¹⁵ Penman, Christie, Andersen, Bradstock, Cary, Henderson, Price, Tran, Wardle, Williams and York (2011) also report that “simulation modelling indicates that fuel reduction has less influence than weather on the extent of unplanned fire”.¹¹⁶

In his submission, Professor Jason Sharples explains that it is critical to understand and create a distinction between “ ‘ordinary’ bushfires and extreme bushfires or bushfires exhibiting dynamic behaviours”, and provides a summary that “the weight of research into the effects of fuel reduction burning on the propagation of extreme bushfires, indicates that as conditions deteriorate, fuel reduction burning is of diminishing effectiveness, and may have no appreciable effect under extreme conditions”.¹¹⁷ These issues are discussed further in Chapter 4.

The Research Hub examined this question using data and satellite imagery from the 2019-20 season. In a study of fire severity in three case study fires (Gospers Mountain, Bees Nest and South Coast complex), this research informed a number of important observations.

Firstly, there was a greater area burnt at lower levels of severity inside areas that had been burnt by prescribed or unplanned fires within the last three years, compared with recently unburnt areas. However, in all three case-study fires, there were also large areas burnt in the high or severe categories within areas that had recently burnt. This suggests that, while past fire can help to reduce fire severity, it does not do this consistently and areas can burn again at high or severe levels despite recent fire.¹¹⁸

Further, the analysis showed that:

- some areas that had been burnt in the last three years (post 2017) appeared to act as a barrier to fire spread in 2019-20
- some recently burnt areas appeared to show reduced fire severity
- other recently burnt areas appeared to have no influence on fire severity.

In general, recent bush fires (unplanned fires) appeared to have a greater influence on preventing fire spread than recent prescribed burns, and while some recent prescribed fires

¹¹⁵Price, O & Bradstock, R. (2012) The efficacy of fuel treatment in mitigating property loss during wildfires: Insights from analysis of the severity of the catastrophic fires in 2009 in Victoria, Australia. *Journal of Environmental Management* 113:146-157. doi: 10.1016/j.jenvman.2012.08.041.

¹¹⁶ Penman, T, Christie, F, Andersen, A, Bradstock, R, Cary G, Henderson, M, Price, O, Tran, C, Wardle, G, Williams, R, & York, A. (2011) Prescribed burning: how can it work to conserve the things we value?. *International Journal of Wildland Fire* 20, 721-733.

¹¹⁷ Professor Jason Sharples, Submission to the Inquiry.

¹¹⁸ NSW Bushfire Risk Management Research Hub (2020) ‘Fire severity and past fire impact’.

had an influence on reducing fire severity, many had no obvious influence on fire severity. These effects are shown for the three case study areas in Figures 2-11, 2-12 and 2-13.

Overall, this work concluded that prescribed burns can reduce the severity of subsequent bush fires. However, “this effect is less than that of wildfires, it is short lived, and it is less effective under severe fire weather conditions”,¹¹⁹ findings that are consistent with much of the available literature.

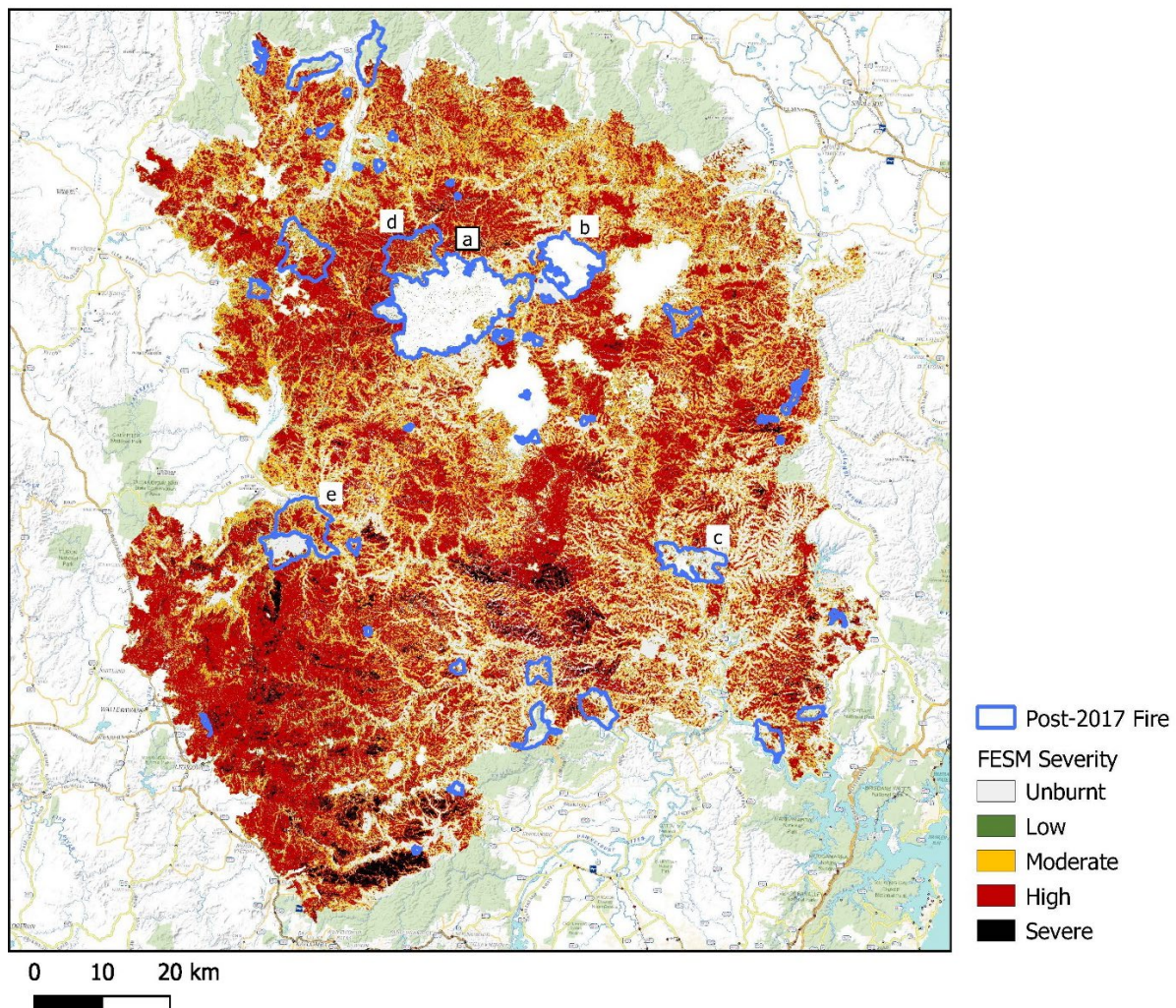


Figure 2-11: Gaspers Mountain fire severity, with post-2017 wildfires and prescribed burns indicated. Fires **a** and **b**, which were wildfires that occurred in early 2018, served to act as a barrier to or significantly reduce severity. Fire **c**, a 2017 prescribed burn, reduced severity overall but areas of high severity remained, while fires **d**, a 2019 prescribed burn and **e**, a 2017 prescribed burn appear to have little impact on severity in the 2019-2020 fire (prepared by NSW Bushfire Risk Management Research Hub).¹²⁰

¹¹⁹ Ibid.

¹²⁰ Ibid.

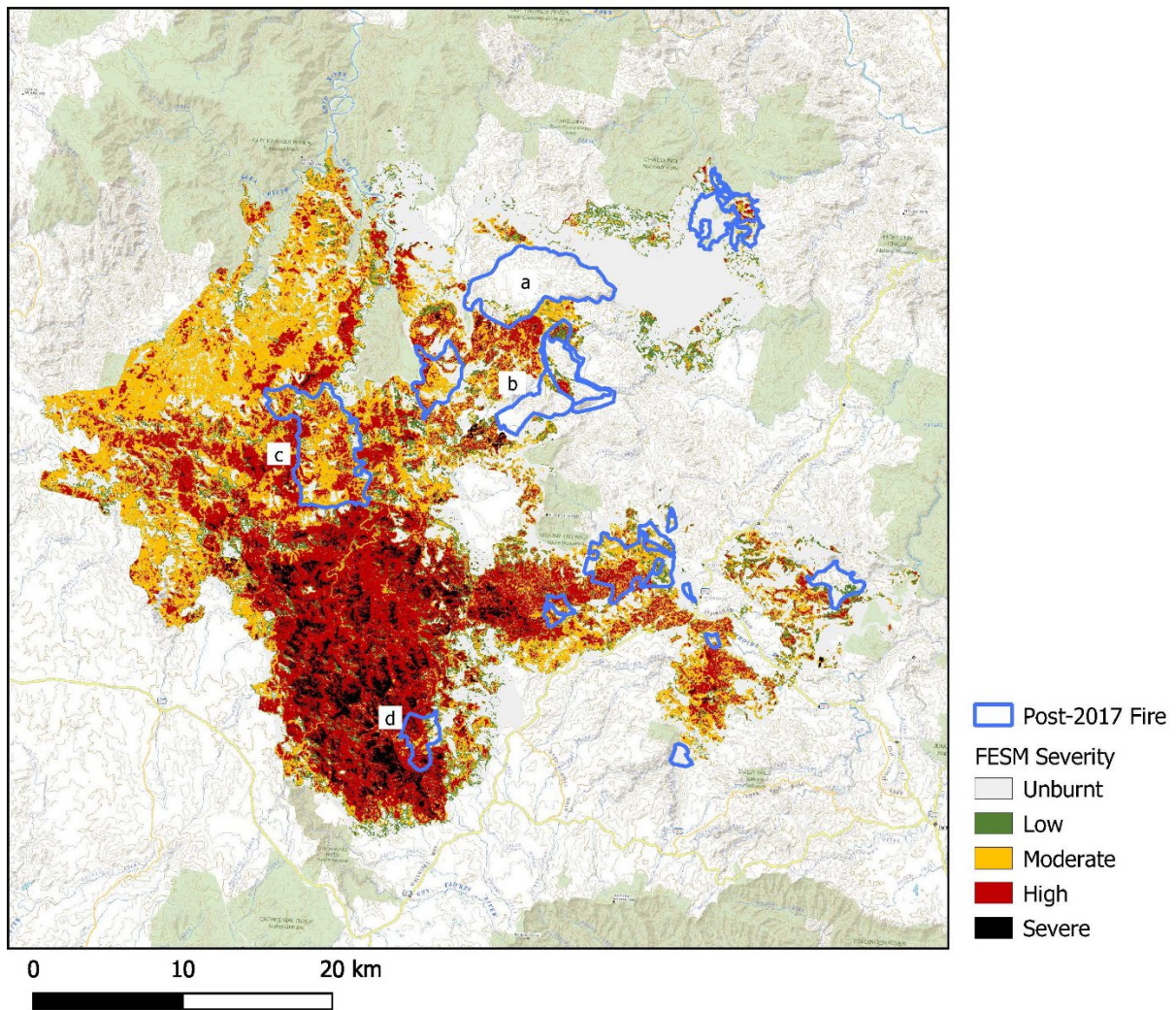


Figure 2-12: Bees Nest fireground fire severity, with post-2017 wildfires and prescribed burns indicated. Fires **a** and **b**, both wildfires from 2018, appear to act as barrier to fire spread. By comparison fire **c**, a wildfire from 2017, and fire **d**, a 2017 prescribed burn, did not appear to act as a barrier or reduce the severity of the 2019-2020 fire (prepared by NSW Bushfire Risk Management Research Hub).¹²¹

¹²¹ Ibid.

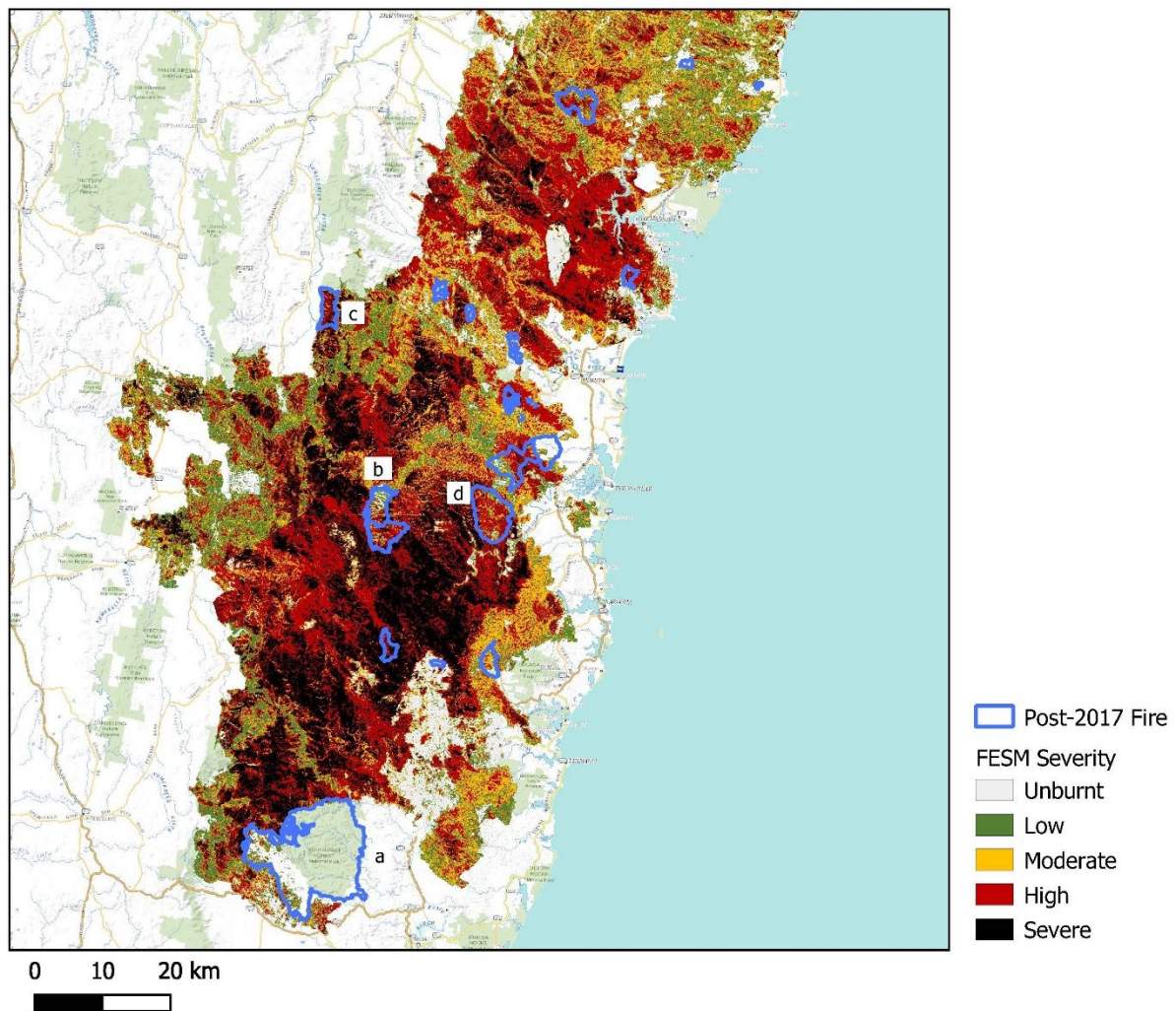


Figure 2-13: Southern portion of the South Coast fire complex fire severity, with post-2017 wildfires and prescribed burns indicated. Fire **a**, a wildfire from 2018, appears to act as a barrier to fire spread, with some patchy areas of low severity burnt within it. Fire **b**, a prescribed burn from May 2019, also appears to reduce severity, while fires **c**, a 2017 prescribed burn, and **d**, a 2018 prescribed burn, did little to reduce the severity of the 2019-20 fire (prepared by NSW Bushfire Risk Management Research Hub).¹²²

¹²² Ibid.

Another important question is whether fuel load or age had an impact on the number of successful ignitions. Certainly, dryness had an impact on the efficiency of ignitions by lightning (i.e. many lightning strikes resulted in ignitions because the fuel was so dry).

While this question cannot be answered with certainty for the 2019-20 season, research by Penman, Bradstock and Price (2013)¹²³ on the Sydney basin found that, on days of Severe or Extreme fire risk, with a Forest Fire Danger Index (FFDI)¹²⁴ value greater than 50, the likelihood of ignition in younger fuels (recently burnt areas) is still high. This work found that fuel reduction is likely to influence lightning ignitions on days with low values of the FFDI – however, it notes that days with low FFDI values are not the conditions when large, serious bush fires tend to occur.¹²⁵

2.2.2.2.1 What don't we know?

Based on the available evidence, the degree to which hazard reduction burning over a larger area in the lead up to the 2019-20 fire season would have limited the size of areas burnt, or the intensity of the serious fires which caused the most damage to towns and private property, is not yet fully understood or quantified.

The experience of the 2019-20 fire season, and the rapid analysis that has been done since the fires, has raised many questions about the role of fuel load, and the significance of fuel load and structure in fire spread and behaviour, especially under extreme fire weather conditions. Given that fuel loads were not necessarily higher in 2019-20 than they had been for the previous 30 years, we need to know more about the role that fuel loads may or may not have played in determining fire behaviour, severity and impacts on communities in individual fires.

We also need to know more about whether and to what degree (if at all) the outcomes from the season could have been different if fuels had been modified in different locations and at different spatial scales.¹²⁶ Answering these questions requires more detailed analysis and more time than was available to the Inquiry – nevertheless they are critical questions to answer to inform future fire risk mitigation priorities.

Hazard reduction practices and priorities for the future are discussed further in Chapter 4.

¹²³ Penman, T, Bradstock, R & Price, O. (2013) Modelling the determinants of ignition in the Sydney Basin, Australia: Implications for future management. *International Journal of Wildland Fire* 22: 469-478. doi 10.1071/WF12027.

¹²⁴ Explained at 2.2.3.1.1 below and also in Chapter 3.

¹²⁵ Penman et al (2013) 469-478.

¹²⁶ NSW Bushfire Risk Management Research Hub (2020) 'Fuel hazard'.

2.2.3 Weather propelled the fires which made them ‘extra bad’ and hard to fight

Key points

- In general, the largest and most damaging fires were driven by bad fire weather.
- In particular, repeat heatwave conditions with high temperatures overnight, high solar insolation,¹²⁷ very low humidity during the day and at night, hot westerly winds, intense ember showers and fire-generated thunderstorms drove extreme fires that spread rapidly and were difficult to suppress or contain.
- The season saw lots of dynamic fire behaviour generating extreme fires which challenge traditional assumptions about how fires behave and spread. This is an emerging area of fire science that needs much greater research investment given the catastrophic consequences of events like fire-generated thunderstorms, and their increased incidence in 2019-20.

2.2.3.1 We experienced frequent, repeated bad fire weather days

There were several important weather conditions in combination that contributed to the extent, severity and escalation of the fires, and the occurrence of ‘blow up’ days. As explained in section 2.2.1, the landscape was very dry and fuel was available to burn, and NSW then experienced the right weather conditions conducive to carrying and spreading fire.

2.2.3.1.1 There were record values of the Forest Fire Danger Index

As noted by the BoM, large areas experienced record fire weather driven by the combination of drought and extreme heat, with individual spike days linked to the onset of strong westerly winds.¹²⁸ The combination of these risk factors – temperature, low humidity, wind speed and dryness of fuel – is brought together in the Forest Fire Danger Index (FFDI), which informs the six Fire Danger Ratings used to communicate fire risks to the public: Low-Moderate, High, Very High, Severe, Extreme and Catastrophic (discussed further in Chapter 3).

The FFDI levels were persistently high throughout the season. For example:

- from October to December 2019, FFDI levels were at record high levels
- a Catastrophic rating was recorded on 6 September 2019 – the earliest ever recorded since that rating was initiated in 2009
- FFDI values for north-east NSW were Very High for 21 days during spring (previous highest count was 11)
- the season saw six days of Catastrophic fire danger, 22 days of Extreme fire danger and 72 days of Severe fire danger.¹²⁹

The Research Hub also examined the fire weather conditions throughout the season to inform the Inquiry, concluding that fire weather conditions during 2019-20 season were by many measures unprecedented compared with historical records going back to 1950.¹³⁰

¹²⁷ “Insolation is the amount of solar radiation received on a given surface in a given time period.” Landsberg, J. & Sands, P. Chapter 2 - Weather and Energy Balance, Terrestrial Ecology, Elsevier, Volume 4, 2011, Pages 13-48. Retrieved from <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/insolation>.

¹²⁸ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 12 March 2020*.

¹²⁹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

¹³⁰ NSW Bushfire Risk Management Research Hub (2020) ‘Fire weather’.

This work observed that:

- mean monthly fire weather conditions (Forest Fire Danger Index (FFDI))¹³¹ “were record-breaking across much of the State from September to January, peaking in December when almost the entire state recorded its worst ever fire weather conditions”
- “for broad areas in the North Coast, Blue Mountains and South Coast regions, records were set for the number of days with Very High or greater fire danger” (FFDI greater than 25), while “the Greater Sydney region recorded its second highest ever number of such days” (see Figure 2-14)
- at many individual locations across NSW, there were new records “for maximum daily fire weather conditions and the number of Very High and Severe fire danger days during the fire season” – but also importantly, “many records were also set for the highest mean monthly **minimum** fire weather conditions, mostly in December 2019”.¹³²

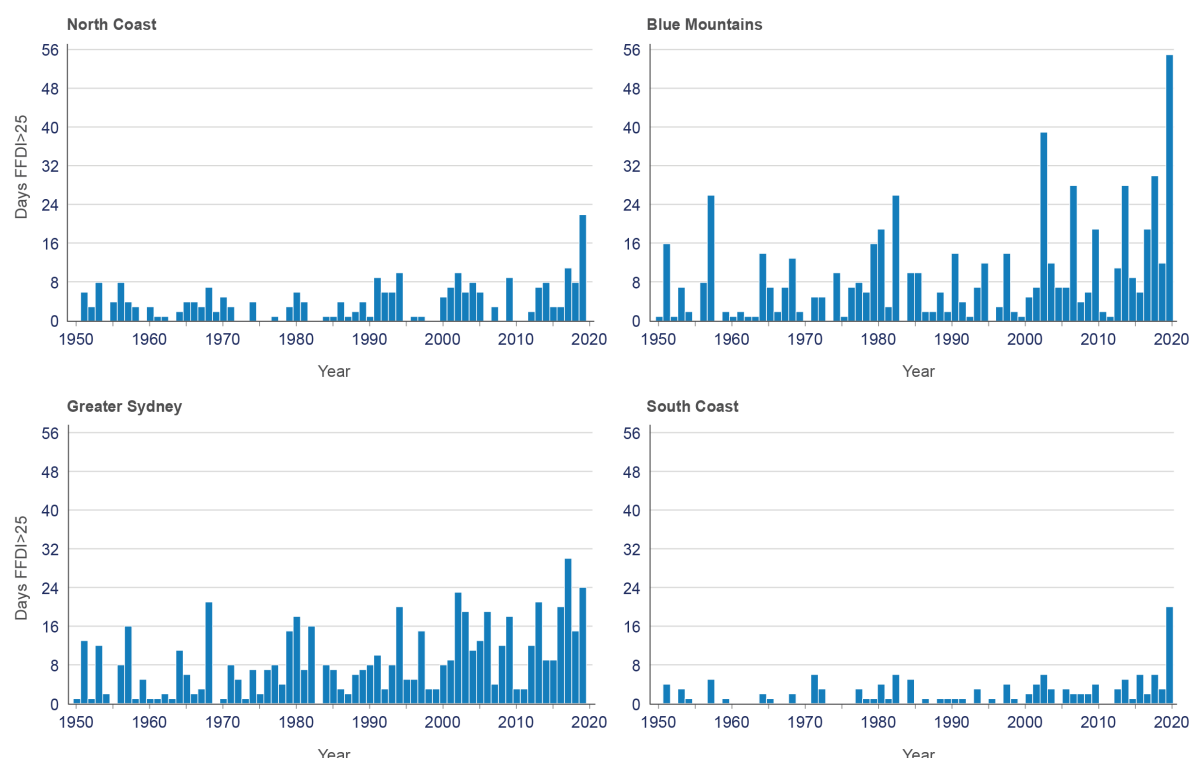


Figure 2-14: Number of Very High or greater fire danger days per year from 1950 to February 2020 in the North Coast (top left), Blue Mountains (top right), Greater Sydney (bottom left) and South Coast (bottom right) (prepared by NSW Bushfire Risk Management Research Hub).¹³³

The Research Hub also looked in detail at the weather conditions at four major fires (Bees Nest, Dunns Rd, Badja, Gospers Mountain). At each of these, there were “extended dry spells and multiple episodes of high temperatures, high wind speeds, low relative humidity” and, therefore, high fire danger.

This work also showed that all four variables used to calculate fire weather conditions via the FFDI (maximum temperature, drought factor (based on rainfall), relative humidity and wind speed) were generally at the upper end of their historical distribution. However, in addition, it

¹³¹ Explained at 2.2.3.1.1 below and also in Chapter 3.

¹³² NSW Bushfire Risk Management Research Hub (2020) ‘Fire weather’.

¹³³ Ibid.

also found that the daily **minimum** fire weather values were also at the upper end of historical distribution.¹³⁴

Many have observed that the unrelenting nature of the weather conditions was a key feature of this season, and that conditions rarely eased to allow fire fighting efforts to catch up, even at night. The work of the Research Hub supports this observation, noting that “There are clear links between extreme fire weather conditions and bush fire risk, but it is possible that the occurrence of very high average and minimum fire danger values, indicating a lack of reprieve from peak conditions, also played a role”.¹³⁵

The Research Hub also examined area burnt alongside FFDI. Figure 2-15 shows that “major surges of fire growth tended to occur during higher FFDI”, but many days of high FFDI did not appear to result in a surge in fire growth.¹³⁶

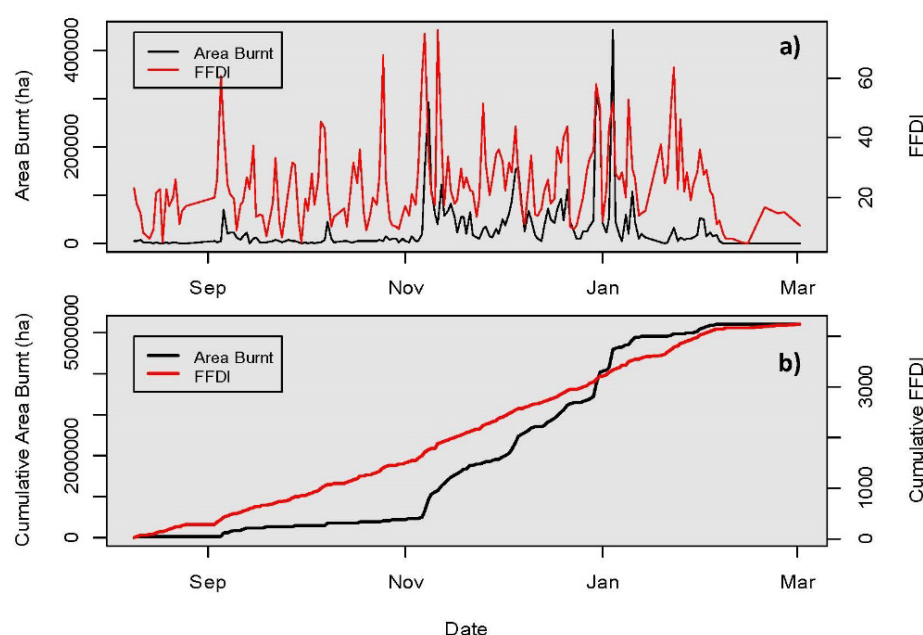


Figure 2-15: Comparison of daily area burnt and FFDI: a) raw values; b) cumulative (prepared by NSW Bushfire Risk Management Research Hub).¹³⁷

This analysis further showed that fire spread under a wide range of wind directions, “though more so under north-westerly than other directions” (see Figure 2-16). The researchers also note that major fire spread happened with south-westerly winds, even though these winds were uncommon.¹³⁸

¹³⁴ Ibid.

¹³⁵ Ibid.

¹³⁶ NSW Bushfire Risk Management Research Hub (2020) ‘Fire spread’.

¹³⁷ Ibid.

¹³⁸ Ibid.

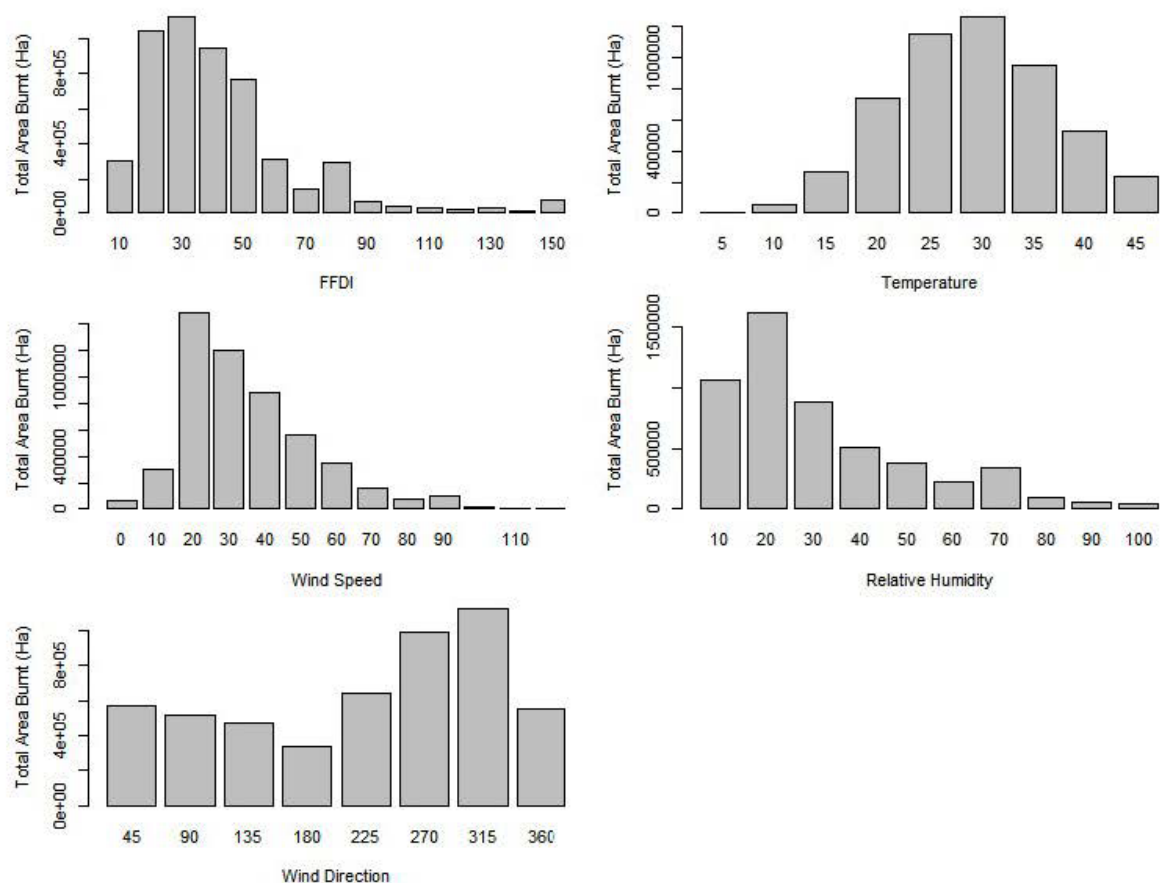


Figure 2-16: Area burnt in different levels of five weather variables across the whole season (prepared by NSW Bushfire Risk Management Research Hub).¹³⁹

This analysis also broke the FFDI into some of its component variables to show variations in geographic patterns. For example, Figure 2-17 shows: areas of fire in the southern tablelands burning under very hot and windy conditions; fires in the central region burning under relatively still but hot conditions; and fires across much of the northern region burning with windy but relatively cool conditions.¹⁴⁰

¹³⁹ Ibid.

¹⁴⁰ Ibid.

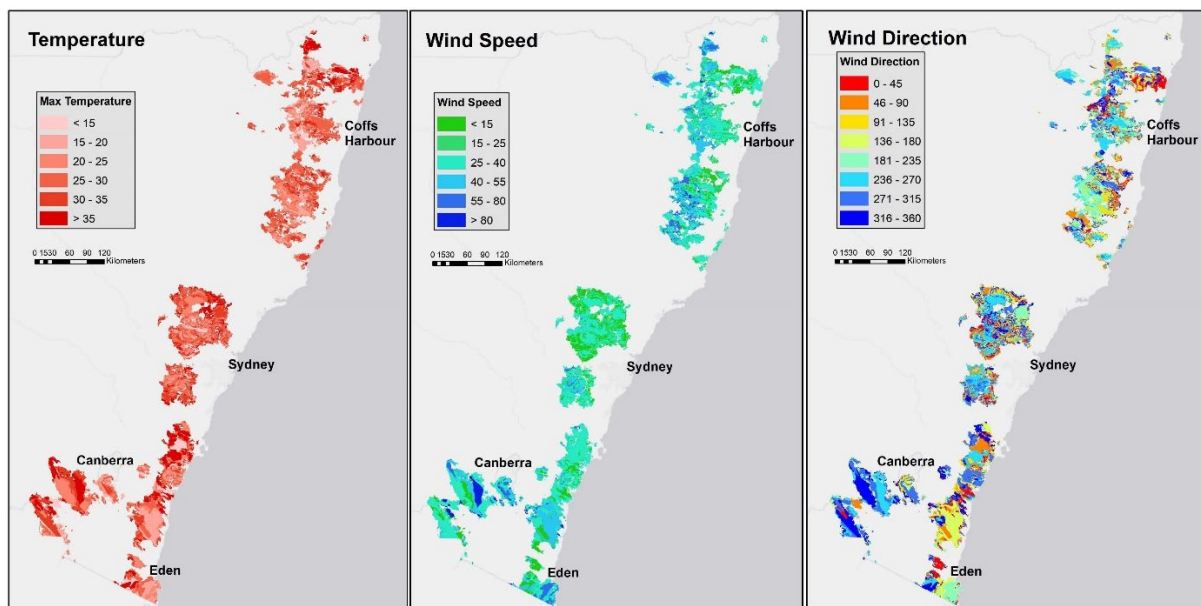


Figure 2-17: Estimated temperature, wind speed and wind direction experienced during the fire (prepared by NSW Bushfire Risk Management Research Hub).¹⁴¹

2.2.3.1.2 NSW experienced frequent heatwaves with high temperatures and low humidity overnight

Frequent heatwaves were a feature of the 2019-20 season that likely had a major influence on the spread and severity of the fires. Heatwaves – consecutive days and nights with unusually high maximum and minimum temperatures – are associated with limited relative humidity recovery overnight which has a cumulative drying effect on fuel. Consequently, fires overnight are not ‘lying down’ but rather actively propagating during the night. Heatwaves also prime the conditions for extreme fire behaviour the following day.¹⁴²

Peace, Nairn, Matthews and McCaw (2020)¹⁴³ also explained that heatwaves:

inhibit formation of overnight near-surface inversions and are synchronous with deep atmospheric boundary layers. These conditions are favourable for plume development and allow stronger, gusty winds to continue through the night. This enables rapid and early transition of the boundary layer to a daytime structure, so Fire Danger Ratings reach 'severe' to 'catastrophic' thresholds earlier in the day, thereby lengthening the window of hours for fires to spread, leading to larger fires, and extending fire spread into the evening.

Many of the Incident Management Teams reported to the Inquiry that temperatures stayed high and relative humidity was often very low overnight, which caused major challenges. Usually, it is expected that there will be some moisture recovery in fuels across the landscape overnight, which calms conditions and allows fire fighting efforts to catch up. However, this season firefighters were contending with fires that made unexpectedly hard

¹⁴¹ Ibid.

¹⁴² BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 12 March 2020*.

¹⁴³ Mika Peace and John Nairn (Bureau of Meteorology), Stuart Matthews, RFS (NSW), and Lachie McCaw (DPAWS, WA); Fire behaviour response to heatwaves during the 2019-2020 summer. Unpublished abstract submitted to the Australasian Fire and Emergency Service Authorities Council (AFAC) 2020 conference.

and fast runs at night and in the early morning because temperatures were high and humidity stayed low, coupled with challenging winds.

For example, the Far South Coast Incident Management Team explained how the Badja, Big Belimba Creek and Tuross Falls Rd fires (which came to be known collectively as the Badja Fire) travelled up to about 20 km in the early hours of 31 December 2019. In doing so it threatened or damaged and destroyed properties in Cobargo, Dignams Creek, Verona, Wadbilliga, Tinpot, Wandella, Quaama, Nerringundah, Cadgee and Yowrie. This fire spread was driven by unusually severe overnight weather conditions with strong, gusty winds from the west-north-west and very low relative humidity of 15-20%.¹⁴⁴

Further inland, the overnight relative humidity recovery was poor, reaching only 23% at Cooma overnight. The relative humidity plummeted on the coast early in the morning with Moruya getting down to 12% at 8 am on 31 December 2019.

The BoM explained that the combination of climate drivers already discussed – overall warmer baseline temperature, below average rainfall and therefore less cloud, and westerly winds bringing hot air from central Australia – produced these successive heatwave events. Often, southerly changes that bring cooler conditions did not come through to break the heatwaves, and there is limited understanding of why these southerlies don't occur as may generally be expected.

The Inquiry asked the BoM whether the low relative humidity often experienced overnight, as observed by those managing fires on the ground, was unusual. The BoM examined early morning (6 am) dew point data and relative humidity since 2000 to compare with the conditions in the 2019-20 season.¹⁴⁵ This found that:

- in September and October, areas in the northern highlands experienced lowest or second lowest dew point and relative humidity on record
- this extended throughout the highlands in November, with most sites experiencing lowest dew point on record for November and December and most sites having monthly relative humidity anomalies of minus 10% or larger
- there were less significant, but still substantial, negative anomalies in coastal areas in November and December, and on the south coast the dry conditions were strongest in November
- by January, the dew point was generally close to average.¹⁴⁶

2.2.3.1.3 Strong, dry winds drove the fires

The period from October to December 2019 brought hot, dry, westerly winds across the continent which led to 'spike' days in fire behaviour.

Data from the BoM shows that, for weather stations in the elevated north east and Hunter and elevated south, it was the windiest spring in at least the last 16 years, while it was one of the windiest at some other stations.¹⁴⁷

¹⁴⁴ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 23 June 2020*.

¹⁴⁵ The BoM used the following automatic weather stations - Coastal: Sale, Bairnsdale, Orbost, Bega, Ulladulla, Nowra, Kempsey, Grafton; Highlands: Gelantipy, Combienbar, Braidwood, Canberra, Mount Boyce (Blue Mountains), Armidale, Glen Innes, Applethorpe (limited data); and Further inland: Khancoban, Wagga.

¹⁴⁶ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 25 May 2020*.

¹⁴⁷ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 12 March 2020*.

Professor Jason Sharples¹⁴⁸ commented that in the earlier phase of the fire season in the north of NSW, the fires were strongly driven by wind, including winds with characteristics similar to foehn winds (infamous over centuries for the fire damage they cause in countries like Switzerland¹⁴⁹). He explains that:

As the name suggests, wind-driven fires largely spread in response to wind speed and direction, and form a typical elliptical shape. However, the severity of these fires was exacerbated by extreme drought... In addition, the winds that drove the episodes of significant fire growth in this first phase exhibited foehn characteristics (Sharples et al. 2010).

[T]he main mechanism driving foehn winds in eastern Australia was found to be isentropic drawdown. In this mechanism, the low-level air flow upwind of a mountain range is blocked and drier and potentially warmer air aloft is drawn down to replace it on the leeward side of the mountain range. This leads to substantially drier and warmer conditions in the lee of many parts of the Great Dividing Range, and these warmer and drier conditions result in lower fuel moisture contents. In the fires experienced in the first phase of fire activity, this effect combined with the extreme drought produced critically low fuel moisture content, which led to very rapid and extensive fire spread and greatly enhanced the spotting process.

Further south, the Cooma Incident Management Team commented on unexpectedly dry winds coming from the east that drove the fires towards the west. These easterly winds would usually be associated with the afternoon 'sea breeze' which would typically bring moisture and cooler temperatures, but this season the easterlies were observed to be very dry which exacerbated the fires, and fanned fire activity on the western edges. The BoM also commented that in some areas downstream of fires thick smoke acted as a 'blanket' to reduce daytime warming and inhibit night-time cooling, which also affected the timing and strength of sea breeze onset and how far it moved inland.¹⁵⁰

Several Incident Management Teams commented that they observed fire running in all directions at once, or against the prevailing wind direction. Due to the size of the fires, different sides of the same fire could be affected by winds of varying strength and direction. The BoM also explained that large fires release heat energy into the atmosphere, and the speed and direction of the surrounding wind can change in response to the heat from the fire. These fire-modified winds can sometimes be opposite in direction and stronger than the prevailing environmental winds.¹⁵¹

2.2.3.2 We saw lots of extreme fire behaviour and fire that 'created its own weather'

The 2019-20 season was also notable for the many instances of extreme fire behaviour, including an unprecedented number of fire-generated thunderstorms. Extreme fire behaviour is influenced by weather, terrain, fuel dryness, as well as more recently identified dynamic processes.¹⁵²

¹⁴⁸ Professor Jason Sharples, Submission to the Inquiry.

¹⁴⁹ Hunt, Nick (2017). *Where the Wild Winds Are: Walking Europe's Winds from Pennines to Provence*. London and Boston: Nicholas Brealey Publishing.

¹⁵⁰ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 25 May 2020*.

¹⁵¹ Ibid.

¹⁵² Professor Jason Sharples, Submission to the Inquiry.

Professor Sharples uses the term 'extreme bush fire' to describe the phenomenon where a fire:

*exhibits deep or widespread flaming in an atmospheric environment conducive to the development of violent pyroconvection, often manifesting as towering pyrocumulus (pyroCu) or pyrocumulonimbus (pyroCb) storms. A distinguishing feature of these types of fires is that they involve a coupling of the fire with the atmosphere well above the mixed layer, which modifies or maintains the fire's propagation (e.g. through mass spotting, blustering winds and lightning).*¹⁵³

He explains that fires escalate into extreme bush fires through the occurrence of one or more blow-up events, which involve a sudden increase in fireline intensity or rate of spread sufficient to preclude direct control or to upset existing suppression plans.¹⁵⁴

Recent research indicates that the traditional understanding of fire spread, which focuses on a 'quasi-steady' rate of spread after it has finished its growth phase, has been shown not to hold in many cases where the rate of spread of the fire varies considerably despite unchanging environmental conditions (fuel, weather, topography). Professor Sharples explains that this is when the fire's spread is driven not only by the environmental conditions, but also by "dynamic interactions between the fire and the atmosphere and even between different parts of the fire itself".¹⁵⁵

Extreme bush fires manifest as coupled fire-atmosphere events, and Professor Sharples states that recent research is also revealing the link between blow-up fire behaviour and formation of deep or widespread zones of active flaming which are more likely to produce plumes that reach high into the atmosphere, which are then more likely to involve processes such as cloud formation and heat release which can trigger pyro cumulus or pyrocumulonimbus (fire-generated thunderstorms).¹⁵⁶

He states that eruptive fire behaviour, vorticity-driven lateral spread and mass spotting all involve dynamic fire propagation, and all are highly likely to have contributed to escalation of the 2019-20 fires into extreme bush fires.¹⁵⁷

2.2.3.2.1 What is vorticity-driven lateral spread?

As described by Professor Sharples:

Vorticity-driven lateral spread (VLS) involves rapid lateral fire propagation across the tops of steep, leeward-facing slopes (Sharples et al. 2012, Simpson et al. 2013, 2016), which has the effect of widening the lateral expanse of the fire. In addition to this, the highly turbulent nature of VLS means that ember production is enhanced, and often results in mass spotting downwind of the lateral spread zone. The dense spot fires so formed then interact, coalesce, and form deep flaming zones.

Dynamic modes of fire propagation like eruptive fire behaviour and VLS are subject to specific environmental thresholds such as sufficiently strong winds and sufficiently steep terrain. This means that rugged terrain; that is, areas with local topographic relief

¹⁵³ Ibid.

¹⁵⁴ AFAC (Australasian Fire and Emergency Service Authorities Council). (2012). Bushfire Glossary. Australasian Fire and Emergency Service Authorities Council, East Melbourne.

¹⁵⁵ Professor Jason Sharples, Submission to the Inquiry.

¹⁵⁶ Ibid.

¹⁵⁷ Ibid.

>300m, is particularly prone to dynamic fire behaviour. This is consistent with recent research findings that extreme bushfires occur almost exclusively in rugged, forested terrain (Di Virgilio et al. 2019), and is also consistent with the spatial patterns of the most damaging of the 2019/20 bushfires, which exhibited a high correlation with rugged terrain.¹⁵⁸

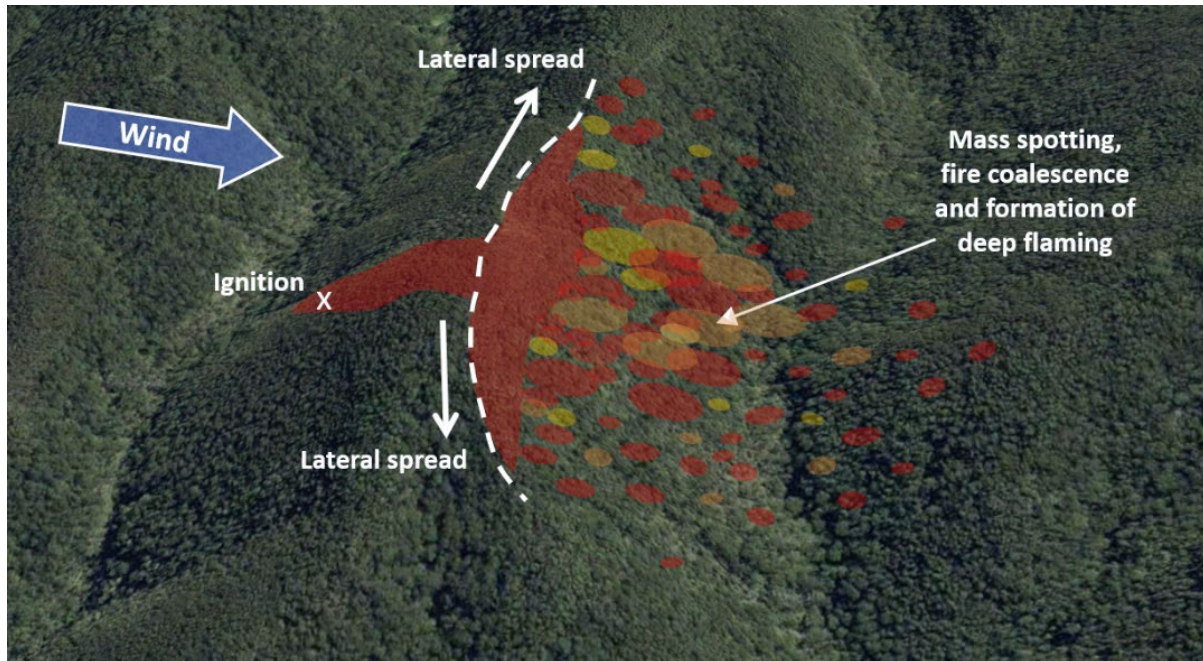


Figure 2-18: Schematic diagram illustrating vorticity-driven lateral spread and associated downwind spotting, spot-fire coalescence and formation of deep flaming. The fire has ignited mid-slope on a windward facing slope and initially spreads up the slope with the wind. As the fire encounters the ridge line (white dashed line), dynamic fire-atmosphere interactions drive the fire laterally (VLS). The regions of lateral spread act as an enhanced source of embers, which are deposited downwind as a dense ember attack (prepared by Professor Jason Sharples).¹⁵⁹

Researchers have been examining data from the 2019-20 season to identify where and how vorticity-driven lateral spread events occurred. In the time available to the Inquiry a complete catalogue of these events was not available.

Identifying these events manually from the large amount of data generated by remote sensing of the 2019-20 fire season is labour intensive. While there were likely to have been many examples of vorticity-driven lateral spread events this fire season, finding them manually is a challenging and time-consuming task given the large scale of the 2019-20 fires.

To overcome this, the Inquiry connected picture processing/machine learning experts at the University of Sydney and fire behaviour experts at the University of New South Wales Canberra in the hope of developing an algorithm for automatic identification of vorticity-driven lateral spread events in linescan data of the fires. The fire behaviour researchers¹⁶⁰ have already developed an algorithm that identifies terrain (generally terrain in the

¹⁵⁸ Ibid.

¹⁵⁹ Ibid.

¹⁶⁰ Professor Jason Sharples, Rick McRae, Dr Rachel Badlan

immediate lee of prominent ridges) that would be prone to vorticity-driven lateral spread.¹⁶¹ Implementing this algorithm will facilitate automatic identification of suspected vorticity-driven lateral spread events in the linescan data.

This exercise will also help refine the understanding of where terrain and wind patterns make areas susceptible to supporting vorticity-driven lateral spread, even if one did not occur there during the 2019-20 season. This in turn should be able to be used in a proactive way to inform the prioritisation of hazard reduction or other management activity, based on an improved understanding of where fires could escalate into extreme bush fires via this mechanism.

While the work could not be completed before the Inquiry finished, the researchers involved, along with NSW RFS, are keen to take this work forward.

2.2.3.2.2 There was a record number of fire-generated thunderstorms

The development of convective fire-atmosphere interactions is very dangerous. Sometimes pyrocumulus clouds will develop, and sometimes these progress to become a pyrocumulonimbus (fire-generated thunderstorm). Both can be dangerous. The NSW RFS notes that the risk to firefighters and the public is not limited to situations where a fire-generated thunderstorm develops, as convective fire-atmosphere interactions which do not result in (or involve) a thunderstorm can still pose a significant risk to firefighters and the public.¹⁶²

The RFS explained that:

convective fire-atmosphere interactions can generate or initiate phenomena (e.g. downbursts) which pose a significant risk to firefighters and the public because they:

- *can occur suddenly, often with no visible warning signs*
- *can initiate weather phenomenon which can suddenly and unexpectedly change a fire's behaviour*
- *can initiate weather phenomenon independent of a fire which pose their own hazards (destructive wind gusts and lightning)*
- *are difficult to forecast (often occurring on such a small scale that they are not able to be resolved by operational numerical weather prediction models which are used to produce weather forecasts).*¹⁶³

These events have been associated with extreme consequences and loss of life in previous fires. Box 2-3 provides a non-exhaustive list of examples.

Box 2-3 : Examples of previous fire-atmosphere interactions, including fire-generated thunderstorms (prepared by NSW RFS)¹⁶⁴

- 18/01/2003 Canberra, ACT – Outside of Canberra two fires coalesce, initiate a thunderstorm, tornadic vortex and impact the city of Canberra causing four fatalities.
- 7/02/2009 Kinglake, VIC – The Kilmore East fire spreads rapidly initiates a thunderstorm and impacts the Kinglake and surrounding townships causing 159 fatalities.

¹⁶¹ Sharples, J, McRae, R, & Wilkes, S, (2012). Wind–terrain effects on the propagation of wildfires in rugged terrain: fire channelling. *International Journal of Wildland Fire* 21, 282-296. doi: 10.1071/WF10055.

¹⁶² RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 17 April 2020*.

¹⁶³ Ibid.

¹⁶⁴ Ibid.

- 30/07/2013 Yarnell Hill fire, Arizona – A natural thunderstorm moves past the fireground and the thunderstorm outflow winds cause the fire to spread unexpectedly and overrun and kill 19 members of the Granite Mountain Hotshots team.
- 06-07/01/2016 Dwellingup, WA – The Waroona-Yarloop fire initiates thunderstorms on three separate occasions exacerbating the fire's spread, causing two fatalities.
- 07/02/2017 Moorlaben, NSW – A lightning strike from a natural thunderstorm kills farmhand Cameron Cox whilst he fights a fire on his family's property beside NSW RFS firefighters.
- 26/07/2018 Redding, California – The Carr fire generates a tornado-strength vortex which along with the progression of the fire is related to four deaths.
- 30/12/2019 Jingellic, NSW – Subject to further investigation, it initially appears that the Green Valley fire generated a tornadic vortex. The fatality of firefighter Samuel McPaul may be attributed to this event, and this is the subject of an ongoing coronial investigation.

Figure 2-19 prepared by the BoM illustrates the mechanism of a fire-generated thunderstorm. These thunderstorms, and extreme bush fires more generally, are a direct threat to firefighters and communities and escalate the fire risk dramatically. The BoM explained that as a fire-generated thunderstorm is developing, we see changing winds at the fire front resulting in less predictable fire behaviour, and increased transport of burning embers and ignitions ahead of the fire front which accelerate spread.

In their mature stage, fire-generated thunderstorms generate 'downbursts' and extreme winds which are a threat to aircraft and ground crews; lightning which leads to new ignitions; dramatic increases in ember transport (up to tens of kilometres), tornadoes and extreme winds; and smoke which is injected into the stratosphere. They can also produce black hail.

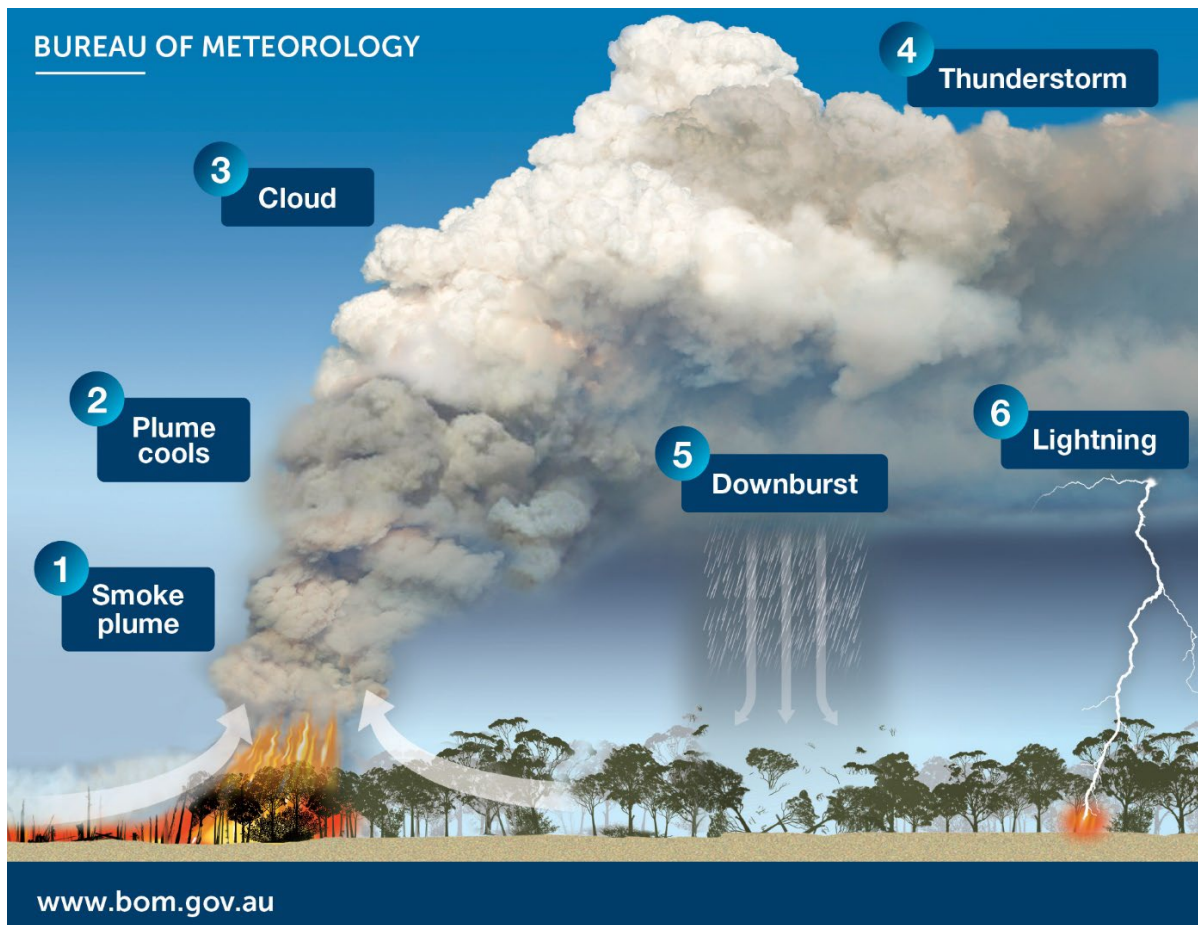


Figure 2-19: Depiction of a fire-generated thunderstorm (prepared by BoM).¹⁶⁵

A notable feature of the 2019-20 bush fire season was the unprecedented number of fire-generated thunderstorms (pyrocumulonimbus) that occurred.

Figure 2-20 shows the cumulative total of fire-generated thunderstorm events in south-eastern Australia since the start of the satellite record in 1978. There was a 50% jump in the cumulative total of fire-generated thunderstorms in the 2019-20 season – from 60 at the end of 2018-19 to 89 at the end of 2019-20.¹⁶⁶

¹⁶⁵ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 12 March 2020*.

¹⁶⁶ Professor Jason Sharples, Submission to the Inquiry.

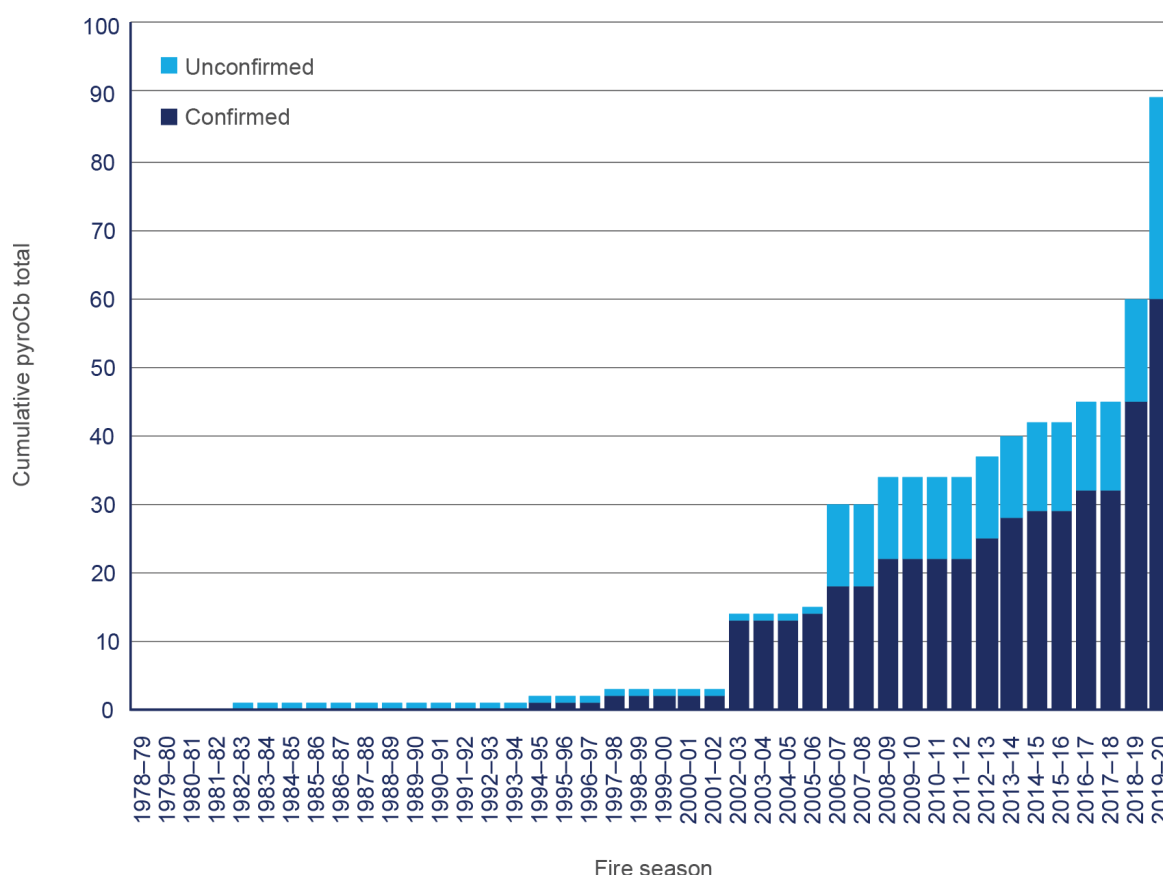


Figure 2-20: Cumulative total of pyroCb events over south-eastern Australia plotted against fire season (prepared by Professor Jason Sharples).¹⁶⁷

Professor Sharples explained that the 2019-20 events indicated in Figure 2-20 are still being examined closely, but noted that they were all violent pyroconvective events, either towering pyrocumulus or pyrocumulonimbus (fire-generated thunderstorms).¹⁶⁸

Professor Sharples has also provided data showing a correlation between low fuel moisture and fire-generated thunderstorms, indicating that critically low fuel moisture content was a prerequisite for extreme bush fire development in the 2019-20 season.¹⁶⁹

Given the extreme consequences associated with dynamic fire behaviour, including fire-generated thunderstorms, and the significant increase in these events observed in the 2019-20 season, this is an area that requires further research effort to understand better. This is discussed further in section 2.5.

¹⁶⁷ Ibid.

¹⁶⁸ Professor Jason Sharples (2020). *Advice to the Inquiry provided 15 July 2020*.

¹⁶⁹ Professor Jason Sharples, Submission to the Inquiry.

2.2.4 Lightning started most of the fires

Key point

- Lightning, often in remote areas, started most of the bush fires that became very large, damaging and hard to suppress.

The largest and most damaging fires in the 2019-20 season were all started by lightning, including Gaspers Mountain, Dunns Road, Badja, Currowan and Green Wattle Creek fires.

The Research Hub prepared analysis examining which ignition sources were associated with fires that were the main causes of loss of human life, houses and area burnt in the 2019-2020 bush fire season.¹⁷⁰

The key statistics from this preliminary analysis include:

- fires suspected to have been started by lightning strikes burnt an area six times greater than fires resulting from other ignition sources
- fires suspected to have been started by lightning contributed to 58.1% of house losses and 45.2% of house damage
- fires that were suspected to have anthropogenic ignition sources contributed to 6.1% of the house losses and 9.3% of house damage
- the fires associated with the remaining house loss and damage had undetermined ignition sources at the time of this study
- a small proportion (3.5%) of fires started on Total Fire Ban (TOBAN) days during the 2019-2020 season, and lightning strikes were the main source of ignitions on TOBAN days.¹⁷¹

The Inquiry asked the BoM whether 2019-20 saw an unusual amount of lightning compared with previous seasons. Unfortunately, high-quality lightning data are not consistently available over time and location in Australia to allow this comparison. However, the BoM reported that opinion from NSW meteorologists is that the frequency of thunderstorm activity during 2019-20 was similar to other years, but with lower rainfall totals increasing the relative frequency of 'dry'¹⁷² rather than 'wet' lightning strikes.¹⁷³

Dowdy (2020)¹⁷⁴ has produced a dataset of lightning across Australia between 1979-2016, which shows a trend towards more dry lightning conditions in recent decades in parts of south-east Australia.

The Inquiry also asked the BoM whether it can determine patterns about which parts of the landscape are more prone to lightning (for example, do ridgetops in certain parts of the State attract more lightning than other parts of the landscape?). Best available information on lightning climatology in Australia shows no clear signal with altitude, but the BoM notes that

¹⁷⁰ NSW Bushfire Risk Management Research Hub (2020) 'Ignition impacts'.

¹⁷¹ Statistics are based on data provided March 2020. At that time, ignition data was available for 49 of 958 fires (accounting for 64% of houses lost) that occurred during the 2019-2020 fire season. The determined ignition sources were provided by the RFS Fire Investigation Unit. Investigations are still in progress so this analysis should be treated as preliminary.

¹⁷² 'Dry' lightning is defined as lightning observed but with rainfall less than 2.5 mm recorded. BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 25 May 2020*.

¹⁷³ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 25 May 2020*.

¹⁷⁴ Dowdy, A. (2020). Climatology of thunderstorms, convective rainfall and dry lightning environments in Australia. *Clim Dyn* 54, 3041–3052. doi: 10.1007/s00382-020-05167-9.

lightning between a cloud and the ground will generally take the shortest pathway to earth, so prominent landscape features like headlands, ridgelines, and trees are more likely to be struck.¹⁷⁵ The data also show a general higher chance of lightning in the north and east of the country compared with the south and west, with a slight increase north of the divide.

While the BoM has advised that there was not an unusual amount of lightning activity in the 2019-20 season, the dryness of the fuel (as discussed in section 2.2.1) was very important. The dry conditions meant that many lightning strikes were effective in starting a fire, and also increased the likelihood of an ignition resulting in a larger fire. The BoM noted that the likelihood of lightning ignition and the survival of an ignition depends on fuel moisture content and characteristics of the ignition point (for example, whether the lightning ignites a fuel bed which is then extinguished by rainfall or ignites a log which smoulders before the fire spreads under more favourable conditions).

Many of the Incident Management Teams responding to fires observed this on the ground. They told the Inquiry that while the amount of lightning may or may not have been unusual compared with previous seasons, what was unusual was that every lightning strike seemed to 'take' this season because of the dryness of the landscape.

Dowdy and Mills (2009) have examined some of the thresholds for determining ignition likelihood, based on a study of lightning fires in Victoria. Notably, this study found that:

- the 'dryness' of weather coincident with the lightning has a large influence on whether a fire will start (e.g. if there is less than 1 mm rain with the lightning, the chance of fire per stroke of lightning is four times higher than average)
- temperatures above 26C, relative humidity below 38% and wind speed above 30 km/h indicate a higher chance of fire if lightning occurs, with relative humidity being a stronger indicator than temperature or wind speed
- dry fine fuels were the best indicator of high chance of fire from lightning
- fires started by lightning burn larger areas than other ignition sources, likely due to them starting in more remote areas and in clusters.¹⁷⁶

These thresholds align with the conditions seen in NSW in 2019-20.

As noted by the Research Hub, more work is needed to understand better the spatial patterns of the ignitions during the 2019-2020 bush fire season. This should inform what can be done to prevent, detect and respond early to new lightning ignitions, given that lightning-ignited fires were the largest and most damaging of the 2019-2020 season. This could be, for example, by prioritising fuel management on ridgetops or other parts of the landscape that may be more prone to lightning ignitions when conditions are as dry as those in 2019-20.

¹⁷⁵ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 25 May 2020*.

¹⁷⁶ Dowdy, A & Mills, G. (2009) Atmospheric states associated with the ignition of lightning-attributed fires. CAWCR (The Centre for Australian Weather and Climate Research) Technical Report No. 019. Retrieved from https://www.cawcr.gov.au/technical-reports/CTR_019.pdf.

2.2.5 Many fires were challenging to tackle early and then hard to contain

Key points

- Many fires were challenging to tackle early due to rugged terrain, remote ignitions and dry fuels. Once they were growing in size, extreme weather and dynamic fire behaviour as well as the growing number and size of fires simultaneously burning throughout NSW made them difficult to contain as resources were stretched.

Issues associated with the response to the bush fires are covered in detail in Chapter 5. However, some key issues are highlighted in this section, as challenges in suppressing the fires were contributing factors to the scale of the 2019-20 season.

The NSW RFS reported that in the 2019-20 season “well-tested fire fighting techniques were not always as effective as they had been in the past” due to the immense scale and severity of the fires.¹⁷⁷

2.2.5.1 Remote terrain presents challenges

Remote terrain made ignitions difficult to spot, and hard to tackle early. For example, the ignition of the Gospers Mountain fire was found when it was approximately 4 hectares at about 1 pm on 26 October 2019. It was too windy to insert a Remote Area Firefighting Team (RAFT) safely via winching, or to water bucket with helicopters. One fixed-wing aircraft was used for direct attack. Fire was active on all edges and had grown to about 25 hectares by 5 pm that day. At that size, direct attack to suppress a remote fire is challenging.

On 27 October RAFT crews were inserted for direct attack. Three fixed-wing bombers were deployed, as well as helicopters. But by 3.30 pm RAFT crews had to withdraw to safety as fire behaviour was too dangerous for direct attack, and a broader containment strategy was developed.

So, even though the fire was detected when still relatively small, the capacity for significant early response was limited due to the weather conditions.

The Inquiry heard that some Incident Management Teams shifted strategy during the season so that the top priority was tackling new ignitions, even if this meant moving resources from existing incidents. NSW RFS advised that this was an important lesson from the 2019-20 season for future fire fighting strategy, noting that:

*As some fires continue to grow and the Incident Management Team has identified that suppression tactics will be protracted, it may be possible to re-task some of the allocated resources to new ignitions. Providing more resources to a fire that has just started would mean firefighters could undertake a more aggressive initial attack, minimising the potential of the new fire taking hold.*¹⁷⁸

These issues, and the importance of early response when fires are small, are discussed further in Chapter 5.

¹⁷⁷ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

¹⁷⁸ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 22 July 2020*.

Another challenge is the ability to detect all new fires in real time, in order to deploy resources as quickly as possible. Some of the challenges and limitations of NSW's current use of remote sensing technology for this purpose is covered in section 2.5. A significant proportion are spotted in real time through aircraft. But some ignitions can't be detected quickly if aircraft can't fly because of smoke or dust, or because of lack of other sensors on satellites, fire towers etc.

2.2.5.2 Traditional methods of suppression and containing did not always work

Professor Sharples explains that extreme weather and dynamic fire behaviour contributes to new fire being hard to suppress and growing quickly:

*Rugged areas are also typically remote and difficult to access. Hence, when a fire is ignited (almost exclusively by lightning in the 2019/20 fires), initial attack is extremely challenging and dangerous, and is more likely to fail (even with extensive aerial firefighting resources) as these fires escalate quickly due to the action of dynamic modes of fire propagation.*¹⁷⁹

The dryness of the landscape also meant that some traditional approaches, like encouraging a fire to run through to a moist gully where it might self-extinguish, were not available.

Intense spotting contributed to the fires spreading very quickly, and as explained further in Chapter 5, traditional options like backburning were at times problematic.

2.2.5.3 Resources were stretched

The rolling and unrelenting fire campaign throughout the State stretched resources (examined further in Chapter 5).

NSW RFS advised that:

*Throughout a normal fire season, the NSW RFS regularly manage and coordinate over 100 incidents concurrently, which many of these may be considered major or significant fires in terms of their size or the time it takes to combat them. At times during the 2019-20 fire season, the NSW RFS managed in excess of over 150 incidents concurrently.*¹⁸⁰

The stretch on resources also extended to tasks like 'mopping up'. The NSW RFS advised that mopping up was largely done at night when conditions eased, and resources could be made available.¹⁸¹ It advised the Inquiry that there is no evidence that any new fires started because of limited resources for mopping up. However, it indicated that fatigue during the later parts of the season could have affected how well mopping up was executed. The Inquiry notes that the extended length of the fire perimeters would have created additional challenges to mopping up all of the contained fire edges.

The Inquiry also notes the challenge that would have been presented had the fires threatened to move towards more heavily populated areas, for example, on the edges of Sydney. The NSW RFS advised that:

In a worst case type scenario, if there were multiple major fires already in the landscape across NSW and a significantly complex fire started burning / impacting

¹⁷⁹ Professor Jason Sharples, Submission to the Inquiry.

¹⁸⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 22 July 2020*.

¹⁸¹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 8 July 2020*.

heavily populated areas (i.e. fire from Wisemans Ferry across Sydney's northern suburbs and southern parts of the Central Coast), at the same time as another fire impacting southern Sydney (i.e. fire from Holsworthy moving east towards the ocean), then these fires and associated impacts would deplete resources from all NSW agencies. The complexity involved in being able to strategically prioritise support while maintaining a detailed oversight of what else is occurring across NSW, may impact or limit the detail of information provided to the public and Government. As well, it would be difficult to maintain and coordinate the amount of resources required to support suppression operations.¹⁸²

¹⁸² RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 22 July 2020*.

2.3 PEOPLE HAVE A LOT OF TROUBLE ANTICIPATING A MAJOR CATASTROPHE

Key points

- Though there was widespread anticipation of a bad season, no one seems to have imagined events on the scale that eventuated.
- While work was done ahead of the season to ensure arrangements were in place for the early availability of aircraft, additional aircraft, interstate assistance and other resources, in some areas resources became overwhelmed by the size of the event.

Fire experts warned that 2019-20 would be a bad fire season. The 2019-20 seasonal outlook released by the Bushfire & Natural Hazards CRC showed that the eastern part of NSW from the range through to the coast had 'above normal fire potential' (Figure 2.21). The fire risk outlook was very similar ahead of the 2018-19 fire season.¹⁸³

These outlooks are designed to communicate at a landscape-scale the risk for the coming season, rather than being a tool to predict the location and extent of specific fires.

AUSTRALIAN SEASONAL BUSHFIRE OUTLOOK: AUGUST 2019

 Above normal fire potential
 Normal fire potential

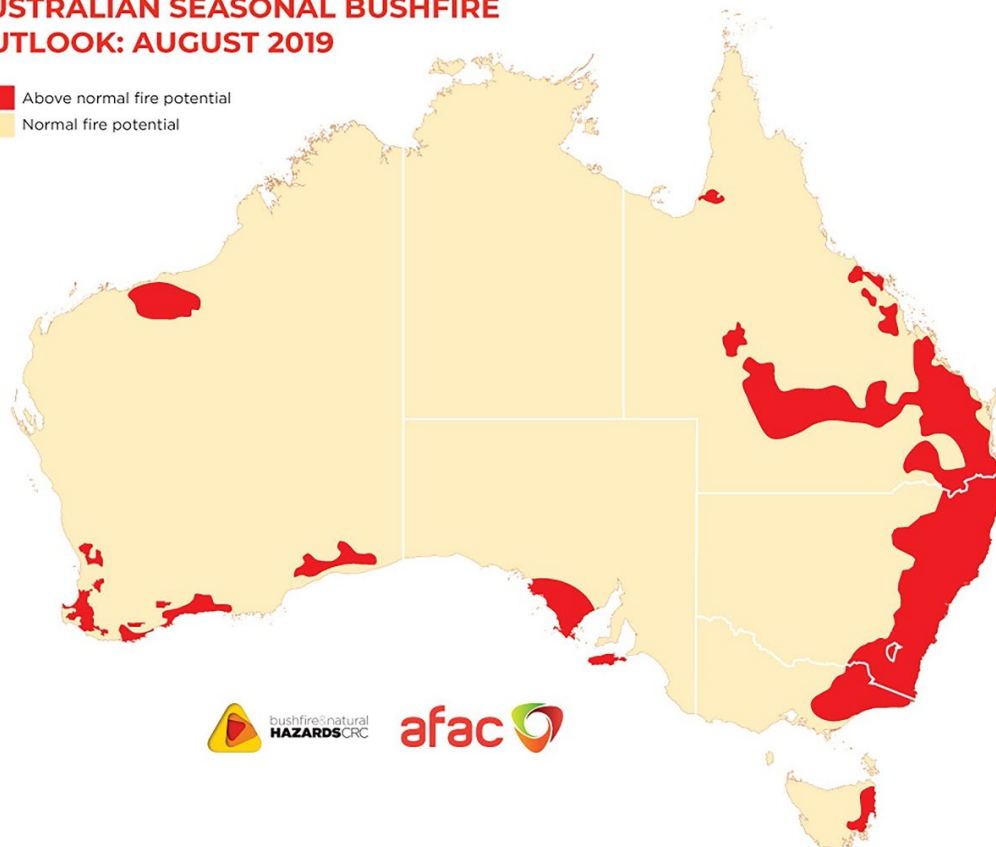


Figure 2-21: Seasonal bush fire outlook map for the 2019-20 bush fire season (prepared by the Bushfire & Natural Hazards CRC).¹⁸⁴

¹⁸³ Bushfire & Natural Hazards CRC. (2018). Southern Australia Seasonal Bushfire Outlook 2018-19. Retrieved from <https://www.bnhcrc.com.au/hazardnotes/55>.

¹⁸⁴ Bushfire & Natural Hazards CRC. (2019). Australian Seasonal Bushfire Outlook: August 2019. Retrieved from <https://www.bnhcrc.com.au/hazardnotes/63>.

Figure 2-22 shows the area burnt in NSW in the 2019-20 season, compared with the area identified as 'above normal fire potential'.

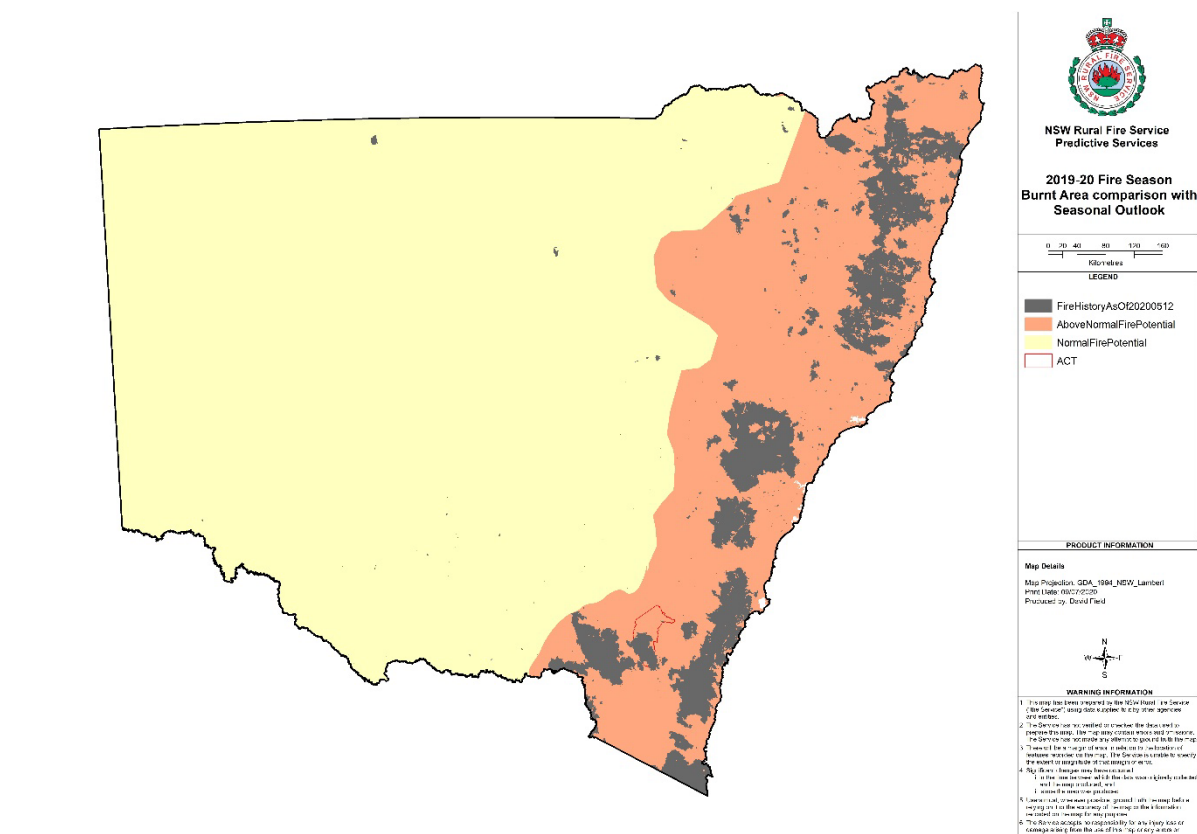


Figure 2-22: Area which (as of 27 Feb 2020) burnt during the 2019-20 season, overlaid on the area identified as 'above normal fire potential' from the bushfire seasonal outlook for 2019-20 published by the Bushfire & Natural Hazards Cooperative Research Centre (prepared by NSW RFS).¹⁸⁵

The Inquiry observed that, while most stakeholders involved in fire fighting, land management and emergency response said they expected it would be a bad season, the scale took many by surprise.

The NSW RFS told the Inquiry that “the conditions experienced throughout the season far exceeded what might reasonably be described as 'above normal'. It was, without doubt, the worst fire season ever experienced in NSW.”¹⁸⁶

The Inquiry observed many people seemed to be aware in a general way that the conditions (fuel, weather, drought, etc.) were bad up and down the State and in neighbouring states and territories. It heard from residents of the South Coast that they knew it would be a bad season when the forested hills turned brown through winter.

But the Inquiry also observed that this awareness of wide-scale and elevated risk did not necessarily lead to everyone being well-prepared, and there did not appear to be a general understanding in the community, even in high bush fire risk areas, of what could be coming.

¹⁸⁵ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 17 April 2020*.

¹⁸⁶ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

For example, why did tourists go to spend their summer holidays on the South Coast when there was a high risk of bush fire?

The Inquiry notes that while many preparations were put in place anticipating a bad season – for example, interstate assistance and early availability of aircraft – the scale ultimately became overwhelming. AFAC commented that:

During this 2019-20 bushfire season, as fire activity elevated across the country in late December, Australian domestic capacity to support the enormity of the bushfire crises, particularly in NSW and Victoria became stretched. On occasion requests for specialist resources were unable to be filled domestically. The ability to sustain such large-scale responses and movements of Interstate/ International personnel across the country for months at a time became challenging. By late December and over the holiday period, many jurisdictions were unable to deploy interstate due to fatigue management, risks and incidents within their own jurisdictions.¹⁸⁷

Tim Harford (2020)¹⁸⁸ wrote about the common phenomena of people not acting quickly or decisively enough to prepare for the worst, even when often aware of the worst-case scenario. He described the big step required between recognising a serious problem that might happen and taking action. Harford (2020) also notes that, even for foreseeable problems, it can be inherently difficult to prepare.¹⁸⁹ Although the scale of this fire season perhaps could have been foreseen in broad terms, the detail of where lightning would strike and how weather would behave to create the largest and most destructive fires is challenging to predict.

These factors point towards scenario planning as a tool for better understanding of what could be possible and planning for it. Ilona Miller, head of Baker McKenzie's global climate change practice, advised the Inquiry that scenario planning has been used by many organisations in the financial sector to quantify climate change risk, and that the same tools could be applied to inform planning and policy decisions for bush fire risk in NSW.¹⁹⁰ Scenario planning would enable NSW to consider the potential for more significant, more extreme events (including worst case scenarios), to quantify the risk, to understand the preparation required to respond to such scenarios, and to identify the policy or other interventions that could exacerbate or reduce that risk.

¹⁸⁷ AFAC (Australasian Fire & Emergency Service Authorities Council), Submission to the Inquiry.

¹⁸⁸ Harford, Tim. (2020, 16 April).: Why we fail to prepare for disasters, *Financial Times*. Retrieved from <https://on.ft.com/36PGKNF>.

¹⁸⁹ Ibid.

¹⁹⁰ Meeting with Ilona Miller on 11 June 2020.

2.4 WHAT CAN WE EXPECT IN THE FUTURE?

Key points

- The 2019-20 fire season was caused by a combination of multiple factors, all working in the same direction to amplify the risk of serious fires. Some of the factors that contributed to the 2019-20 season can be linked with changes in climate associated with increased greenhouse gas emissions. Attributing some of the other factors to a particular cause is not so clear, for example, we cannot say for sure exactly why the rainfall deficits and therefore the consequent drought leading into the fire season was so long and severe. Nevertheless, conditions we are seeing over south east Australia are consistent with what climate change projections have been saying will happen.
- Overall, the weight of evidence indicates that it is likely that we will see extreme fire conditions again when the risk factors combine in the right way. Extreme fires and fire seasons are likely to become more frequent.
- Therefore, NSW needs to do much more to prepare the community for the likelihood of such events, so that communities can then work together with State and local government agencies towards a greater level of bush fire preparedness.

2.4.1 Things could have been worse

The 2019-20 season could have been worse in a few different dimensions. For example, conditions could have seen more fires affecting major population centres. This would have presented considerable resourcing challenges as so many resources were already deployed elsewhere in the State, including NSW RFS brigades from around the urban areas, substantial Fire and Rescue NSW resources, and resources from interstate and overseas – all of which were stretched as it was.

It was also fortunate from a fire management perspective that grass fuel loads were limited west of the range due to drought. If there had been fire risk west of the divide, resources would have been stretched even further.

2.4.2 The risk profile for the 2020-21 fire season is different

The NSW RFS informed the Inquiry that the risk profile for the 2020-21 fire season will be primarily determined by winter and spring rainfall, grass growth and the key climate drivers (IOD, ENSO and SAM – discussed in section 2.2.1.4). The BoM indicates that conditions may reach or exceed the threshold for La Niña by the end of spring, while the IOD is expected to remain neutral.

While 2019 was the driest year on record for Australia, the first half of 2020 has seen more normal rain patterns for southern and eastern Australia.¹⁹¹ Recent rainfall associated with an east coast low in mid-July is likely to have reduced the intensity of the drought in south eastern NSW. However, the northern ranges and far north coast are still experiencing drought conditions.¹⁹² Overall, long term rainfall deficiencies remain across the State.¹⁹³

¹⁹¹ Bushfire & Natural Hazards CRC. (2020). Australian Seasonal Bushfire Outlook: July 2020 Hazard Notes. Retrieved from <https://www.bnhcrc.com.au/hazardnotes/75>.

¹⁹² RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 16 July 2020*.

¹⁹³ Bushfire & Natural Hazards CRC. (2020). Australian Seasonal Bushfire Outlook: July 2020 Hazard Notes. Retrieved from <https://www.bnhcrc.com.au/hazardnotes/75>.

The longer-term outlook for eastern Australia indicates that spring is likely to bring wetter than average conditions, which is likely to increase grass fuels in central NSW.¹⁹⁴ NSW RFS has advised that it continues to monitor the increasing grass fuel loads and grass fuel dryness in central NSW.

For forested regions, as of 14 July 2020, the forest fuel moisture in NSW is approximately average for this time of year. That, plus the rainfall outlook outlined above, means the risk posed for the 2020-21 bush fire is considered to be average for forested areas of NSW, including areas that did not burn during the 2019-20 season.

2.4.3 How has the large area burnt in 2019-20 changed the risk profile?

The Research Hub undertook large scale fire behaviour simulations to examine how the implied reduction in fuel loads due to the 2019-20 NSW bush fires will influence the future bush fire risk trajectory in NSW.¹⁹⁵ It examined four case study areas – around Jervis Bay, Gloucester, Blue Mountains and Casino.

Overall, this work found that bush fire risk following the 2019-20 fire season is likely to be reduced, although the residual risk may be substantial in some areas. It also found that, while prescribed burning may contribute towards further risk mitigation, overall risk is likely to rise steadily in coming years as the forests recover.¹⁹⁶

It notes that the reductions in future bush fire risk as a result of the 2019-20 fire season are “partial and temporary”, and that, even with reduced fuel loads, some residual risk remains. It predicts that over the next six years the risk will increase, “in some cases returning to or even exceeding pre-2019-20 levels.”¹⁹⁷

This work notes that prescribed burning could “mitigate some, but not all of the risk associated with the accumulation of fuel after the 2019-20 fire season”, depending on case study area. For example, it suggests that until at least 2025, no more than 5% of the case study landscapes in Casino, Gloucester or the Blue Mountains can be treated with prescribed burning if vegetation is to be maintained within its tolerable ecological threshold, while in Jervis Bay this figure is 2%.¹⁹⁸

2.4.4 NSW should expect more extreme fire risk conditions, more frequently

Fires will not be of the scale and type seen in the 2019-20 season every year. However, a repeat of fires of that scale, or worse, is a realistic prospect. Indeed, we should expect to see serious fires more frequently.

For a fire season like 2019-20 to occur again, multiple risk factors need to combine in the right way and there are some key drivers that we need to be watching closely. Unfortunately, there are several factors ‘loading the dice’ to increase the probability of these things combining in the right way for serious fires to become more frequent in the future.

¹⁹⁴ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 16 July 2020*.

¹⁹⁵ NSW Bushfire Risk Management Research Hub (2020) ‘Future risk analysis’.

¹⁹⁶ Ibid.

¹⁹⁷ Ibid.

¹⁹⁸ Ibid.

Some of the important contributing factors can be linked to changes in climatic conditions associated with increased carbon dioxide emissions. The higher concentrations of carbon dioxide in the atmosphere affect the risk of some conditions conducive to fire occurring. However, how other influential drivers will change in the future (e.g. the IOD, ENSO, sudden stratospheric warming events and negative SAM conditions) is unclear.

In general, much of what is being observed in south-eastern Australia is consistent with climate change projections. These projections predict that many of these trends will continue. The Research Hub notes that

*if current climate trends continue then the fire weather conditions experienced during the 2019-20 fire season will become increasingly likely. Interannual variability remains significant, so we can expect to see increases in both the mildest and the most extreme seasons. On current trends many of the records set during the 2019-20 season are likely to be broken in the next 1-2 decades.*¹⁹⁹

This section discusses what we know about some of the key trends and projections that in combination increase the odds of more frequent, serious fire seasons, specifically:

- increase in the risk of heatwaves
- trends towards reduced cool season rainfall in the south-east and drought indicators
- variations in key drivers of climate (ENSO, IOD and SAM)
- length of the fire season
- conditions that encourage fire-generated thunderstorms
- sources of ignition (i.e. dry lightning).

2.4.4.1 Trends and projections of more heatwaves

Heatwaves increase risk in a few different ways, and long-term trends in key climate variables, in particular rainfall, have increased the tendency for dry and warm winter and spring conditions over south-east Australia. The drier and warmer conditions are more likely in south-eastern Australia in any given year due to climate change associated with increased carbon dioxide emissions. These conditions tend to encourage plant growth, and the higher solar insolation provides the energy to increase evaporation and cause landscapes and fuels to dry.²⁰⁰

As noted in section 2.2.1.5, we have already seen Australia's mean annual temperature increase by almost 1.5C since 1850. CSIRO reports that we can expect the increase in global average temperature to exceed 1.5C between around 2030 and 2050 if warming continues at the current rate, and based on the emissions already generated (i.e. trends for the next 20 or so years are 'locked in').²⁰¹

CSIRO further reports that projected Australian average annual temperatures indicate that, even under low emission scenarios, temperatures are likely to increase further and this increase could be extreme under high-emissions scenarios.²⁰²

¹⁹⁹ NSW Bushfire Risk Management Research Hub (2020) 'Fire weather'.

²⁰⁰ Professor Andy Pitman (2020). *Advice to the Inquiry provided 2 July 2020*.

²⁰¹ CSIRO (Commonwealth Scientific and Industrial Research Organisation) (2020). Response to Notice to Give Information 21 April 2020 for the Royal Commission into National Natural Disaster Arrangements. Retrieved from <https://naturaldisaster.royalcommission.gov.au/system/files/exhibit/CSI.500.001.0001.pdf>.

²⁰² Ibid.

The average warming noted above dramatically increases the risk of heatwaves. Successive heatwaves were a significant contributing factor to the 2019-20 bush fire season. Multiple projections indicate that we should expect to see increased heatwave intensity, duration and frequency in NSW and ACT.²⁰³ In part this is associated with the average warming, but it also appears related to how warming is influencing weather patterns including southerly changes. We need to know a lot more about how warming in the averages influences weather patterns associated with fire over NSW.²⁰⁴

Heatwaves were often associated with low overnight humidity during the 2019-20 season, which contributed to extreme fire behaviour at night. We need to know more about what is influencing humidity under extreme conditions.

2.4.4.2 Trends and projections for reduced cool season rainfall in the south-east, and drought

The BoM advised that long-term trends show a 10-15% decrease in rainfall in recent decades in south-eastern Australia, largely driven by a lack of wet years, or wet months, since the mid-1990s.²⁰⁵

This change has been most significant in the cool season (April-October).²⁰⁶

Projections also indicate that droughts in southern Australia are likely to last longer, and there are hints that they may be more intense.²⁰⁷ However, climate projections are not robust over NSW although there are hints of a trend toward longer and more intense drought.²⁰⁸ As discussed in section 2.2.1, drought is a key antecedent condition that has preceded most serious fire seasons.

2.4.4.3 Trends of worsening fire danger and longer seasons

As explained in section 2.2.3, the Forest Fire Danger Index (FFDI) is an indicator of fire risk that combines humidity, wind speed, fuel dryness and temperature.

The BoM and Research Hub studies have explained that fire seasons are already observed to be worsening in a few dimensions with trends towards more days with higher FFDIs and trends towards fire seasons starting earlier in the year and becoming longer.

The BoM also explained that NSW is seeing an increase in annual mean sea level pressure over time. Higher pressures mean reduced rainfall and cloudiness which lead to increased landscape dryness, and the drying trend is especially strong in spring.²⁰⁹ The BoM reports

²⁰³ Argüeso D, Di Luca A, Evans JP, Parry M, Gross M, Alexander L, Green D, Perkins S. Heatwaves affecting NSW and the ACT: recent trends, future projections and associated impacts on human health. NARCLIM Technical Note 5. Report to the NSW Office of Environment and Heritage, 2015.

²⁰⁴ Professor Andy Pitman. (2020). *Advice to the Inquiry provided 2 July 2020*.

²⁰⁵ CSIRO (Commonwealth Scientific and Industrial Research Organisation). (2012). Climate and water availability in south-eastern Australia: A synthesis of findings from Phase 2 of the South Eastern Australian Climate Initiative (SEACI), CSIRO, Australia, September 2012, 41. Retrieved from http://www.seaci.org/publications/documents/SEACI-2Reports/SEACI_Phase2_SynthesisReport.pdf.

²⁰⁶ BoM (Bureau of Meteorology). Webpage. State of the Climate 2018. Retrieved from http://www.seaci.org/publications/documents/SEACI-2Reports/SEACI_Phase2_SynthesisReport.pdf.

²⁰⁷ Ukkola, A, De Kauwe, M, Roderick, M, Abramowitz, G, & Pitman, A, (2020). Robust future changes in drought in CMIP6 projections despite uncertainty in precipitation, Geophysical Research Letters, accepted 27th April.

²⁰⁸ Professor Andy Pitman. (2020). *Advice to the Inquiry provided 2 July 2020*.

²⁰⁹ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry provided 25 May 2020*.

that this is contributing to an increasing trend in the spring accumulated FFDI indices since 1950 (see Figure 2-23) and a one to four-month earlier date for the first day with a FFDI greater than 25 (i.e. equating to a Fire Danger Rating of Very High or more) for parts of eastern NSW (noting considerable interannual variability) (Figure 2-24).

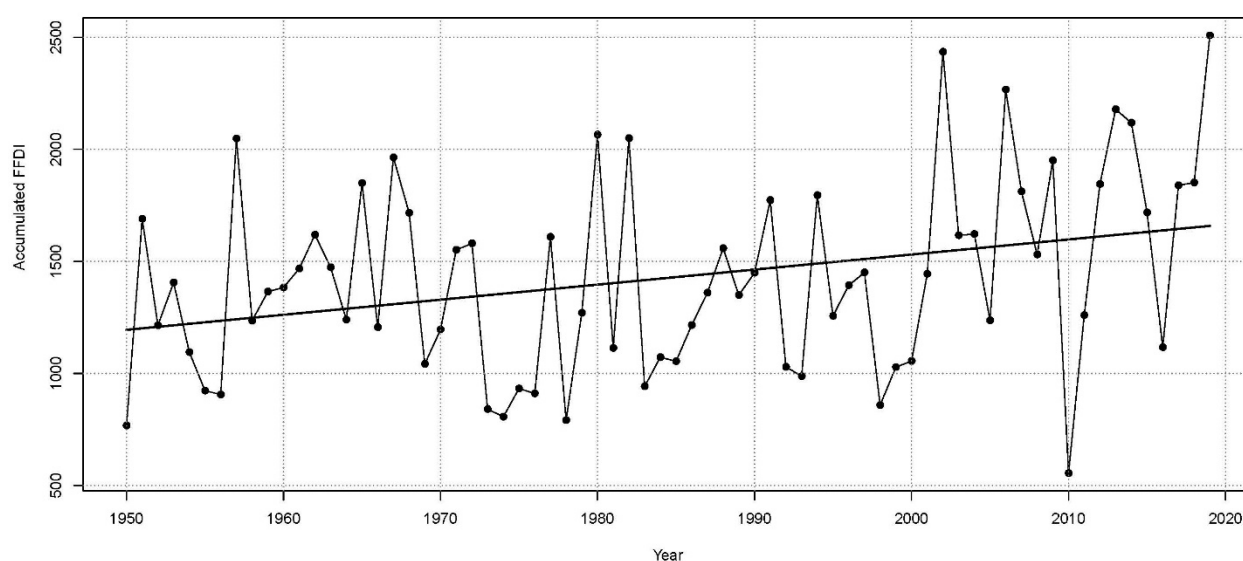


Figure 2-23: Long term trend in NSW September-November (Spring) accumulated FFDI. The trend is represented by an ordinary least-squares linear regression model (prepared by BoM).²¹⁰

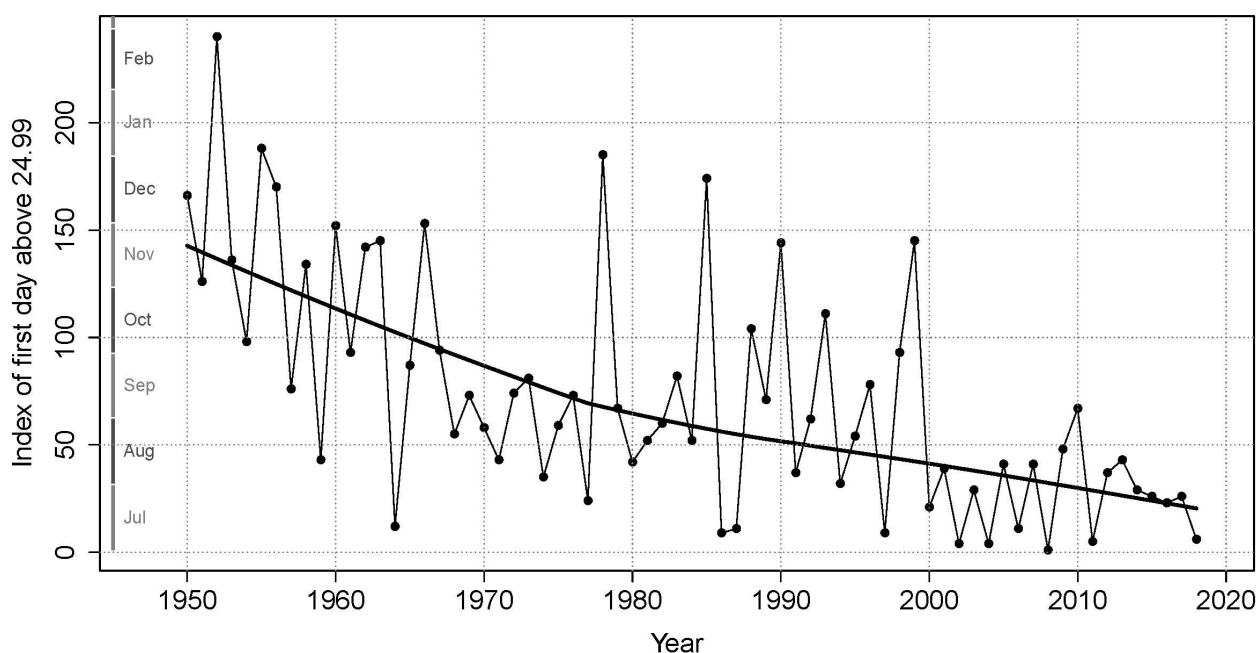


Figure 2-24: Earliest day with Very High FFDI (at or above 25) in south-coastal NSW, showing a trend towards earlier start of fire season. The trend is estimated using a local regression technique (prepared by BoM).²¹¹

²¹⁰ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry* provided 25 May 2020.

²¹¹ BoM (Bureau of Meteorology). (2020). *Advice to the Inquiry* provided 12 March 2020.

2.4.4.4 Some of the key modes of climate variability could be worse and more frequent

As explained in section 2.2.1.4, some large-scale climate modes influence rainfall in Australian and NSW – IOD, ENSO and SAM. It is also possible for these modes of variability to occur at the same time, intensifying conditions that lead to drying.

Some initial emerging research suggests that intensity and/or frequency could be increasing for modes of variability that contribute to drier conditions and therefore increased fire risk in NSW.

For example, section 2.2.1.4.1 explained that the positive IOD may have contributed to setting the scene for the bad 2019-20 fire season. One study²¹² examined the IOD through history and found that there had been even more extreme positive IOD events in the past than in 2019. Reconstruction of IOD variability over the last millennium (back to 1240), using 'cores' taken from coral, indicated an event in 1675 that was about 30-40% stronger than any seen in the instrumental record. Historical accounts from that time show that this was accompanied by severe drought, crop failures and civil disturbance in Asia.

Even within its natural variability, the positive IOD can be stronger than in 2019, and there is some initial emerging evidence that these occurrences could become more frequent in the future due to increased carbon dioxide emissions.²¹³

Another study²¹⁴ emphasises that we need to understand more about what drives the breaking of drought conditions, and that we might need to modify our thinking to assume that drier conditions are the default. Consequently, in order to understand bush fire risk, we need to get better at predicting the occurrence of the phases that increase the probability of wetter conditions – La Niña and negative IOD – and understand the influence that increased emissions may have on these drivers of variability.

Professor Pitman further explained that it is important to find physical mechanisms that help predict how the modes of variability influence rainfall, and determine if these can be captured in models.

2.4.4.5 Are we likely to see more fire-generated weather due to climate change?

The BoM reported to the Inquiry that NSW is trending towards conditions more favourable to development of fire-generated thunderstorms. These thunderstorms develop when the right mix of atmospheric instability, dryness, topography and vegetation type and surface fire weather conditions combine.²¹⁵

Di Virgilio, Evans, Blake, Armstrong, Dowdy, Sharples and McRae (2019) reported that climate change could amplify these conditions by, in particular, increasing atmospheric dryness and instability across south-eastern Australia. This would see more fire-generated weather across a longer fire season, in particular the extension into spring of the period

²¹² Abram, N.J., Wright, N.M., Ellis, B. et al. (2020) Coupling of Indo-Pacific climate variability over the last millennium. *Nature* 579, 385–392. doi: 10.1038/s41586-020-2084-4.

²¹³ Ibid.

²¹⁴ King et al (2020) 177–179.

²¹⁵ 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. *Geophysical Research Letters*, 46, 8517–8526. doi: 10.1029/2019GL083699.

conductive to fire-generated thunderstorms, which has resourcing implications for fire fighting.²¹⁶

This is supported by Dowdy and Pepler (2018) who examined atmospheric, climate and Forest Fire Danger Index data from 1979 to 2016. This study showed that south-eastern Australia increasingly experienced more days where environmental conditions were favourable for fire-generated thunderstorms. Consequently, the risk of these thunderstorms has increased “in southeast Australia during spring and summer due to a combination of significant decreases in atmospheric stability and humidity as well as more severe fire weather conditions”.²¹⁷

2.4.4.6 Sources of ignition

Section 2.2.4 above explained that there has been a trend towards more dry lightning, which is favourable for starting fires, especially when the landscape is dry. However, there is a need for more research into lightning trends, and how its occurrence could be expected to change in the future, especially in south-eastern Australia.²¹⁸

2.4.4.7 There appear to be global trends towards more serious fires

The trend of more extreme fire seasons and large fires in Australia appears to be part of an emerging trend globally, as shown in the following examples:

*Europe*²¹⁹

- 250 sq km burnt in forest fires in Sweden in 2018
- more European countries were affected by large wildfires in 2018 than ever before
- Greenland experienced large wildfires in 2017 and 2019
- Portugal had its first documented fire-generated thunderstorm in 2017 (62 people killed)
- 102 people were killed by wildfires in Greece during the 2018 European heatwave
- Spain had its largest wildfires in 20 years during the 2019 European heatwave
- Poland in April 2020 saw some of the worst fires for over 100 years²²⁰

*Asia*²²¹

- 2020 fires and heatwaves in Siberia including fire-generated thunderstorms north of the Arctic circle

*South America*²²²

²¹⁶ Ibid.

²¹⁷ Dowdy, A, & Pepler, A (2018) Pyroconvection risk in Australia: Climatological changes in atmospheric stability and surface fire weather conditions. *Geophysical Research Letters*, 45, 2005–2013, p. 2012. doi: 10.1002/2017GL076654.

²¹⁸ Dowdy, A & Mills, G. (2009) Atmospheric states associated with the ignition of lightning-attributed fires. CAWCR (The Centre for Australian Weather and Climate Research) Technical Report No. 019. Retrieved from https://www.cawcr.gov.au/technical-reports/CTR_019.pdf.

²¹⁹ Professor Jason Sharples. (2020). *Advice to the Inquiry provided 23 April 2020*.

²²⁰ Dowell, Stuart. (2020, 22 April). Firefighters battle to contain worst fires for over 100 years as they ravage largest national park in Poland, *The first News*. Retrieved from <https://www.thefirstnews.com/article/firefighters-battle-to-contain-worst-fires-for-over-100-years-as-they-ravage-largest-national-park-in-poland-12179>.

²²¹ Professor Jason Sharples (2020). *Advice to the Inquiry provided 15 July 2020*.

²²² Bowman, D, Moreira-Muñoz, A, Kolden, C, Chávez, R, Muñoz, A, Salinas, F, González-Reyes, Á, de la Barrera, F, Williamson, G, Borchers, N, Cifuentes, L, Abatzoglou, J and Johnston, F (2018) Human–environmental drivers and impacts of the globally extreme 2017 Chilean fires. *Ambio* 48, 350–362. doi: 10.1007/s13280-018-1084-1.

- In 2017 central Chile experienced “some of the most intense landscape fires on Earth in this century”

—as well as the United States.²²³

Historically, bush fires have been concentrated in southern Australia and western North America. However, land change and a changing climate are contributing to more fires in southern Europe and other Mediterranean climate zones.²²⁴

2.4.5 Assessing and communicating risk

The trends tell us that NSW needs to be monitoring the factors contributing to bush fire risk very closely, to ensure that a realistic assessment of bush fire risk is communicated very clearly to the NSW community.

The experience of 2019-20, along with the trends and signals we can see for the future, show that we need to be prepared for potentially more frequent severe fire conditions and also that the fires themselves may become more extreme, especially in the forested regions of NSW – and we need to be thinking about extremes when we plan and prepare for future bush fire seasons.²²⁵

The Inquiry heard that the 2019-20 bush fire season was not the “new normal, but it’s possibly an indication of the new extreme”,²²⁶ and that there could potentially be a shift in what we might expect from an average season if the whole envelope of possibilities shifts upwards.²²⁷

Therefore, the Inquiry recommends that there be a formal process for assessing and communicating bush fire risk to Government and the community at the start of each bush fire season.

This should be based on sophisticated monitoring of key signals that can indicate a bad season, including detailed spatial monitoring of fuel dryness and the modes of variability that influence rainfall in south-eastern Australia. To inform this, further research is needed to find the physical mechanisms that help predict how the modes of variability influence rainfall.

Recommendation 2: That at the start of each fire season, based on advice from the Bush Fire Coordinating Committee, Government provide a public statement with an evaluation of the likely fire season risk and the effectiveness of the planning and preparation for the upcoming season. This should be based on sophisticated monitoring of the key risk factors and signals for an extreme fire season. It should form the basis for clear public communication about these risks on a regional basis and the actions that Government proposes in preparation.

²²³ NASA Earth Observatory. (2018). Retrieved from <https://climate.nasa.gov/blog/2830/six-trends-to-know-about-fire-season-in-the-western-us/>.

²²⁴ Bowman, D et al (2018) 350–362.

²²⁵ Price, O & Bradstock, R. (2012) 146-157.

²²⁶ Professor Ross Bradstock quoted in Carter, Lucy, Robb, Kirsten, Francis, Laura & Hose, Nick (2020, 9 March) Daintry Gerrand lost her sister in the bushfires and this is her message for Australia, ABC News. Retrieved from <https://www.abc.net.au/news/2020-03-09/daintry-gerrand-lost-her-sister-in-the-bush-fires/12033208>.

²²⁷ Professor Ross Bradstock (2020). *Advice to the Inquiry provided 6 July 2020*.

Further, as explained throughout this Chapter, there is still a lot to learn about the 2019-20 bush fire season as a whole, and about individual fires, across Australia. Many researchers commented to the Inquiry that research to enable better understanding of past bush fires is hampered by nationally inconsistent data sets about bush fires, and incomplete records.

Recommendation 3: That the NSW Government, along with other Australian governments, ask AFAC 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.

2.5 TECHNOLOGY AND TRAINING – NEEDS AND OPPORTUNITIES

It would have been even harder to understand the causes and characteristics of the 2019-20 bush fires, and to respond to them, had they had happened, say, 50 years ago.

Technological and research advances over that time meant that we have better fire fighting equipment on the ground, the ability to know about weather and climate phenomena, and to understand the characteristics of the fires from remote sensors and our advances in fire research. Data from sensors and major computational advances allowed interpretation of what was happening (e.g. fire weather) in ways that helped with the bush fire response.

However, while our capabilities are certainly better than they were 50 years ago, in order to protect lives in likely future bush fire events technological capabilities should be pushed much harder to improve bush fire interpretation and response significantly. This can also be a major economic opportunity for NSW.

This section examines one of the major classes of technology used in all aspects of bush fire – remote sensing – and how this could be improved.

The section then discusses how another country (the Netherlands) nationally responded to highly recurring natural disasters (inundation due to being below sea level) to prevent the loss of life and create a major industry, and the Inquiry suggests this is an analogue for what NSW (and Australia more generally) could do.

The section concludes by expanding on the specifics of research and training priorities to tackle particular research challenges, and the opportunity to build a world class centre of bushfire understanding in NSW, and a major industry.

2.5.1 Remote sensing technology for bush fires – uses, current limitations and possibilities

Key points

- Remote sensing is an invaluable aid to predicting weather and climate and assessing fire location, conditions, extent and behaviour, and was used extensively by the NSW RFS in the 2019-20 season. But Australia's capabilities in this field have not been harnessed as much as they could be to fight bush fire.
- Automatic sensing of fire for big fire-risk seasons could, and must, be much better, especially given Australia's strong capabilities in the field. This includes enhanced capability for early detection of new ignitions, real time tracking of the fire edge progression and intensity as it spreads, and better understanding of vegetation and fuel load issues before the fires start.
- Remote sensing is relevant to all the Terms of Reference, as the data it provides can be used to monitor and analyse the causal factors of a bush fire, but also to inform planning and preparation for, and responding to, a bush fire event.
- A spatial technology acceleration program is needed in NSW (and Australia) to maximise the information available from all the various remote sensing technologies currently in use.

With the increasing number, intensity and frequency of bush fires, there is an urgent need to extend NSW's current prevention and response capabilities with new and innovative ways to plan, prepare and respond to bush fires in NSW. Understanding the start and spread of bush fires and fighting them is inherently a spatial information problem and a sensory one (vision, sound, smell). The most important class of technology for acquiring spatial and sensory information is remote sensing in its various forms. This section covers how this technology is used currently in NSW fire management before and during a fire season and discusses remote sensing technology strengths, limitations and possibilities – in other words, how it may be pushed further and used better to assist fire fighting and preparing for bush fire risks in the future.

2.5.1.1 How remote sensing technology can be used in fire management

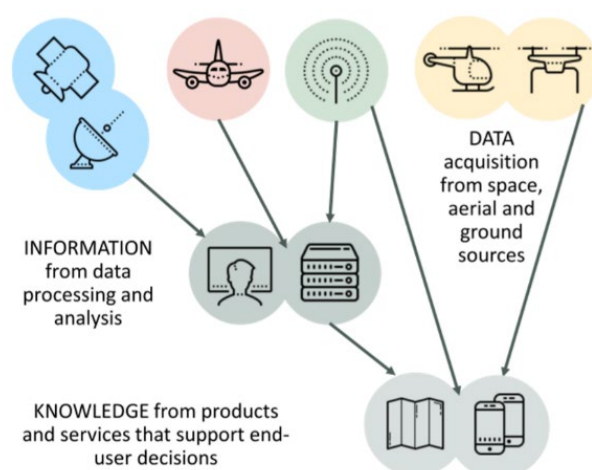


Figure 2-25: Overview of remote sensing technology and data lifecycle: collection, processing and outputs. Legend – Blue: Satellite; Red: Aerial processing; Yellow: Aerial live; Green: Ground (reproduced from the Draft Bushfire Earth Observation Taskforce Report, *Draft to the Inquiry* provided 18 May 2020).

Remote sensing technology in bush fire management functions to collect, process and deliver sensory data and spatial information with a view to providing a real-time and accurate assessment of fire risk, conditions, extent and behaviour.

Relevant data can be collected from sensors mounted on different infrastructure at various platforms or heights – ranging from space, atmospheric altitudes, to aerial and ground level. Depending on the particular need or purpose, sensors are commonly mounted on ground-based infrastructure such as towers, or aerial assets like high-altitude platforms, drones and aircraft – both planes (fixed-wing) and helicopters (rotary wing), balloons at high and low altitudes, and satellites in orbit (low-medium earth

orbit and geosynchronous/geostationary).²²⁸ Each of these can provide different levels of coverage, resolution, frequency, ease of use, cost, and complexity.²²⁹

Once collected, the data require processing, analysis and, often, fusion with data from other sources before outputs can be delivered to users to inform decision making.²³⁰ Some systems offer on-board processing and can immediately broadcast outputs in a ready-to-use form. Typically, though, a more complete picture is obtained by bringing data from many sources together (data fusion), as the greatest use of remote sensing inputs generally comes when data inputs from various sources are integrated and overlaid against relevant background information in supporting systems.²³¹ This data integration, fusion and analysis is either done automatically, or by various agencies at federal, state and local levels, or commercially for a fee.

The outputs of data collection and fusion have application at various stages of fire management decision making, including planning, preparing for and preventing fire, and informing the response to a fire. To be end-user friendly, data outputs from various sources are ideally available for direct visualisation through a platform such as the NSW RFS ICON system, for analysis, as inputs to fire models of various kinds, or for fusion with data from other sensors to provide greater situational awareness.

In an ongoing sense, remote sensing data from satellites, radar, balloons, and weather stations are used for short and long-term weather prediction and for climate forecasts. For planning and preparation before the fire season begins, the data collected, processed and fused aid in assessment of fire risk and appropriate mitigation – for example, the identification of fuel loads and subsequent hazard reduction needed. Immediately before a fire event, timely outputs from remote sensing technology (especially in the infrared part of the spectrum) can enable early detection – for example, monitoring lightning strikes in heavily forested areas, and obtaining information about location and localised conditions at the time of ignition. In responding to established fires, agencies need to be able to access near real-time spatial and sensory information at an appropriate resolution to track fire edge, movement, intensity and contributing factors including weather and terrain. This enables proactive decision making during the response, informing the allocation of resources and public communications. Remote sensing technology may also be used following a fire to map and assess burned areas and monitor recovery efforts, but this is outside the Inquiry's Terms of Reference and not discussed further.

2.5.1.2 No single remote sensing method provides all the information for assisting with bush fires

Each method, technique or tool for remote sensing, whether it be a fire tower, detection aircraft, drone or satellite, has various strengths and shortcomings. Some of these trade-offs are shown in Figure 2-26 below.

For example, geo-stationary satellites (permanently positioned to continually cover a designated area) provide 'always on' coverage. As Australia does not own or control any

²²⁸ Australian Space Agency. (In preparation) Bushfire Earth Observation Taskforce Report 2020. *Draft to the Inquiry provided 18 May 2020*, p.12.

²²⁹ Ibid, p. 10.

²³⁰ Ibid.

²³¹ Ibid.

satellites or civilian high-altitude drones of its own, the satellite and high-altitude imagery relevant to bush fire it receives has limitations:

- resolution is too coarse to pinpoint ignitions before they start significant fires
- resolution is too coarse to detect fire edges/extents.

Imagery from line scanning and other devices mounted on aircraft that fly directly over the fires is very useful, but there was a limited number of linescan aircraft available in the 2019-20 season and frequent, extended periods when it was not safe to deploy aircraft.

The tools that bring data from multiple sources together to build a reliable overall picture from composite sources have not yet been developed. There is a critical need to compress the data acquisition, integration, fusion and analysis steps into streamlined, automated delivery pipelines, so that the time frames currently achievable, which range from many hours to days and in some cases weeks, can be shortened.

	SUCCESSSES	LIMITATIONS
 PRE-FIRE: prevention & preparedness	✓ Grassland curing data available every 8 days ✓ Flammability ratings available every 16 days ✓ Wide range of datasets available to be used to perform risk assessments incl weather monitoring ✓ Staff from federal agencies integrated into state emergency service teams	✗ Require integrated early fire detection platform providing high resolution data ✗ Complete, up-to-date foundational data sets not readily available ✗ Fuel state data not nationally operational ✗ Location of fire break construction is occasionally not known
 DURING-FIRE: response	✓ Collaboration and sharing of resources ✓ Line scanning aircraft available to provide near-real time imagery of fires ✓ Hotspots for strategic fire mapping ✓ Weather observation ✓ Water bodies mapping for large aircraft to re-stock	✗ Tasking of high-resolution data via satellite too slow ✗ Insufficient coverage of multiple large fires via airborne ✗ Difficult to know if detected hotspots are false positives ✗ Commercial licencing arrangement are a barrier to data sharing ✗ Resolution & frequency of data available for tactical response

Figure 2-26: Example overview of strengths and weakness of satellite remote sensing in planning, preparing for, and responding to fire (reproduced from the Draft Bushfire Earth Observation Taskforce Report, *Draft to the Inquiry provided 18 May 2020*).

2.5.1.3 The Bushfire Earth Observation Taskforce

Noting these limitations and given the challenges of managing the megafires of the 2019-20 season, in January 2020 the Hon Karen Andrews MP, Federal Minister for Industry, Science and Technology “tasked the Australian Space Agency (‘the Agency’) to consider the role of space based Earth observation to support planning, response and recovery efforts related to bushfires. ... The Agency, in partnership with the CSIRO, Geoscience Australia (GA) and the Bureau of Meteorology (‘the Bureau’), established the Bushfire Earth Observation Taskforce (the taskforce) which has engaged with emergency management agencies, State and Territory governments, and the research community to understand this issue and consider opportunities for the future.”²³² Spatial Services in the Department of Customer Services coordinated NSW involvement in the Taskforce.

The final draft report²³³ of this Taskforce has been circulated and reviewed by the Inquiry and is due to be released shortly. The draft report includes an excellent description of remote sensing technologies and how they can be used to assist before, during and after bush fires. It also makes several short-term recommendations to help with the next fire

²³² Ibid, p. 3.

²³³ The Inquiry acknowledges the help of Dr Megan Clark AC, Head, Australian Space Agency, for allowing reference to this draft report.

season within existing resources, and longer-term recommendations for improved capability.²³⁴ The Inquiry commends the work of the Bushfire Earth Observation Taskforce in examining how to develop further the use of remote sensing for bush fire risk management and endorses the Taskforce report's recommendations, both short and long term, particularly regarding the development of capability to back international missions focused on supporting bush fire activities and including consideration of Synthetic Aperture Radar (SAR) technology for bush fire support.

2.5.1.4 Remote sensing technology and techniques were used in various ways

Fire and land management agencies at state and federal level have remote sensing capability and this technology provided useful information during the planning, preparation, and response phases of the 2019-20 bush fire season.

NSW RFS uses remote sensing technologies in various ways. While it reported to the Inquiry that its firefighters on the ground and in fire fighting vehicles provided the best intelligence they could on particular fires, considering the extent and scale of the fires,²³⁵ it also found camera platforms on helicopters with infra-red and high definition imagery along with remote sensing data from multispectral scanning devices ('linescanners') mounted on contracted fixed-wing aircraft particularly useful.

The NSW RFS reports that across 165 days during the 2019-20 season a total of 565 linescanning flights was flown, amounting to 7,469 flight hours.²³⁶ And, in the 214-day period from 10 August 2019 to 11 March 2020, NSW RFS flew its linescanning aircraft for at least some time on 88% of days.²³⁷

Linescanning produces good quality imagery above active bush fires, making it possible to see details of the fire edge, extent and intensity. This imagery helped NSW RFS Incident Controllers make informed decisions at the height of the season about resource commitments and the issue of public warnings during fire events.²³⁸

But more linescanning would have helped. Given the relatively low number of aircraft available and the number of big fires raging simultaneously, only a relatively small number of linescanner 'snapshots' of each fire was possible, a drawback given the highly dynamic and dangerous nature of these fires. In order to address this and to reduce reliance on contract resources, NSW RFS will shortly take delivery of two Cessna Citation aircraft with the Overwatch TK-9 Imaging System to be ready for the 2020-21 season.²³⁹ NSW RFS anticipates these will allow it to scan up to 400,000 hectares per hour when flying at 16,000 feet and allow the detection of fires as small as 15cm wide.²⁴⁰

A drawback of any sensor mounted on piloted, fixed-wing aircraft is that the sensor is useless when the plane can't fly as happens when smoke/dust/fog makes flying impossible. The NSW RFS estimates that there were 26 days between 10 August 2019 and 11 March 2020 when linescanning aircraft could not be used at all due to ambient conditions affecting

²³⁴ Australian Space Agency. (In preparation) Bushfire Earth Observation Taskforce Report 2020. *Draft to the Inquiry provided 18 May 2020*, p. 20.

²³⁵ NSW RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 9 June 2020*.

²³⁶ NSW RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 8 July 2020*.

²³⁷ Ibid.

²³⁸ NSW RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 9 June 2020*.

²³⁹ Ibid.

²⁴⁰ Ibid.

visibility or resourcing considerations.²⁴¹ It is important to note that these figures do not include instances where scanned imagery was insufficient or where scans were not able to be completed as frequently as preferred.²⁴² While this is a relatively small period of time (12%), this inability to fly can be an issue when the need to know about new ignitions, edges and spread is most needed.

However, NSW RFS also has other sources of remote sensing data and other information to provide help with fire detection and monitoring functions. This information is monitored by officers in the NSW RFS State Operations Centre and local Operations Centres. Sources include ground-based, aerial and satellite resources, such as:

- Triple Zero calls and calls to sources such as the Bush Fire Information Line which can add to situational awareness especially with validation from field resources²⁴³
- information from fire or communications towers (owned and or operated by Forestry Corporation NSW, NPWS, Water NSW²⁴⁴ and some Rural Fire Districts) strategically located throughout the State. These are often resourced during high risk periods or lightning events to provide early fire detection capabilities²⁴⁵
- live camera streams and infrared cameras from rotary-wing aircraft²⁴⁶
- data it ingests from the Bureau of Meteorology and other suppliers to monitor/detect lightning ignitions and provides in a spatial view on NSW RFS's Common Operating Picture
- Digital Earth Australia (DEA) Hotspots²⁴⁷ satellite data supplied by Geoscience Australia, displayed in the Common Operating Picture, primarily to support fire detection in remote areas²⁴⁸ though it is only of limited use as it has limited data update frequency at five passes a day and cannot see sufficiently through clouds, heavy smoke or tree canopy²⁴⁹
- satellite imagery and data from Himawari-8, a geostationary satellite that can see all of NSW, are downloaded, processed and displayed by NSW RFS every 10 minutes. However, the NSW RFS reported mostly using raw imagery (2km resolution) and corrected true colour imagery (1km resolution), as post-processed by the Bureau of Meteorology.²⁵⁰ This is used to help identify persistent heat signatures or hot spots.²⁵¹

NSW RFS also has five trailer units, towable by 4x4 vehicles, that are capable of launching weather balloons, and 26 Portable Automatic Weather Stations (PAWS) which can be used to monitor weather behaviour and detect dangerous fire weather conditions at strategic locations.²⁵² It is also finalising procurement of fixed automated weather systems (AWS) to

²⁴¹ NSW RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 8 July 2020*.

²⁴² Ibid.

²⁴³ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 8 July 2020*.

²⁴⁴ WaterNSW reported to the Inquiry that it owns and operates two towers, and NPWS owns an additional tower that is operated by the NSW RFS: WaterNSW. (2020). *Advice to the Inquiry provided 21 July 2020*.

²⁴⁵ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 9 June 2020*; RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 8 July 2020*; Water NSW. (2020). *Advice to the Inquiry provided 22 April 2020*.

²⁴⁶ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 9 June 2020*.

²⁴⁷ Geoscience Australia. (2020). Digital Earth Australia Hotspots. Retrieved from <https://hotspots.dea.ga.gov.au/>

²⁴⁸ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 8 July 2020*.

²⁴⁹ NSW RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 8 July 2020*.

²⁵⁰ Ibid.

²⁵¹ Ibid.

²⁵² Ibid.

be installed at NSW RFS sites where ongoing gaps exist in the BoM AWS network. The number and locations are yet to be finalised.²⁵³

Remote sensing for fire-related purposes is also used by other state and Commonwealth agencies. For example, as well as DEA Hotspots from Geoscience Australia and the remote sensing data and data fusion products (from satellites, Radar, balloons, AMDAR) used by the BoM for weather and climate prediction already mentioned, other examples include:

- the Fire Extent and Severity Project (FESM) project, led by the Department of Planning, Industry and Environment (DPIE) Remote Sensing Team in collaboration with NSW RFS, uses satellite imagery and machine learning to automate the mapping of the final extent of a bush or grass fire as well as to identify the severity of the fire spatially.²⁵⁴ LiDAR and satellite data from FESM (and MODIS satellite imagery) can be used to map fuel load and moisture readings, and also to assist with the modelling and characterisation of fire spread²⁵⁵
- Fire and Rescue NSW has 15 Remotely Piloted Aircraft Systems (RPAS) or drones ranging in size and capability, with high resolution visual cameras to specialised infrared sensors.²⁵⁶ During the response to the 2019-20 fires, FRNSW flew 50 missions using drones.²⁵⁷ Chapter 5 explores the operational use of drone technology in greater detail.
- Forestry Corporation of NSW similarly uses drone technology to gather fire intelligence. Information captured is broadcast directly to Forestry Corp fire units and can be viewed in real time on mobile tablet devices using Forestry Corp's MapApp.²⁵⁸
- National Parks and Wildlife Services, with NSW RFS, adopted a vehicle-mounted, spatially enabled, camera-based system (RACAS) to do fire trail condition assessments.²⁵⁹ NPWS drones were also used during the season to conduct night time operations, field assessments and to run thermal line scans.²⁶⁰
- Crown Lands ran a pilot in 2019 to inspect a select area of fire trails from the air utilising a rotary wing aircraft as an observation platform²⁶¹
- the Australian Defence Force conducted several aerial imagery flights over the period 11 November 2019 to 12 February 2020 at the request of NSW RFS.²⁶² Aerial imagery captured by Defence using unmanned aerial systems, rotary-wing and fixed-wing platforms was provided to the NSW RFS with the aim of helping with situational awareness, fire mapping and road route assessment, among other activities.²⁶³

Currently NSW RFS tends to use the output from the various remote sensing sources available to it independently (i.e. the information from multiple sources is not fused) but does have the capability to display some of the sources (including some that are post-processed in various ways – an example is DEA Hotspots) through its system. As it said, "The NSW

²⁵³ Ibid.

²⁵⁴ Meeting with DPIE (Department of Planning, Industry and Environment) 29 June 2020; RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 8 July 2020*.

²⁵⁵ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 9 June 2020*.

²⁵⁶ FRNSW (Fire and Rescue NSW). (2020). *Advice to the Inquiry provided 29 April 2020*.

²⁵⁷ Ibid.

²⁵⁸ FCNSW (Forestry Corporation of NSW). (2020). *Advice to the Inquiry provided 27 March 2020*.

²⁵⁹ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 25 March 2020*.

²⁶⁰ NPWS (National Parks and Wildlife Services). (2020). Firefront newsletter.

²⁶¹ DPIE (Department of Planning, Industry and Environment). (2020). *Advice to the Inquiry provided 1 April 2020*.

²⁶² Department of Defence. (2020). *Advice to the Inquiry provided 17 April 2020*; Department of Defence. (2020). *Advice to the Inquiry provided 26 June 2020*.

²⁶³ Department of Defence. (2020). *Advice to the Inquiry provided 26 June 2020*.

RFS COP and Fire Weather Portal include sentinel data from Geoscience Australia and Bureau of Meteorology. However, currently the FCNSW MapApp, FRNSW drone data/footage and any imagery provided by Defence assets during operations are stand alone and not integrated into the single point of truth.”²⁶⁴

2.5.1.5 Australia has strong capability in remote sensing

NSW, and Australia more generally, has strong capability in remote sensing both commercially and in the public sector. It has been active in this field since the late 1970s.²⁶⁵

The Department of Customer Services (DCS) through Spatial Services is the key spatial data agency in NSW and the State has a long history of developing and using remote sensing and spatial expertise (and various NSW government agencies were members and associate members of the Cooperative Research Centre for Spatial Information, CRC SI, throughout its existence 2003-18²⁶⁶ as were several companies based in NSW). Spatial Services coordinates NSW government access to a wide variety of remote sensing data sources including State-wide imagery from more than 100 satellites orbiting Earth.²⁶⁷ But many other State agencies also have strong spatial information capabilities including DPIE, Transport for NSW, Infrastructure NSW and Regional NSW.

NSW coordination with other Australian governments and the government of New Zealand on remote sensing and spatial matters more broadly is coordinated through the Australia and New Zealand Spatial Information Council (ANZLIC) which is the peak intergovernmental organisation providing leadership on all aspects, including the collection, management and use, of spatial information.²⁶⁸ ANZLIC was a key player in promoting the greater integration of spatial data with other built and natural environment information with a view to, among other things, reducing natural disaster and climate impacts on people, property and the environment.²⁶⁹

Acquiring remote sensing data can be expensive. At present, Australia does not own any satellites and is reliant on international satellite operators for the provision of data from satellite-mounted sensors. Australia also does not own any non-defence, high-altitude platforms.

Formal, informal and ad hoc partnerships ensure that Australia can receive satellite data using an extensive network of ground-based infrastructure. As such, there is no neat separation between the types of remote sensing capabilities from space systems employed by the Commonwealth and state or territory agencies.²⁷⁰ Maintaining and developing these

²⁶⁴ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 16 July 2020*.

²⁶⁵ Warne, Denis. (1978). *Landsat image analysis: application to hydrographic mapping*. Department of Engineering and Physics, The Australian National University, Canberra. Retrieved from <https://openresearch-repository.anu.edu.au/handle/1885/114474>. doi: 10.25911/5d74e5947957c.

²⁶⁶ CRC SI (Australian and New Zealand Cooperative Research Centre for Spatial Information). (2020). History. Retrieved from <https://www.crcsi.com.au/history-2/>.

²⁶⁷ Digital NSW. (2019, 29 October). Retrieved from <https://www.digital.nsw.gov.au/article/spatial-services-maps-future-nsws-digital-transformation>.

²⁶⁸ ANZLIC Spatial Information Council. (2020). Foundation Spatial Data Framework. Retrieved from <https://www.anzlic.gov.au/>.

²⁶⁹ ANZLIC Spatial Information Council. (2020). ANZLIC Strategic Plan 2020-24. Retrieved from <https://www.anzlic.gov.au/anzlic-council/anzlic-strategic-plan-2020-24>.

²⁷⁰ Australian Space Agency. (In preparation) Bushfire Earth Observation Taskforce Report 2020. *Draft to the Inquiry provided 18 May 2020*, p 12.

partnerships is critical to continue effectively using broad scale satellite observation for various purposes including bush fire management. For example, the Joint Remote Sensing Research Program (JRSRP) is a long standing and highly productive collaboration between several east coast universities and governments²⁷¹ that has produced significant research and outcomes, including the FESM project mentioned above.²⁷²

The Inquiry considers it is essential that NSW continues to collaborate with other governments both through ANZLIC and through direct national and international partnerships to foster further development, research, analysis and technical expertise in this area.

2.5.1.6 We have a lot of capability – but have not applied it as much as we could to help with bush fires

The Inquiry was impressed with how NSW RFS worked at great speed to use quite a diverse array of remote sensing imagery and information to infer the characteristics of the big fires in the 2019-20 season, but the Inquiry and several of the remote sensing agencies and companies it consulted²⁷³ were surprised that more sophisticated data fusion and automatic decision-making tools were not available to assist NSW RFS with this task, given Australia's capabilities in this field.

The use of raw imagery is important because the human eye is very expert at tasks such as feature extraction (e.g. being able to see the fire edge), but data fusion and decision-making tools can be very helpful in bringing together data, especially partial and 'dirty' data from many, disparate sources, to form a more comprehensive, reliable and 'always-on' total picture of fires across the State. And from such a comprehensive picture, needed features (e.g. fire edge and its speed of change, fire spread, temperature, etc.) can be extracted continuously (using artificial intelligence, more specifically picture processing techniques – another area where Australia has strong capability). Given that there is currently no single remote sensing source that can give the complete picture of a fire at once, fusing data from multiple remote sensing and other sources to build a comprehensive picture from which features can be extracted for reliable results should provide a significant boost in fire fighting capability. Such data fusion and decision-making and decision-assisting tools have long been in use in other domains, notably in weather prediction and defence.

The Earth Observation Taskforce²⁷⁴ notes that we could be much smarter in how we integrate and fuse remote sensing data from many disparate sources to build a more comprehensive, constantly updating automatic picture of any particular bush fire with a near-real-time assessment of fire edge, temperature and spread.

Such effective data integration and fusion will ensure that data are seamlessly captured, processed and visualised in shared systems that are interoperable and easily accessible.

²⁷¹ The University of Queensland and the Queensland, New South Wales and Victorian state governments, the University of New South Wales and the University of New England.

²⁷² DPIE (Department of Planning, Industry and Environment). (2020). *Advice to the Inquiry provided 6 July 2020*.

²⁷³ Meetings with Lockheed Martin 9 July 2020; FrontierSI 8 April 2020; Bushfire Earth Observation Taskforce 1 May 2020; Spatial Services, NSW Department of Customer Service 17 February, 28 April and 23 June 2020; Stephen Jacoby 28 April 2020; DPIE (Department of Planning, Industry and Environment) 29 June 2020.

²⁷⁴ Australian Space Agency. (In preparation) Bushfire Earth Observation Taskforce Report 2020. *Draft to the Inquiry provided 18 May 2020*, p 12.

This will provide a meaningful and complete picture of fire conditions and environmental factors in near-real time, enabling rapid and proportionate decision-making during all phases of bush fire management. Critically, it will also increase capacity to deliver emergency updates and information to the community, government and industry during the response phase.

Australian organisations were not the only ones surprised that sophisticated decision-making tools analogous to the ones used in weather prediction and defence had not been developed for fire fighting. Following the recent devastating wildfires in California, the Gordon and Betty Moore Foundation held a workshop of 40 stakeholders from fire management, US federal and state governments, non-government organisations, universities and industry in April 2019. Its summary is worth quoting:

Opportunities and challenges

A number of practical opportunities were identified for improving fire immediate response, involving some new technological and organizational capabilities including those in the private and defense sectors. Advances in data collection and numerical modeling were also identified that could enhance current assessments of fire risk and fire behavior. The group felt that much could be done to enhance fire immediate response with data and technology that are currently available but not yet harnessed.

With the pace of technological advancement (e.g., satellite, airborne and ground-based sensors, cloud computing, artificial intelligence and autonomous vehicles), it was recognized that the fire management community needs help determining operational suitability, reliability and readiness of new technologies to support real-time decision making.

The attendees identified fragmentation in how technological solutions are deployed in Early Fire and agreed that no one entity is entirely responsible for managing wildfire in California. Although there is a common goal of reducing loss of life and property, different stakeholder communities have differing views on how best to achieve that goal, which has resulted in technological fragmentation; different organizations use different tools. Technological fragmentation appears to manifest both institutionally, with expertise often constrained to a single department or research group, and spatially—firefighters in Northern and Southern California use different data to predict where and how a fire will burn. The workshop surfaced a pressing need for a common, operational intelligence platform to bring together disparate sources of data and model output in real-time to support fire immediate response decision-making.

Additionally, ingrained, habitual, and traditional thinking are at least as potent obstacles to radical improvement in fire management as are the technical issues, and a longer-term strategy is needed to change perspectives on fire, such as the commonly held perspective that every wildfire demands response. A more selective response strategy based on contemporary principles of forest management and models of risk could undergird a more selective, scaled and strategically effective response system.

A shared, interoperable data platform, fully leveraging the data and technology of the day, would improve wildfire operations intelligence and coordination within and across agencies and could support significant near-term improvement. However, the group identified knowledge and data gaps in how we characterize and predict the spread of wildfires. For example, the current network of weather sensors failed to capture how hot and fast winds would blow through the complex topography around Paradise during the Camp Fire, and the resulting predictions underestimated the rapid rate of spread. As a result, it's not yet clear that, even if there were clear communication between organizations, we currently understand fires well enough to stop the five percent of fires that are not contained.

Recommendations

How, then, can technological innovation fill these data, knowledge and institutional gaps to support the various organizations involved in immediate response? The workshop identified the following priorities and recommendations, which are described in detail in the report.

- *Develop a shared, integrated platform for diverse sources of data, intelligence and information*
- *Conduct new wildfire risk assessments with high-resolution mapping technologies*
- *Improve scientific understanding of “megafires” through retrospective analysis*
- *Enhance fire behavior models and associated inputs for real-time prediction*
- *Perform a cost-benefit analysis of investment in solutions vs. reactive management*
- *Target investments in the development and adoption of new technologies*
- *Expand multi-stakeholder dialogue, collaboration and action*

*The goals of the recommendations above mirror those of fire management organizations: to preserve life and property, and to maintain healthy, resilient ecosystems. The current wildfire policy of extinguishing all fires allows fuels to accumulate. Along with a warming climate and inadequately scaled mitigation policies, the conditions are in place for repeated, severe and costly wildfires. The workshop elucidated the need to scale up preventative measures and to strike a new balance between resource allocation for near-term firefighting and long-term fuels management. Acting on the above priorities could help achieve these goals, supporting California’s ongoing efforts to improve resilience in its ecosystems, institutions and communities.*²⁷⁵

The Inquiry is of the view that this largely applies here in Australia as well.

Developing new comprehensive data platforms and decision-making tools will require resources and good cooperation between the fire authorities, the agencies specialising in spatial matters, and experts from the fire, remote sensing and artificial intelligence domains. Both ANZLIC and AFAC (the Australasian Fire and Emergency Service Authorities Council) will be important contributors but, given what we know from the 2019-20 season, NSW is in a good position to take a leading role in what is probably best undertaken as a national effort.

2.5.1.7 A possible early win

While it is unlikely Australia would want to pay for a dedicated geostationary satellite to monitor bush fires, it might consider purchasing one or more high-altitude platforms for this purpose despite the cost, given the fact that these big fires could easily happen again.

However, not all remote sensing technology is as expensive.

An example of an existing installation that demonstrates the advantages of optimising the lifecycle of data retrieved by relatively low-tech remote sensing technology is the Latrobe Valley Information Network (LVIN).²⁷⁶

Established in response to large-scale events that have previously affected the region, including the Hazelwood Coal Mine Fire in 2014 and the Black Saturday fires of 2009, the LVIN began with instrumented towers used to monitor nearby timber plantations, coal mines, power stations, landfill sites and water catchments. Now, the \$1.7 million automated network utilises 45 integrated sensors placed at strategic, high-risk locations around the Latrobe Valley that can operate as a stand-alone unit, but also as part of a network to provide data

²⁷⁵ Gordon and Betty Moore Foundation. (2019). Fire Immediate Response System Workshop Report, April 24-26, 2019. Retrieved from <https://www.moore.org/article-detail?newsUrlName=workshop-report-fire-immediate-response-system>.

²⁷⁶ Dickens, Jessica (eds). (2019, 3 December). Environmental Monitoring Network: Making LaTrobe Valley Safer, *InfraStructure magazine*. Retrieved from <https://infrastructuremagazine.com.au/2019/12/03/environmental-monitoring-network-making-latrobe-valley-safer/>.

on environmental parameters including weather, air, soil and water composition, sound, movement, visual and thermal imaging.²⁷⁷

For fire particularly, the LVIN sensors can monitor weather conditions leading into the fire season, then detect fire ignition, location, temperature and movement. Multiple fires can be viewed simultaneously so that active conditions affecting fire growth and movement can be better understood.

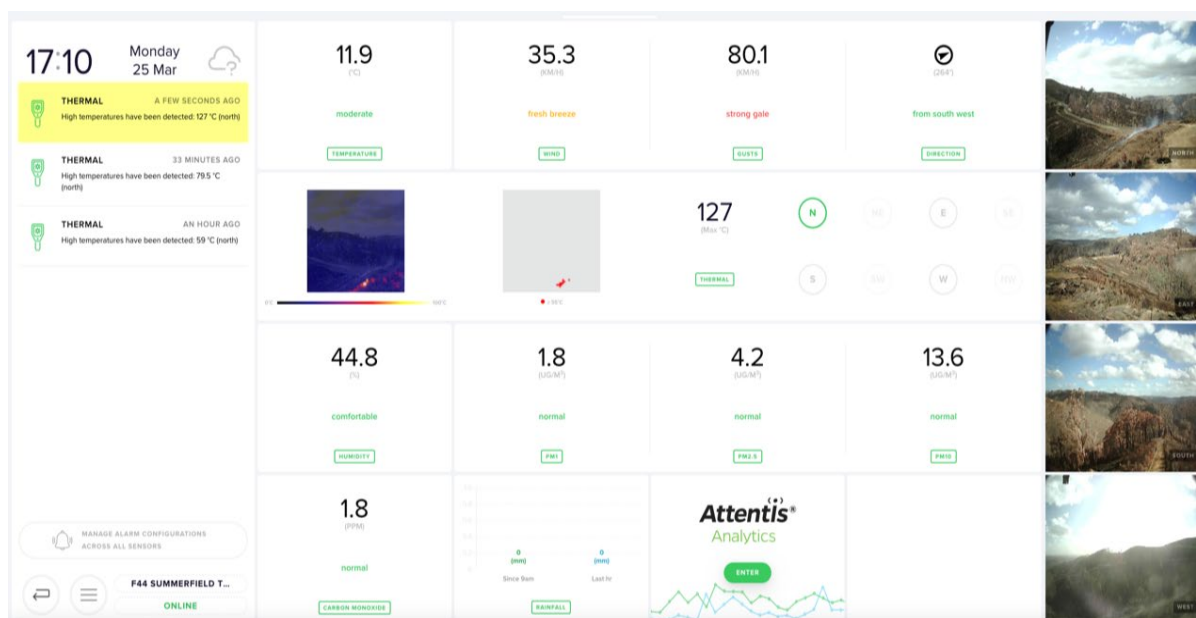


Photo 2-1: Screenshot of LVIN online portal displaying thermal, sensor and visual smoke information relating to a re-ignition adjacent to an at-risk property and home, March 2019. Provided by Latrobe City Council 21 July 2020.

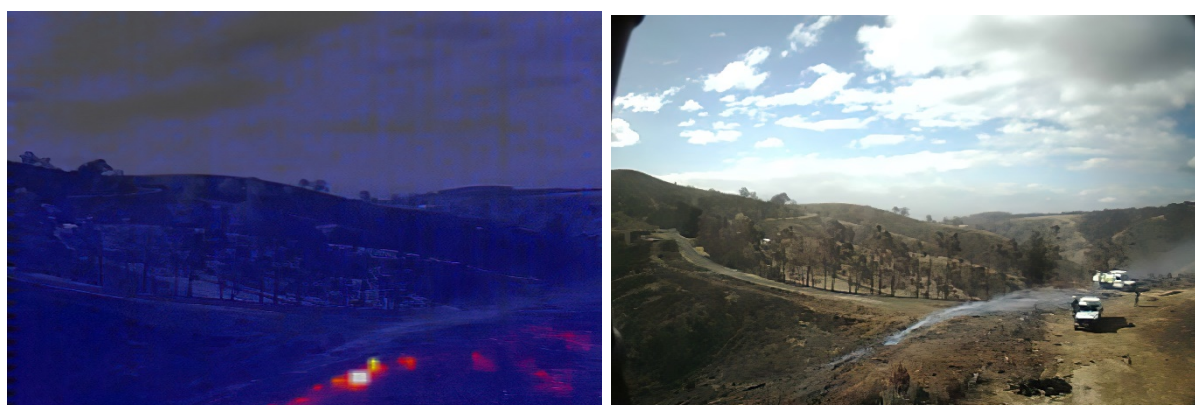


Photo 2-2: Side-by-side thermal and visual image from the LVIN showing the heat source(s) detected and crews onsite for the same fire shown above in March 2019. This autonomous detection sends an alert to any individual or group who have set up alarm configurations. Provided by Latrobe City Council on 21 July 2020.

²⁷⁷ Bernasconi, Amelia. (2019, 3 May). World-first weather monitoring system takes off in regional Victoria, *ABC News*. Retrieved from <https://www.abc.net.au/news/2019-05-03/world-first-weather-monitoring-system-for-latrobe-valley/11074888>.

The LVIN integrates the data and information collected in various ways, and data from other sensors and/or networks can be combined with LVIN data and analytics and transmitted to improve overall understanding of the region, facility or location.²⁷⁸ The 75,000 residents of the La Trobe Valley have free access to monitor this real-time information via an online portal and notifications from local agencies and emergency services.

Installations such as this in high fire-risk areas of NSW, especially near towns and cities, could be an important, relatively cheap and relatively quick development.

2.5.2 NSW needs to enhance its remote sensing capability as a matter of priority

In summary, while remote sensing technologies used by NSW RFS to date have been a useful adjunct in fire fighting, they could be extended significantly to provide much more powerful capability.

There is also an urgent need to:

- consolidate and rationalise the number and range of participants in procurement and acquisition of remote sensing products and services. A useful distinction can be drawn between the skills and capabilities required to deliver many of these products and services, and the skills and capabilities required to leverage them operationally.
- consolidate and coordinate the number and range of participants in Earth Observation/remote sensing/imagery research and development.

These actions will streamline the delivery pipeline to make better information available faster and provide critical mass to build on NSW's and Australia's extensive operational and research expertise in this field.

While NSW can and should take a lead on this, it is also essential that Government advocate at a national level to push existing technology as far as possible, including via acquiring expensive infrastructure items such as high altitude platforms owned nationally, and encourage new technological innovation by developing a plan for effective and innovative fire management using remote sensing technology.

Recommendation 4: That, in order to improve capability to detect ignitions and monitor accurately all fire edge intensity and progression automatically across the State in near real time, Government establish a spatial technology acceleration program to maximise the information available from the various remote sensing technologies currently in use and to plan for inclusion of new remote sensing systems that can sense precisely and rapidly through heavy smoke, cloud, fog and dust. This will require work within the State and with partners nationally and internationally.

²⁷⁸ LVIN (Latrobe Valley Information Network). (2020). LVIN: Frequently Asked Questions. Retrieved from <https://lvin.org/frequently-asked-questions.html>.

2.5.3 The Dutch flood story

Simon Kuper²⁷⁹ describes a story of a then 18-year-old man seeing his father cry for the first time as massive floods in January 1953 destroyed his town, Oude-Tonge in the Netherlands. A total of 1,815 people died in this disaster. The Dutch Government's response was to resolve that no one would lose their life in such an event again, and Kuper reports that "though most of the Netherlands is either below sea level or prone to river floods, the number of people killed by flooding since 1953 is zero".

The Dutch response drove huge technological development, the creation of an industry that now sells its expertise internationally, and a clear view that investment in disaster prevention is more cost-effective than the huge cost of emergency response and rebuilding.

2.5.4 Using the bush fire challenge to become a global centre for fire fighting technology and megafire research and training

The 2019-20 bush fire season presents a similar opportunity to that the Dutch faced in 1953 – to harness the significant research and technology strengths within the State so that NSW becomes a world leader in bush fire research and technology development, with a particular focus on extreme bush fire behaviour that was such a feature of the 2019-20 bush fire season.

The weather and climate observations that have been discussed throughout this Chapter would not have been possible 50 years ago without many of the technologies discussed in the Remote Sensing section of this Chapter.

There is now the opportunity to harness available technology, including robotics, in new and innovative ways and push capabilities further to find more effective and safer ways to monitor and respond to bush fire. There are also important research questions to be answered to gain a better understanding of extreme fire behaviour and of the mechanisms driving bush fire risk; and important training priorities.

2.5.4.1 Research concentration

As often happens in Australia, when there is a major challenge, the community and institutions rise to it, increase capacity and respond. Two examples are Australia's research strengths in telecommunications and plant breeding. This is also happening with bush fire research, which has evolved considerably from the early work done in the 1970s by Roger Wettenhall²⁸⁰ on the Hobart 1967 fire through to the sophisticated research and analytical capabilities evidenced throughout this Chapter from entities such as the NSW Bushfire Risk Management Research Hub and the BoM.

NSW has been very fortunate to have the Research Hub, and for it to have prioritised rapid research projects to inform this Inquiry. It was established by the NSW Government in 2018 as "a partnership between researchers at the University of Wollongong, Western Sydney University, the University of NSW, the University of Tasmania, supported by the NSW

²⁷⁹ Kuper, Simon. (2020, 30 January) Can the Dutch save the world from the danger of rising sea levels?, *Financial Times*. Retrieved from <https://www.ft.com/content/44c2d2ee-422c-11ea-bdb5-169ba7be433d>

²⁸⁰ Roger Wettenhall, *Bushfire Disaster: An Australian Community in Crisis*, Sydney, Angus & Robertson, 1975.

Department of Planning, Industry and Environment and the NSW Rural Fire Service”,²⁸¹ and is directed by Professor Ross Bradstock at the University of Wollongong. The Research Hub is an outstanding example of drawing on the strengths of multiple universities (including expertise outside of NSW), and working in close partnership with government agencies including fire authorities to deliver research that is timely and relevant to the needs of its users and that allows the rapid translation of research findings into practice. It also allows agencies and practitioners to pose and have problems solved on specific issues. The Inquiry commends this initiative of the NSW Government.

More generally, Australia has had the Bushfire Cooperative Research Centre, followed by the Bushfire and Natural Hazards Cooperative Research Centre, which has acted as a good coordinating mechanism for research nationally in bush fire and fire-related topics. The actual research coordinated through the CRC is completed by very strong researchers in universities, CSIRO, Geoscience Australia, the BoM and specialist SMEs.

NSW, and Australia, have been fortunate to have the benefit of these arrangements, but they need to be strengthened still further given the nature of the challenges.

The Inquiry strongly recommends that the Research Hub along with the more general arrangements for research on bush fire continue.

2.5.4.2 Technology development and commercialisation

In addition to the priorities already outlined for harnessing and pushing remote sensing technology further, NSW has other areas of research strength that need to be capitalised on.

For example, NSW is home to the Australian Centre for Field Robotics²⁸² (ACFR) at the University of Sydney, a world-leading centre for large robotics and automation. ACFR is active in finding solutions for fire fighting challenges. There are many opportunities for robotics and unmanned vehicles or aircraft to support the work of fire fighters, especially when conditions are too dangerous to have people in the field. For example, there is an obvious opportunity to trial the adaptation of robots that have been developed for agricultural applications to help with, for example, mopping up activities, fire trail monitoring and maintenance, or identification and management of dangerous trees. This type of innovation can help to remove firefighters from dangerous situations, as well as help to manage the strain on human resources when the scale of a fire season is as overwhelming as it was during 2019-20.

The Inquiry recommends that the NSW Government use the successful model of the Medical Devices Fund²⁸³ to establish a Bushfire Technology Fund to support this technology development and commercialisation.

2.5.4.3 Extreme bush fire research

As described throughout this Chapter, there is also a need to further invest in research into extreme fire behaviour that was such a feature of the 2019-20 season, in particular to enable

²⁸¹ The Bushfire Hub. Our Team. Retrieved from <https://www.bushfirehub.org/team/>.

²⁸² University of Sydney. Australian Centre for Field Robotics. Retrieved from <https://www.sydney.edu.au/engineering/our-research/robotics-and-intelligent-systems/australian-centre-for-field-robotics.html>.

²⁸³ NSW Health. Medical Devices Fund. Retrieved from <https://www.medicalresearch.nsw.gov.au/medical-devices-fund/>.

better prediction of dynamic fire behaviour and extreme bushfires. The emerging research capability in this area is already impressive.

Specific research issues that require attention include:

- formation and impacts of fire-generated thunderstorms, including the environmental conditions associated with these events
- potential for automatic identification of vorticity-driven lateral spread fire behaviour in the landscape as discussed above
- use of technology to improve predictive capability (for example mobile dual polarisation-doplar radar)²⁸⁴
- the drivers of humidity under extreme conditions
- understanding and predicting conditions where a bush fire will not be able to be suppressed and other strategies will be required.

Continuing to strengthen our understanding of bush fire-related phenomena will enable:

- more effective resource deployment during bush fires, for example, earlier targeting of incidents that are likely to escalate
- effective and timely warnings to communities and fire fighters in the field about the likelihood of very dangerous conditions
- better targeting of proactive mitigation measures, for example, managing fuel loads on ridgetops or other terrain that may be susceptible to ignition or development of extreme fire behaviour.

Recommendation 5: That Government establish NSW as a major world centre of bush fire research, and technology development and commercialisation. This should include:

- a) establishing a Bush Fire Technology Fund, modelled on the Medical Devices Fund, to assist with the rapid development of technologies and services to sense, fight, mop up after and protect from bush fires
- b) commissioning further research into extreme fire behaviour and building up the research and research training capacity in this field. This will improve our ability to understand, model and predict the likelihood of extreme fire behaviour in the landscape and enable targeting of fire fighting resources to areas where fires are likely to become most damaging.

2.5.5 Training priorities

An enhanced focus on research and technology development must be accompanied by an emphasis on training. The Inquiry has identified a series of initial priorities for training to ensure that fire fighting practice keeps up with new and emerging research.

2.5.5.1 Fire behaviour analysts

Fire Behaviour Analysts, both centrally and embedded in Incident Management Teams, played a very important role during the 2019-20 season.

The importance of this expertise will only increase, and the season demonstrated how important is to be able to predict what is likely to happen at a very fine, local scale.

As explained by the BoM,²⁸⁵ the modification of local wind near a fire might not be captured by the Automatic Weather Station network, especially in mountainous areas, and local fire-

²⁸⁴ RFS (Rural Fire Service). (2020). *Advice to the Inquiry provided 17 April 2020*.

²⁸⁵ BoM (Bureau of Meteorology). (2020). *Advice provided to Inquiry 25 May 2020*.

modified winds and temperatures may not be captured in the standard models and forecasts.

Therefore, it is important that Fire Behaviour Analysts have a sound understanding, and ideally local knowledge, of local weather effects. The BoM also suggests that portable weather stations placed at major fires will also help to provide real time observations for short-term forecasts.

The Inquiry recommends:

- that Fire Behaviour Analyst training is enhanced with a particular focus on local weather effects
- that there is further investment in Fire Behaviour Analyst training so that there are sufficient numbers of analysts available for deployment to all Incident Management Teams at the scale that was required during the 2019-20 season.

2.5.5.2 Meteorologists

During the 2019-20 season, BoM meteorologists were embedded in the NSW RFS State Operations Centre. These meteorologists supported the Fire Behaviour Analysts at State Operations and embedded in the Incident Management Teams and provided detailed briefings, responded to questions, monitored for conditions that might lead to fire-generated weather and provided forecasts. International meteorologists also provided support to the BoM. The NSW RFS advised that the availability of additional BoM meteorologists this season was very effective.²⁸⁶

The Inquiry was impressed by the expertise in fire behaviour demonstrated by several of the meteorologists at the BoM that it spoke with during the Inquiry. The Inquiry recommends that more meteorologists are trained in Australia to have a higher level of expertise in bush fires and fire behaviour, which is a specialised area, in order to have more of these resources available for large fire seasons, and for potentially embedding in Incident Management Teams when needed.

2.5.5.3 Firefighters

As discussed earlier in this Chapter, fire-generated thunderstorms and other extreme fire behaviour is very dangerous and poses direct risks to firefighter and community safety. The understanding of these phenomena has emerged relatively recently and is increasing rapidly.

Formal fire fighting training materials must be updated to reflect this improved understanding of extreme bush fire behaviour, and there is an urgent need to provide dedicated training in extreme fire behaviour for firefighters, across all the fire management agencies.

2.5.5.4 Research training

The Inquiry also recommends further investment in research training for fire fighting problems, for example, by supporting PhD scholarships specifically for NSW RFS members, which would be focussed on building fire research and modelling capability. The Inquiry has observed that the researchers with practical experience in fire fighting bring exceptional insight to these issues.

²⁸⁶ RFS (Rural Fire Service). (2020). *Advice to the Inquiry provided 22 April 2020*.

Recommendation 6: That Government support training initiatives to increase the capacity of fire authorities to fight the kind of megafires seen in the 2019-20 season. The training initiatives should include:

- a) targeted training in local weather effects for fire behaviour analysts who are embedded in Incident Management Teams
- b) an increase in the number of trained fire behaviour analysts so that, should there be a repeat of the scale of these fires, all Incident Management Teams can have an embedded analyst and there is some redundancy under more normal conditions
- c) training of more meteorologists in fire behaviour so there are more expert resources available to embed within the NSW RFS State Operations Centre
- d) dedicated training for firefighters in extreme fire behaviour
- e) support for research training in challenging firefighting problems.

3 PREPARATION AND PLANNING – EMERGENCY MANAGEMENT

3.1 INTRODUCTION

The Inquiry's Terms of Reference require it to look at the "preparation and planning by agencies, government, other entities and the community for bushfires in NSW, including current laws, practices and strategies, and building standards and their application and effect."²⁸⁷ The Inquiry is required to make recommendations as considered appropriate, on "preparation and planning for future bushfire threats and risks".²⁸⁸

Fires have always been a part of the Australian environment. As described in Chapter 2, bush fire risks have increased in recent years as a result of climate change, extreme weather events, protracted fire seasons and shorter periods for preparation and planning. The Inquiry has noted in this report that the 2019-20 bush fire season was unprecedented in its length, intensity and areas impacted. It heard several times that the 2019-20 bush fire season is not the "new normal, but it's possibly an indication of the new extreme".²⁸⁹ Given the evidence that extreme weather events are likely to become more frequent, the State needs to ensure that it is prepared for these 'unprecedented' seasons, as well as the smaller-scale localised fires that are seen each year.

Many factors led to the extensive fire season, many of which were predicted beforehand. This Chapter will examine the widespread and extensive work that is required and undertaken ahead of each bush fire season, and whether the preparation before this season was appropriate based on the predicted size and scale of the fires.

This Chapter provides an overview of the legislative and governance framework in relation to disaster preparedness, including an overview of the responsibilities of Commonwealth, State and local government and local bush fire committees and the roles and responsibilities of agencies in relation to preparedness and planning. Critical to bush fire preparedness is the community, and in this Chapter the Inquiry examines the current measures in place to support community preparedness ahead of the bush fire season. This Chapter also provides an overview of the Fire Danger Ratings and warnings systems and how they are utilised to inform fire fighting agencies and the community to respond appropriately.

²⁸⁷ Term of Reference 2.

²⁸⁸ Term of Reference 5.

²⁸⁹ Meeting with Shane Fitzsimmons, former NSW RFS Commissioner on 23 March 2020. Professor Ross Bradstock quoted in Carter, Lucy et al. (2020, 9 March). Daintry Gerrand lost her sister in the bushfires and this is her message for Australia, ABC. Retrieved from <https://www.abc.net.au/news/2020-03-09/daintry-gerrand-lost-her-sister-in-the-bush-fires/12033208>.

3.2 THE LEGISLATIVE FRAMEWORK

Key points

- The legislative mechanisms in place to enable coordinated fire fighting arrangements and trigger a state of emergency are sufficient and were used extensively throughout the 2019-20 fire season.
- There have been suggestions the statutory bush fire danger period should be extended in light of more frequent extreme weather events. The Inquiry considers this is not required as there is sufficient flexibility in the existing legislation.
- The Bush Fire Coordinating Committee and Bush Fire Management Committees established under the *Rural Fires Act 1997* are a generally sound governance framework; however, there is a lack of accountability and risk-based performance auditing of BFMCs. The Inquiry considers the governance and accountability framework could be improved.

3.2.1 NSW Bush fire danger period

3.2.1.1 The 2019-20 bush fire danger period was exceptionally long

Section 81 of the *Rural Fires Act 1997* provides that the NSW bush fire danger period (BFDP) commences on 1 October and ends on 31 March the following year. During the BFDP, a fire permit is required for burning activities (e.g. if a landholder wants to undertake hazard reduction on their property).

As stated in Chapter 2, the 2019-20 fire season was eight months long, and started months ahead of the statutory bush fire danger period. The fires started on 1 July 2019 and burned until 2 March 2020 after 240 consecutive days of active fires.²⁹⁰

The NSW Rural Fire Services Commissioner has the power to modify the BFDP in all or part of a local government area (LGA) or to extend the BFDP in all or part of the State. The Commissioner can declare that:

- (a) *there is no bush fire danger period in the area or part, or*
- (b) *a different period is the bush fire danger period for the area or part.*²⁹¹

An order can be made for an area on the recommendation of the relevant Bush Fire Management Committee (BFMC)²⁹², or on the Commissioner's own initiative. However, the Commissioner is required to consult with local fire authorities before an order is made. Any BFMC recommendation is also endorsed by the relevant District and Area Commander. Variations approved by the Commissioner or Executive Director Operations are published in the Government Gazette.²⁹³

The 2019-20 season saw the following variations made to amend the Bush Fire Danger Period dates:

²⁹⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

²⁹¹ Section 82, *Rural Fires Act 1997*.

²⁹² Described further in section 3.3.1.

²⁹³ Section 82, *Rural Fires Act 1997*– 4.13.05 Procedure for Bush Fire Danger Period Variations.

BFDP Dates	Number of Local Government Areas
1 August 2019	12 LGAs
17 August 2019	9 LGAs
1 October 2019	All remaining LGAs except 8 to commence on 14 October 2019
14 October 2019	8 LGAs

Table 3-1: Amendments to Bush Fire Danger Period dates during 2019-20 bush fire season.²⁹⁴

3.2.1.2 There is sufficient flexibility for the NSW RFS Commissioner to change the Bush Fire Danger Period (BFDP) if required

It was suggested to the Inquiry that section 81 of the *Rural Fires Act 1997* should be amended to extend the BFDP from 1 August to 30 April the following year.²⁹⁵

The Inquiry found that the current process allows the Commissioner sufficient flexibility to recognise local conditions and amend the BFDP on a risk basis. The Inquiry further notes that extending the BFDP in legislation would add unnecessary bureaucracy when the risk doesn't warrant it for property owners and land managers, as they are required to obtain permits before lighting fires for land clearance or fire breaks during a BFDP. Given the fire season often moves from north to south, uniformly extending the BFDP across the State may adversely impact the ability of landowners and land managers in the southern parts of the State as they utilise fire for land clearing or creating fire breaks during the planning and preparation processes ahead of the fire season.

The Inquiry's view is that the current variation process is assessed each year on a risk basis and no legislative amendment is required to extend the bush fire danger period.

3.2.2 Emergency management legislative framework

3.2.2.1 The SERM Act provides the overarching framework for emergency management in NSW

The *State Emergency and Rescue Management Act 1989* (SERM Act) specifies in broad terms the emergency management system in NSW. The Deputy Premier and the Minister for Police and Emergency Services are jointly responsible for the SERM Act. Resilience NSW within the Department of Premier and Cabinet administers it.

The SERM Act prescribes the stages of an emergency, as follows:

- (a) **prevention** in relation to an emergency includes the identification of hazards, the assessment of threats to life and property and the taking of measures to reduce potential loss to life or property, and
- (b) **preparation** in relation to an emergency includes arrangements or plans to deal with an emergency or the effects of an emergency, and
- (c) **response** in relation to an emergency includes the process of combating an emergency and of providing immediate relief for persons affected by an emergency, and
- (d) **recovery** in relation to an emergency includes the process of returning an affected community to its proper level of functioning after an emergency.²⁹⁶

²⁹⁴ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 6 May 2020*.

²⁹⁵ For example, Emergency Leaders for Climate Action, Submission to the Inquiry.

²⁹⁶ Section 5, *State Emergency and Rescue Management Act 1989*.

This Chapter describes the legislative framework and agency responsibilities for bush fire prevention and preparation.

3.2.2.2 The Rural Fires Act provides for coordinated fire fighting arrangements

The *Rural Fires Act 1997* (the Act) establishes the NSW Rural Fire Service (NSW RFS)²⁹⁷ and provides the legislative framework for the “prevention, mitigation and suppression of bush and other fires in local government areas (or parts of areas) and other parts of the State constituted as rural fire districts”.²⁹⁸

The Act also provides the framework for the coordination of bush fire fighting and bush fire prevention throughout the State,²⁹⁹ and establishes the Bush Fire Coordinating Committee (BFCC).³⁰⁰ The principal responsibility of the BFCC is planning for bush fire prevention and coordinated bush fire fighting. The BFCC is required to constitute Bush Fire Management Committees (BFMCs) for rural fire districts and may constitute them for other parts of the State. These committees are responsible for the preparation of bush fire management plans for the local areas for which they are constituted,³⁰¹ and are discussed in section 3.3.1. below.

3.2.2.3 Section 44 of the Rural Fires Act allows the RFS Commissioner to take charge of operations

Section 44 of the Act requires the NSW RFS Commissioner to “take charge of bush fire fighting operations and bush fire prevention measures and to take such measures as the Commissioner considers necessary to control or suppress any bush fire in any part of the State if, in the opinion of the Commissioner”:

- (a) a bush fire is assuming such proportions as to be beyond the capabilities of local fire fighting authorities
- (b) prevailing conditions are giving rise to the likelihood that a bush fire will assume such proportions
- (c) a bush fire is not being effectively controlled or suppressed by local fire fighting authorities, or
- (d) a bush fire is burning in a place that is not the responsibility of any fire fighting authority.

The first Section 44 declaration for the 2019-20 season was made on 10 August 2019. In total 43 declarations were made, with the last revoked on 4 March 2020.³⁰²

3.2.2.4 The Rural Fires Act provides a clear single line of accountability during large bush fires

NSW is well served by its coordinated bush fire fighting arrangements, particularly during those incidents that are subject to a Section 44 declaration. As stated above, Section 44 provides a clear single line of accountability to the NSW RFS Commissioner for bush fires anywhere in NSW.

²⁹⁷ Part 2, *Rural Fires Act 1997*.

²⁹⁸ Section 3, *Rural Fires Act 1997*.

²⁹⁹ Section 3, *Rural Fires Act 1997*.

³⁰⁰ Part 3, *Rural Fires Act 1997*.

³⁰¹ Part 3, *Rural Fires Act 1997*.

³⁰² RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

Further s.45(1) states:

*The Commissioner may give such directions as the Commissioner considers necessary to fire control officers, deputy fire control officers, officers of rural fire brigades, local authorities, officers or members of Fire and Rescue NSW, members of the NSW Police Force and other persons in connection with the prevention, control or suppression of any bush fire in the area or locality in which the Commissioner has taken charge or is taking measures under this Division.*³⁰³

Fire and Rescue NSW and the NSW RFS cooperate under a number of legislative instruments and Memoranda of Understanding to ensure cooperative fire fighting is achieved by frontline personnel. The Inquiry found that After Action reviews and general commentary indicate that the coordination and cooperation between fire authorities to respond to severe bush fires has largely been very successful.

The *Rural Fire Services Act 1997* (Section 44) and the *Fire and Rescue NSW Act 1989* designate specific areas and responsibilities to avoid any perceived conflict between agencies. The *Fire and Rescue NSW Act* places statutory obligations on the Fire and Rescue NSW Commissioner in relation to Fire Districts. A Section 44 declaration under the *Rural Fire Services Act* means that all resources in a specific geographical area, which may include a Fire District/s, come under the responsibility of the Section 44 Incident Controller.

It was suggested to the Inquiry that there is opportunity to develop a methodology to ensure that, as resources are taken charge of (either within a declared area or as allocated from outside that area), the two fire agencies can continue to deliver services to the community if other unrelated events occur.

This may include the standing up of additional resources from further afield, or the NSW RFS Commissioner (or delegate) releasing resources, for delivery of services such as responses to motor vehicle accidents, hazardous materials incidents or emergencies.

Recommendation 7: That the NSW RFS Commissioner consult with the Fire and Rescue NSW Commissioner and other emergency services to develop a protocol in the event that simultaneous emergency events necessitate the re-allocation of resources while a Section 44 declaration is in place.

3.2.2.5 There were three State of Emergency declarations during the 2019-20 season

The SERM Act permits the Premier to declare that a state of emergency exists in the whole or part of the State, if satisfied that an emergency constitutes “a significant and widespread danger to life or property”.³⁰⁴

The declaration is made by way of a written order, which must be published in the *NSW Government Gazette*. The Premier is also obliged to publicise the declaration of a state of emergency through the media.

Once a declaration has been made, the Minister for Police and Emergency Services is responsible for controlling and coordinating the activities of government agencies and the

³⁰³ Section 45(1), *Rural Fires Act 1997*.

³⁰⁴ Section 33(1), *State Emergency and Rescue Management Act 1989*.

allocation of resources for responding to the emergency (typically delegated to the State Emergency Operations Controller or another person).³⁰⁵

A declaration confers upon the Minister or delegate wide ranging powers. The Minister may, for example:

- direct any government agency to do or refrain from doing any act or function
- order evacuations
- order public or private places in the emergency area to be closed
- order traffic to be stopped
- order power or water to be shut off
- order the pulling down, destruction or shoring up of any wall or premises that has been damaged in an emergency area
- take possession and make use of any person's property for the purposes of responding to an emergency (with appropriate compensation).

In the seven and a half years between March 2012 and October 2019, two states of emergency were declared under the SERM Act: one in March 2012 due to severe flooding and one in October 2013 due to bush fires.

In the single 2019-20 bush fire season, three states of emergency were declared:

- 11-18 November 2019
- 19-26 December 2019
- 2-10 January 2020.

3.2.3 Inspector General of Emergency Management

It was suggested to the Inquiry that, based on similar models in Victoria and Queensland, NSW should appoint an Inspector General for Emergency Management (IGEM) to oversee agencies responsible for emergency management.

The Victorian IGEM was established in the *Emergency Management Act 2013* with two primary objectives. First, to “provide assurance to the government and the community in respect of emergency management arrangements in Victoria”, and second to “foster continuous improvement of emergency management in Victoria”.³⁰⁶ The Victorian IGEM undertakes reviews, evaluations and assessments of Victoria’s emergency management arrangements and the sector’s performance, capacity and capability.³⁰⁷ Similarly, the Queensland IGEM was established in 2013 “to enable confidence in Queensland’s emergency management arrangements”, by providing oversight and quality assurance of agencies responsible for disaster management.³⁰⁸

The Inquiry notes that on 6 April 2020 the Premier announced the establishment of Resilience NSW – a new agency to “drive world-leading disaster preparedness and recovery approach for the NSW community”.³⁰⁹ Resilience NSW is responsible for all aspects of

³⁰⁵ Section 36, *State Emergency and Rescue Management Act 1989*.

³⁰⁶ Section 62, *Emergency Management Act 2013* (Vic).

³⁰⁷ IGEM (Inspector-General for Emergency Management). (2020). About the Inspector-General for Emergency Management. Retrieved from <https://www.igem.vic.gov.au/about-us/about-the-inspector-general-for-emergency-management>.

³⁰⁸ Queensland Government Inspector-General Emergency Management. About Us. Retrieved from <https://www.igem.qld.gov.au/about-us>.

³⁰⁹ NSW Premier. (2020). RFS Commissioner Fitzsimmons to lead new Resilience NSW agency. Retrieved from <https://www.nsw.gov.au/media-releases/rfs-commissioner-fitzsimmons-to-lead-new-resilience-nsw-agency>.

disaster recovery and building community resilience to future disasters. This includes overseeing and coordinating emergency management policy and service delivery.

Resilience NSW is located within the Department of Premier and Cabinet and is therefore well placed to lead a whole-of-government approach to emergency management capability, planning and coordination, and disaster response and recovery. The Inquiry is of the view that the location of Resilience NSW within a central agency presents opportunities for a more coordinated, cohesive approach to emergency management in NSW and therefore does not consider that an IGEM in NSW would be appropriate at this stage. The Inquiry notes, however, the benefits of the independence of the IGEM role and acknowledges that this may be reviewed in the future.

3.3 NSW GOVERNANCE FRAMEWORK

Key points

- The *Rural Fires Act* provides a governance framework for bush fire prevention, mitigation and suppression at the State and local level.
- While all relevant agencies and non-government organisations appear to be represented on the Bush Fire Coordinating Committee and local Bush Fire Management Committees, there is a need to ensure committee members are appropriately senior and can actively participate in decision-making.
- There is a need to strengthen existing governance mechanisms to ensure the State-level committee has appropriate oversight over local committees, and that issues are escalated from the local to the State level to ensure they are resolved in a timely and efficient way.
- The BFCC should endorse the annual public statement regarding likely fire season risk and the effectiveness of planning and preparation to ensure collective responsibility for identifying and mitigating bush fire risk.

3.3.1 Bush Fire Coordinating and Management Committees

State and territory governments have primary responsibility for emergency management legislation, policy and frameworks within their jurisdiction. The Commonwealth Government, through Emergency Management Australia, coordinates physical and financial support for disasters and emergencies.³¹⁰ In NSW, the Bush Fire Coordinating Committee (at the State level) and Bush Fire Management Committees (at the local level) oversee bush fire preparedness.

The Bush Fire Coordinating Committee (BFCC) is constituted as a corporation under section 46 of the *Rural Fires Act 1997*. The BFCC is chaired by the NSW RFS Commissioner with members from NSW government agencies and non-government organisations and Ministerial appointees who have a direct responsibility and/or interest in

³¹⁰ Department of Home Affairs. (2020). Emergency management. Retrieved from <https://www.homeaffairs.gov.au/about-us/our-portfolios/emergency-management/about-emergency-management>.

preventing and fighting bush fires.³¹¹ Agency representatives range in seniority from Commissioner and Deputy Commissioner through to Senior Manager and Manager.³¹²

The BFCC is responsible for:

- planning for bush fire prevention and coordinated bush fire fighting
- advising the RFS Commissioner on bush fire prevention, mitigation and coordinated bush fire suppression³¹³
- constituting Bush Fire Management Committees (BFMCs) in areas where a rural fire district has been established, and in urban areas where there is a reasonable risk of bush fire.³¹⁴

At the local level, BFMCs are responsible for ensuring that bush fire management is adequately assessed and designed for holistic protection of the community, based on a tenure blind,³¹⁵ cooperative and coordinated approach that utilises community and interagency involvement.³¹⁶ In fulfilling this role, BFMCs are required to prepare, monitor and maintain:

- Bush Fire Risk Management Plans, which identify community assets at risk of bush fire and set out a five-year program of treatments (e.g. hazard reduction burning, community education, emergency planning and mechanical clearing)
- Operations Coordination Plans, which outline the arrangements for coordinated fire fighting practices across the BFMC area (i.e. if a Section 44 declaration is made)
- Fire Access and Fire Trail (FAFT) Plans, which identify the appropriate means of accessing land to prevent, fight, manage and contain bush fires.³¹⁷

The *Rural Fires Regulation 2013* sets out the stakeholders who are to be invited to become members of the BFMC (noting membership from each agency is not compulsory).³¹⁸ These stakeholders include local councils, Fire and Rescue NSW, National Parks and Wildlife (NPWS), Crown Lands, Forestry Corporation NSW, NSW RFS local brigades, rural landholders, distribution network service providers, local Aboriginal land councils and anyone else approved by the BFCC. There are currently 56 BFMCs across NSW.³¹⁹

In addition to their statutory functions, the BFCC has also tasked BFMCs with:

- promoting and developing coordination and cooperation between member organisations and agencies

³¹¹ BFCC members: NSW Rural Fire Service, Fire and Rescue NSW, NSW Police Force, Department of Industry – Primary Industries, NSW Department of Industry – Crown Lands and Water, NSW National Parks and Wildlife Service, Nature Conservation Council of NSW, Resilience NSW, Forestry Corporation of NSW, Local Government NSW, NSW Rural Fire Service Association and NSW Farmers Association.

³¹² RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 16 July 2020*.

³¹³ Section 48, *Rural Fires Act 1997*.

³¹⁴ Section 50, *Rural Fires Act 1997*.

³¹⁵ See further discussion of tenure at 3.3.1.1.

³¹⁶ RFS (NSW Rural Fire Service). (2019). Bush Fire Management Committee Charter. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0007/176695/Bush-Fire-Management-Committee-Charter.pdf.

³¹⁷ Sections 51 and 52, *Rural Fires Act 1997* and clause 15, *Rural Fires Regulation 2013*.

³¹⁸ Clause 14, *Rural Fires Regulation 2013*.

³¹⁹ Retrieved from <https://www.rfs.nsw.gov.au/resources/publications/bush-fire-risk-management-plans>.

- assisting in the coordination of bush fire mitigation works programs in the BFMC's area of responsibility, including assessing and prioritising funding applications that support these activities.³²⁰

3.3.1.1 BFMCs are required to manage complex cross-tenure and cross-agency issues

Developing and executing bush fire risk management plans, implementing hazard reduction and enabling access during fires through properly prepared fire trails require NSW government agencies and landholders to work across tenure types to achieve a common objective, i.e. protecting the community from bush fire risk.

The BFMC Charter, issued by the BFCC, states that statutory roles and responsibilities of government agencies and rights of landholders are to be respected.³²¹ However, the statutory objectives of BFMC members and the interests of landholders are sometimes in tension with each other. For example:

- the NSW RFS is responsible for protecting the community from, and reducing the risk of, fire³²²
- Forestry Corporation is responsible for growing, protecting and harvesting a commercial timber supply and maximising the net worth of the State's investment³²³
- NPWS is responsible for conserving and protecting wildlife, wilderness areas, wild rivers, wildlife, Aboriginal objects and Aboriginal places³²⁴
- private landholders are generally focussed on trying to use their land for commercial and/or lifestyle purposes.

The Inquiry has heard that the ability of BFMCs to manage these tensions and achieve their fire risk management objectives is highly variable, with some held up as exemplary and others requiring a lot of improvement. For example, the Lower Hunter BFMC has demonstrated that strong inter-agency collaboration can lead to improved fire trail management (further discussed in Chapter 4). On the other hand, the Inquiry was also presented with the view that some BFMCs and government agencies engaged in a 'tug-of-war over which agency was accountable for funding and mitigation works'.³²⁵ In another area, the Inquiry heard that some representatives of the local BFMC didn't seem to have the authority to make decisions on behalf of their agency. The Inquiry notes that the updated *BFMC Policy* released in March 2020 states that "it is expected that all members of the BFMC ... have authority to commit their organisation to agreed actions"; however, there is no accompanying verification process to ensure this is the case.³²⁶

Given the range of different statutory responsibilities and interests that BFMC members are required to serve, it is inevitable that tensions will arise and that concessions will need to be made in the service of protecting the community from bush fire risk through appropriate

³²⁰ RFS (NSW Rural Fire Service). (2019). Bush Fire Management Committee Charter. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0007/176695/Bush-Fire-Management-Committee-Charter.pdf.

³²¹ RFS (NSW Rural Fire Service). (2019). Bush Fire Management Committee Charter. Clause 6.2. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0007/176695/Bush-Fire-Management-Committee-Charter.pdf.

³²² Section 9, *Rural Fires Act 1997*.

³²³ Division 2, *Forestry Act 2012*.

³²⁴ Section 12, *National Parks and Wildlife Act 1974*.

³²⁵ Dr Joe McGirr MP, Member for Wagga, Submission to the Inquiry.

³²⁶ BFMC Policy March 2020.

hazard reduction and preparation of fire trails. Ideally, solutions should be agreed at the local level by BFMCs, to ensure local community priorities shape the negotiated outcome while taking into account the requirements set down at State level. It is therefore important these decisions are made by people with the requisite discretion and authority, with clear escalation pathways in place if negotiated agreements are unable to be reached. The Inquiry recommends that agencies review BFMC membership and confirm to the NSW RFS that members have sufficient discretion and authority to agree and implement risk mitigation activities at the local level.

3.3.1.2 BFCC members must be appropriately senior and escalation pathways must be strengthened

While the Inquiry understands that resolving inter-agency issues and tensions between competing statutory responsibilities is complex, it is not acceptable that unresolved issues inhibit the adequate protection of NSW communities from bush fire risk (for example the construction and maintenance of fire trails, further discussed in Chapter 4). It is clear that escalation and accountability mechanisms for resolving inter-agency issues must be strengthened, in order better to protect communities from the future risk of bush fires.

The *BFMC Policy*, issued by the Bush Fire Coordinating Committee (BFCC), states that “BFMCs will aim to reach consensus on a tenure-blind basis ... if unable to be resolved, issues can be referred to the BFCC for resolution”.³²⁷ However, the Inquiry has found that BFMCs are not referring unresolved inter-agency issues to the BFCC for resolution as a matter of course. A review of the minutes from the last three years of BFCC meetings demonstrated that, while some BFMCs have made presentations to the BFCC on the successes and challenges experienced in implementing their plans, this does not appear to include escalating any ‘sticking points’ between agencies at the local level. There is therefore a risk that issues are being left unresolved and acting as ‘roadblocks’ impeding bush fire risk management activities.

As the escalation of issues from BFMCs to the BFCC is currently effectively optional, and in light of what the Inquiry has heard relating to inter-agency issues at the local level, the Inquiry recommends that the *BFMC Policy* be amended to require BFMCs to refer unresolved issues to the BFCC promptly for resolution. Once an issue has been escalated to the BFCC, it must be resolved in a timely manner to ensure prevention and mitigation works are not delayed.

The need to resolve competing statutory responsibilities and policy objectives is not new and is not confined to bush fire prevention and mitigation. This is a perennial challenge across a range of policy areas, at all levels of government. In discussions with stakeholders, the Inquiry heard of a range of approaches that had been pursued in other policy contexts and noted that the seniority and influence of those charged with resolving issues was a primary driver of success. Similarly, in the bush fire context, BFCC members should be appropriately senior to ensure they can make commitments on behalf of their agency. After reviewing the current BFCC membership, the Inquiry recommends that NSW government agency members should be at the level of Coordinator General/Deputy Secretary/Deputy Commissioner/Agency Head (or equivalent), and that the NSW RFS Commissioner should continue as Chair. The Inquiry recommends the NSW RFS consider enhancing the

³²⁷ BFMC Policy March 2020.

transparency and community accountability of BFCC decision-making, for example by publishing the BFCC/BFMC membership and minutes on its website.

As discussed in Chapter 2, the Inquiry recommends that at the start of each fire season, based on advice from the BFCC, the Government provide a public statement with an evaluation of the likely fire season risk and the effectiveness of the planning and preparation for the upcoming season. This should be based on sophisticated monitoring of the key risk factors along with an overview of the areas of greatest risk. Given the range of agencies that are responsible for taking action to ensure NSW is well-prepared, it is appropriate that the BFCC endorses the evaluation ahead of any public statement.

3.3.1.3 The BFCC should exercise stronger oversight of Bush Fire Risk Management Plans

As noted above, BFMCs are required to produce a range of plans for the BFCC's approval, with varying review and approval cycles for each type of plan. For example, Bush Fire Risk Management Plans must be submitted within 12 months of the BFMC being formed, and then within each subsequent five-year period, to the BFCC for approval.³²⁸ However, a review of the available Bush Fire Risk Management Plans on the NSW RFS website reveals that of the 61 Plans,³²⁹ currently 16 are overdue and 8 drafts have been submitted for review. There is no set timeframe for the BFCC and NSW RFS Headquarters to finalise plans: the only timeframe is the initial 12 months and then subsequent 5 year review.³³⁰ The Inquiry recommends that the BFCC ensure that all Bush Fire Risk Management Plans, Operation Coordination Plans and Fire Access and Fire Trail (FAFT) Plans are compliant with the timeframes specified under section 52 of the *Rural Fires Act*.

In addition, section 62A of the *Rural Fires Act* provides that the NSW RFS Commissioner “may conduct a performance audit of the implementation of bush fire risk management plans generally in the State or for a specified rural fire district or other part of the State”, either at the Commissioner’s own initiative or at the request of the BFCC. The legislation requires performance audits to be recorded in the RFS Annual Report. However, the Inquiry’s review of NSW RFS Annual Reports found that a performance audit of bush fire risk management plans has not been conducted for the past eight years, as the most recent performance audit was conducted in 2010-11.³³¹ Similarly, there appears to be limited, if any, use of statutory compliance and enforcement powers in relation to fire trails, further discussed in Chapter 4.

The Inquiry considers there is a need for the NSW RFS Commissioner, as Chair, to strengthen oversight of BFMCs to ensure they are held accountable for meeting their responsibilities. This is particularly important given the significance of the 2019-20 fire season, the critical role that BFMCs and Bush Fire Risk Management Plans, Operation Coordination Plans and FAFT Plans play in ensuring communities are prepared, and the variability in BFMC performance across NSW. The Inquiry recommends the BFCC develop a

³²⁸ RFS (NSW Rural Fire Service). (2019) Bush Fire Management Committee Handbook, p 8. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0004/176692/Bush-Fire-Management-Committee-Handbook-2020.pdf.

³²⁹ There are currently 56 BFMCs and 61 BFRMPs. Discrepancy arises from some BFMCs combining as a result of council mergers or local choice but have not updated/combined their Risk Management Plans.

³³⁰ Review of available Bush Fire Risk Management Plans occurred on 12 July 2020.

³³¹ RFS (NSW Rural Fire Service). (2011). NSW RFS Annual Report 2010/11, Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0012/4440/2010-11-Annual-Report.pdf. p 58.

risk-based performance auditing cycle to ensure Bush Fire Risk Management Plans, Operation Coordination Plans and FAFT Plans are fit-for-purpose and any opportunities for improvement are identified and actioned. The Inquiry recognises the additional workload that this will entail, given there are currently 56 BFMCs across NSW.

Recommendation 8: That, to strengthen cross-agency accountability and deliver improved bush fire risk management outcomes:

- a) Bush Fire Coordinating Committee (BFCC) members from NSW government agencies are at the level of Coordinator General/Deputy Secretary/Agency Head/Deputy Commissioner (or equivalent)
- b) the BFCC ensures all Bush Fire Risk Management Plans, Operation Coordination Plans and Fire Access and Fire Trail (FAFT) Plans are compliant with the timeframes outlined in section 52 of the *Rural Fires Act* as soon as practicable
- c) the BFCC develops a risk-based performance auditing cycle to ensure Bush Fire Risk Management Plans, Operation Coordination Plans and FAFT Plans are fit-for-purpose and any opportunities for improvement are identified and actioned
- d) the NSW RFS considers the best way of enhancing the transparency of BFCC decision-making, for example by publishing BFCC membership and minutes on its website
- e) the BFCC endorses the annual statement to Parliament on the likely fire risk and the effectiveness of planning and preparation
- f) relevant agencies review Bush Fire Management Committee (BFMC) membership and confirm to the NSW RFS that members have sufficient discretion and authority to agree and implement risk mitigation activities at the local level
- g) the NSW RFS Commissioner amends the BFMC Policy to require BFMCs to refer unresolved issues to the BFCC for resolution.

3.4 PRE-SEASON BRIEFING

The NSW RFS led development of a pre-season outlook from the NSW perspective and made a major contribution to the Australia-wide outlooks produced by Emergency Management Australia and the Bushfire and Natural Hazards CRC.

The NSW RFS relies on multiple sources when developing its pre-season outlook briefings. As well as sourcing from in-house experts and personnel, it works collaboratively with the Bureau of Meteorology, Geoscience Australia and Spatial Services to produce supporting data.

The pre-season outlook and briefings focus primarily on awareness and understanding of the expected conditions, with information formulated through analysis of weather patterns and fuel loads.

Very early on the NSW RFS was vocal about its concerns on the likelihood of an above normal fire season in forested areas on and east of the Great Dividing Range and was briefing internal and external stakeholders accordingly. The NSW RFS also expressed pre-season concerns that long term rainfall deficiencies had severely impacted water resources. The preceding months had been some of the driest on record³³² and, as noted by the

³³² BoM (Bureau of Meteorology). Severe fire weather conditions in southeast Queensland and northeast New South Wales in September 2019. Retrieved from http://www.bom.gov.au/climate/current/statements/scs7_1.pdf

Bureau of Meteorology, “[by] the start of September 2019, much of eastern Australia was primed for high fire danger ratings”.³³³

Absent from pre-season briefings are specific details on preparedness and mitigation activities for which all NSW fire fighting agencies and land managers are held accountable. The Inquiry believes that briefings about expected conditions should be accompanied by measures taken by fire authorities and land managers in preparation for those conditions. As discussed in Chapter 2, the Inquiry recommends that at the start of each fire season, based on advice from the BFCC, the Government provide the public with an evaluation of the likely fire season risk and the effectiveness of the planning and preparation for the upcoming season.

This might include specific information on:

- the amount and efficacy of hazard reduction undertaken in the lead up to the start of the season
- the state and condition of NSW’s vast network of fire trails
- condition of fire fighting fleet and equipment
- firefighter readiness and training
- the types and level of engagement with property owners and the wider community in identified at risk areas
- changes to planned operational response in light of expected conditions, for example managing water scarcity, and
- other similar indicators.

3.4.1 Applying lessons learnt from previous seasons

An important phase in the preparation ahead of the bush fire season is ensuring consideration and implementation of lessons learnt from previous seasons. Capturing the lessons learnt is critical to emergency management agencies to ensure continuous improvement, information sharing, planning, emergency risk management and improving response and recovery.

In NSW there is an overarching framework for emergency management agencies to capture the learnings from previous seasons and make recommendations for improvements for future seasons. The *Lessons Management Framework for the NSW Emergency Management sector* provides a foundation for implementing Lessons Management capability across the sector. It was endorsed by the State Emergency Management Committee (SEMC) in March 2019.³³⁴

The Lessons Management Framework identifies five essential elements to support the implementation of a Lessons Management lifecycle:

- governance
- leadership and culture
- roles, responsibilities and accountability
- standard language, and

³³³ BoM (Bureau of Meteorology). Dangerous bushfire weather and heat in spring 2019. Retrieved from <http://www.bom.gov.au/climate/current/statements/scs72.pdf>

³³⁴ Resilience NSW (2019). Lessons Management Framework. Retrieved from <https://www.emergency.nsw.gov.au/Pages/emergency-management/lessons-management/Lessons-management-framework.aspx>.

- a clearly defined Lessons Management process for identifying, sharing and learning lessons.

Applied together, the elements support and sustain a consistent approach to Lessons Management across the sector. The Framework acknowledges the good work already being done by many organisations and provides a way for organisations to develop and build on existing levels of maturity in Lessons Management.

Resilience NSW³³⁵ advised the Inquiry that the Framework is scalable and can be implemented at an organisational, local, regional and State level. Resources have been produced to support implementation, and to increase the lessons management capability within NSW, such as online training in lessons management, tools for writing and recording observations.

As outlined in Chapter 2, extreme fires and fire seasons are likely to become more frequent. The Inquiry supports the current Lessons Management Framework approach, and notes that the lessons learnt from the 2019-20 fires will be critical to prepare for future seasons.

3.5 NSW FIRE AUTHORITIES – RESOURCING

Key points

- NSW was well prepared for a ‘normal’ fire season, but the 2019-20 season was extraordinary which stretched resources across the State. The Inquiry found that fire fighting personnel numbers for NSW fire authorities have remained stable or increased over the past 10 years.
- The Inquiry heard numerous times that ‘all the firefighters in Australia’ couldn’t have stopped some of the fires in the 2019-20 season due to their size, speed and ferocity.
- NSW has Memoranda of Understanding (MOUs) with fire services in other states and territories to provide a ‘surge’ capacity during peak periods. MOUs are also in place with Canada, the USA and New Zealand.
- As fire seasons are becoming longer and more extreme in both the northern and southern hemispheres, there is a growing risk this will inhibit fire authorities’ ability to release resources to assist other jurisdictions.

The pre-season briefing indicated the 2019-20 bush fire season was going to be severe. This section examines the budget, resource allocations and personnel of fire fighting agencies to examine whether adequate resources were in place ahead of the 2019–20 fire season.

3.5.1 Fire fighting personnel

There are four NSW agencies with responsibility for fire fighting (known as ‘fire authorities’). The NSW Rural Fire Service (NSW RFS) is the lead bush fire management agency in NSW and works together with the other NSW fire authorities set out in the *Rural Fires Act*: National Parks and Wildlife Service (NPWS), Fire and Rescue NSW (FRNSW) and the Forestry Corporation of NSW.

³³⁵ Resilience NSW. (2020). *Advice to the Inquiry provided 13 May 2020*.

3.5.2 NSW Rural Fire Service (NSW RFS)

The NSW RFS is the lead combat agency for all fires occurring within Rural Fire Districts, which includes responsibility for structural fire fighting in more than 1,200 towns and villages. The NSW RFS comprises 2,002 rural fire brigades with a total membership of 71,234 (as at 30 June 2019).³³⁶ Of these, 49,517 members hold a fire fighting qualification, while other members perform critical support roles including logistics, communications, catering and administration.³³⁷ Key demographics of NSW RFS members include:

- 22% of NSW RFS members are female
- 16,251 members (23%) are aged up to 34 years, 21,538 members (30%) are between 35-54 years of age, and 31,395 members (44%) are 55 years and over. The average age of NSW RFS members is 51 years.³³⁸

The NSW RFS employs over 900 paid staff to manage operations and support the work of members.³³⁹

Following the 2019-20 season, the NSW RFS has received 8,872 new membership applications, and processed more than twice as many applications from 1 September 2019 to 30 April 2020 compared to the previous year.³⁴⁰ This is a promising sign that NSW RFS membership will continue to expand as current members retire. The Inquiry notes that COVID-19 restrictions may impact timeframes for the onboarding of new members, which means it is unlikely that membership numbers will increase greatly ahead of the 2020-21 season.

As discussed further in Chapter 5, the Inquiry recognises how important volunteerism is to fire fighting arrangements in NSW and does not consider this should change. However, as extreme fire seasons are likely to occur again in the future, it is essential that the NSW RFS and the NSW Government have clear visibility over how many NSW RFS members are available to perform a fire fighting role. The Inquiry recommends future Annual Reports include information on how many NSW RFS members hold a fire fighting qualification, and how this figure is trending over time, to ensure immediate rectifying action can be taken if there is a downward trend.

3.5.3 National Parks and Wildlife Service (NPWS)

The NPWS is responsible for suppressing fires that start on NPWS-managed land. This consists of over 880 parks and reserves covering 7.2 million hectares, 90% of which is designated as 'bush fire prone land' under the *NSW Environmental Planning and Assessment Act 1979*.³⁴¹

The NPWS employs the largest contingent of paid firefighters in NSW who specialise in bush fire suppression. As at October 2019, NPWS employed 1,067 trained firefighters.³⁴² A number of submissions to the Inquiry were of the view that there has been a significant

³³⁶ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 17 April 2020*.

³³⁷ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 22 June 2020*.

³³⁸ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 27 July 2020*. The Inquiry notes that age data was unavailable for 2,050 members (2.88%).

³³⁹ RFS (NSW Rural Fire Service). Fast facts. Retrieved from <https://www.rfs.nsw.gov.au/about-us/fast-facts>.

³⁴⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 17 April 2020*.

³⁴¹ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 14 April 2020*.

³⁴² Ibid.

reduction in qualified and experienced firefighters in NPWS.³⁴³ NPWS advised the Inquiry that NPWS firefighters have an average of 13 years' experience, 80% have over five years' experience³⁴⁴ and 44% have over 15 years' experience.³⁴⁵ Approximately 400 NPWS firefighters are trained to undertake Remote Area Response Team roles.³⁴⁶ Beyond accredited frontline fire fighting staff, the NPWS also provides staff to form part of Incident Management Teams³⁴⁷ and logistical support. In total, the NPWS had a total of 1,294 staff available for the 2019-20 season.³⁴⁸

The Australian Workers Union (AWU) submitted there were 115 unfilled frontline firefighter vacancies in NPWS ahead of the 2019-20 season (50 of which were still vacant), and reductions in the number of fire trained positions in NPWS.³⁴⁹ However, advice from the NPWS to the Inquiry confirmed that the number of NPWS staff fully accredited for fire fighting has remained relatively stable from 2011-12 to 2019-20. There were 1,050 fire fighting staff in 2011-12 compared to 1,067 staff in 2019-20.³⁵⁰ The Inquiry notes that current NPWS staff totals are approximately 50 less than the number recommended in the NPWS *Living With Fire Strategy 2012-2021*, and encourages NPWS to ensure staff totals align with the strategy by 2021.

3.5.4 Forestry Corporation of NSW

The Forestry Corporation of NSW is responsible for suppressing fires that start on State forests, which make up over 2 million hectares.³⁵¹ Forestry Corporation firefighters are specialists in large forest fires (tall timber) with extensive on-ground experience, as well as expertise in using heavy machinery (e.g. to help build containment lines).³⁵²

Forestry Corporation has 538 firefighters available for deployment (342 full-time permanent staff and 196 seasonal contractors) and 91 operational personnel available to fill Incident Management Team (IMT) roles.³⁵³ The Inquiry understands that, while there has been a shift towards employing seasonal contractors for fire fighting roles instead of full-time permanent staff, this has not affected the fire fighting capacity available during the bush fire season over the last 10 years.

3.5.5 Fire and Rescue NSW (FRNSW)

Fire and Rescue NSW is responsible for fire, rescue and hazmat services in cities and towns within designated fire districts across NSW. As at 30 June 2019, FRNSW employed a

³⁴³ Public Service Association (PSA), Submission to the Inquiry.

³⁴⁴ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 14 April 2020*.

³⁴⁵ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 1 April 2020*.

³⁴⁶ Ibid.

³⁴⁷ As referred to in Chapter 1, an Incident Management Team (IMT) is a multi-agency team established, when a Section 44 declaration (discussed in 3.2.2.3 above) is made, to organise the response to major fires. The role of the IMT is discussed in Chapter 5.

³⁴⁸ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 1 April 2020*.

³⁴⁹ Australian Workers Union (AWU), Submission to the Inquiry.

³⁵⁰ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 1 April 2020*.

³⁵¹ FCNSW (Forestry Corporation of NSW). (2020). 2019-2020 bushfire response. Retrieved from <https://www.forestrycorporation.com.au/operations/fire-management/2019-2020-bush-fire-response>.

³⁵² Ibid.

³⁵³ FCNSW (Forestry Corporation of NSW). (2020). *Advice to the Inquiry provided 2 June 2020*.

combined total of 6,787 trained firefighters, made up of 3,513 permanent full-time fire officers and 3,274 retained (i.e. on-call) fire officers.³⁵⁴

3.5.6 Firefighters from interstate and overseas

Agreements to share resources across jurisdictions provide a 'surge' capacity for local firefighters during peak fire periods. The NSW RFS has Memoranda of Understanding (MOUs) with fire services in bordering Australian states and territories (Queensland, ACT, Victoria and South Australia). These MOUs enable the NSW RFS to request assistance from other states and territories as required, and vice versa, and were heavily relied upon during the 2019-20 season (see Chapter 5 for details on deployments).

In addition to domestic arrangements, Emergency Management Australia has similar resource-sharing MOUs with Canada, the USA and New Zealand, with deployments facilitated through AFAC.

However, the ability for fire authorities to provide support to other states and territories is contingent on demands in their own jurisdiction. As outlined in Chapter 2, as fire seasons become longer and more extreme in each state and territory, fire authorities' ability to share resources is increasingly limited. MOUs with other countries are also based on the assumption that fire seasons, and their peaks, will occur at different times of the year, enabling fire fighting authorities to share resources during the 'off season'. However, similar to Australia, there is evidence that fire seasons in the western United States,³⁵⁵ Canada³⁵⁶ and New Zealand³⁵⁷ are becoming longer and more extreme, increasing the demands on their fire fighting resources and constraining their ability to share these with other countries.

If NSW's ability to draw upon fire fighting personnel from other jurisdictions becomes more limited in the future, this could require an expansion of fire fighting capability in NSW. However, further work is needed to quantify the likely impact of changing fire seasons and any potential flow-on effects on resourcing levels within or available to NSW.

Recommendation 9: That the NSW RFS work with AFAC to analyse the impact of changing fire seasons on inter-jurisdictional resource sharing agreements, both domestic and international, and determine any flow-on effects for NSW fire fighting personnel capacity.

3.5.7 Fire fighting equipment

Each fire fighting agency owns a number of ground and aerial equipment for fire fighting activities with access to additional resources on call when required. The NSW RFS has a

³⁵⁴ FRNSW (Fire and Rescue NSW). Our Workforce and Ranks. Retrieved from <https://www.fire.nsw.gov.au/page.php?id=136>.

³⁵⁵ Jolly, W, Cochrane, M, Freeborn, P, Holden, Z, Brown, T, Williamson, G & Bowman, D. (2015). Climate-induced variations in global wildfire danger from 1979 to 2013. *Nature Communications* 6, 7537.]

³⁵⁶ Coletta, Amanda. (2019, 11 June). Canada's wildfire season is off to a ferocious start, *The Washington Post*. Retrieved from https://www.washingtonpost.com/world/the_americas/canadas-wildfire-season-is-off-to-a-ferocious-start/2019/06/10/9d2d67bc-88a2-11e9-9d73-e2ba6bbf1b9b_story.html.

³⁵⁷ Deguara, Brittney. (2020, 10 January). Wildfires could become bigger, frequent and more intense in New Zealand, *Stuff*. Retrieved from: <https://www.stuff.co.nz/environment/climate-news/118662207/wildfires-could-become-bigger-more-frequent-and-more-intense-in-new-zealand>.

fleet of over 6,300 vehicles throughout NSW with varying tanker sizes and water capacity. FRNSW has 706 fire fighting trucks, which includes 582 fire trucks with pumps, 28 trucks with ladder platforms and aerial pumpers and 96 Rescue and Hazardous Materials (Hazmat) Vehicles. NPWS has a total of 398 ground appliances. In addition, NPWS had 5 aerial assets and the RFS had 325 aerial assets at their disposal. A full list of the 2019-20 ground and aerial appliances available for the 2019-20 season is attached at Appendix Four.

3.5.8 Combat agency budget allocations

The cost of fire and emergency services agencies in NSW is fully funded from the State budget. However, to partially offset costs, revenue contributions are obtained by Revenue NSW from insurers and local government. The method of determining contributions is set out in the *Emergency Services Levy Act 2017*,³⁵⁸ which sets a funding target equal to the cost of the fire and emergency services, less depreciation and own source revenues. The NSW Government then applies a levy equating to 73.7% of total funding target on insurers who are entitled to receive premiums for property in NSW, and 11.7% on NSW local government authorities. The remaining 14.6% is funded directly by the NSW Government.

The following sections provide an overview of combat agency budgets.

3.5.8.1 NSW Rural Fire Service

The Rural Fire Fighting Fund (RFFF) is established under Part 5 of the *Rural Fires Act 1997*. It is a Special Deposits Account, managed by the Treasury, into which all contributions to the NSW RFS budget are payable. Funds payable from the RFFF are used, among other things, to help meet the costs of rural fire brigade expenditure and the operations of the NSW RFS, including what would be considered 'capital expenditure' for other State government agencies, such as construction of brigade buildings and the purchase of fleet. This is because fire fighting equipment and facilities (fire fighting apparatus, buildings, water storage towers or lookout towers) purchased using monies from the RFFF are vested in the council of the area for or on behalf of which they were purchased or constructed.³⁵⁹

In the 2019-20 State Budget, the NSW RFS was budgeted to receive a total expenses allocation of \$524.3 million. This represents an increase of almost \$80 million or 17.9% on the original 2018-19 allocation. Funding allocations to the NSW RFS, as at the start of each financial year, have consistently increased, with recurrent funding doubling since the 2010-11 financial year.³⁶⁰

The Inquiry received submissions and verbal commentary that it appeared from the 2019-20 Budget Papers that there had been a \$26.7 million³⁶¹ or 4.8% decrease to the NSW RFS budget.

The Inquiry established that in 2013-14 NSW Budget Papers ceased making allocation on allocation comparisons for agency budgets, and now compare the new financial year's budget to the revised total budget for the previous year. End of year variations to total

³⁵⁸ Parts 2 and 3, *Emergency Services Levy Act 2017*.

³⁵⁹ *Rural Fires Act 1997*.

³⁶⁰ NSW Treasury. (2010). 2010-11 State Budget Paper No. 3, Budget Estimates, pp 10-12. Retrieved from <https://www.treasury.nsw.gov.au/sites/default/files/2017-06/2010-2011%20Budget%20Papers%20BP3%20Budget%20Estimates.pdf>. The NSW RFS received a recurrent funding allocation of \$262.2 million in the 2010-11 State Budget.

³⁶¹ Greens Party Room, Submission to the Inquiry.

budgets for the NSW RFS can be attributed to several factors, but the NSW RFS has confirmed that primarily they are reflective of the level of bush fire activity during that particular year.³⁶²

The reduction from the 2018-19 Revised Budget is entirely explained by the fact that, in the 2019-20 Budget, no allocation is made for natural disaster expenses. This is because it is not possible to know with any great certainty the number or magnitude of natural disasters that will occur in any given year, or the financial cost of responding to those events. As a result of the 2019-20 bush fire season, the NSW RFS is projected to spend hundreds of millions over and above its allocation. The Inquiry notes that Treasury has predicted the NSW RFS may receive an additional \$315 million, once final season costs are calculated.³⁶³

3.5.8.2 Fire and Rescue NSW

In the 2019-20 State Budget, Fire and Rescue NSW was budgeted to receive a total expenses allocation of \$774.3 million.³⁶⁴ This represents a \$45 million, or 6.2%, increase on the original 2018-19 financial year's allocation. In all, according to State Budget papers, recurrent funding for Fire and Rescue NSW (and its predecessor NSW Fire Brigades) has increased by around \$200 million over the last 10 financial years.³⁶⁵

FRNSW has provided the Inquiry with information and advice on its fleet procurement program, which is most representative of its capital expenditure on bush fire fighting activities. The Inquiry notes that capital funding to FRNSW over the past 10 years has been the same in real terms. The Inquiry reviewed FRNSW's capital expenditure authorisation limits over a 10-year period, noting it is not unusual for annual agency capital budgets to fluctuate depending on expenditure priorities. The highest over this period was \$74.9 million in 2018-19, down to \$48.5 million in 2012-13. Allocations have averaged around \$58 million over the 10-year period.

3.5.8.3 National Parks and Wildlife

The Inquiry notes that its Terms of Reference specifically require an examination of resourcing, and a number of submissions have been received that reference significant budget cuts to NPWS. However, the Inquiry has been unable to do a comparative assessment of NPWS budget allocations for the last 10 years for a range of reasons, including:

- as NPWS is not a separate reporting entity it does not have separate audited financial accounts – rather, the costs associated with running NPWS are part of broader cluster expenses (currently the Department of Planning, Industry and Environment)

³⁶² RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 17 February 2020*.

³⁶³ NSW Deputy Premier and Treasurer (2020). NSW Government to provide stamp duty relief for people who lost homes during bushfires. Retrieved from https://www.treasury.nsw.gov.au/sites/default/files/2020-03/FINAL%20-%2020200303%20-%20Barilaro%20Perrottet%20med%20rel%20-%20Stamp%20Duty.docx_.pdf.

³⁶⁴ NSW Treasury. (2019). 2019-20 State Budget Paper No. 3, Budget Estimates, pp 6-15. Retrieved from https://www.budget.nsw.gov.au/sites/default/files/budget-2019-06/6_Stronger_Communities_cluster-BP3-Budget_201920.pdf.

³⁶⁵ NSW Treasury (2010). 2010-11 State Budget Paper No. 3, Budget Estimates, pp 10-32. Retrieved from <https://www.treasury.nsw.gov.au/sites/default/files/2017-06/2010-2011%20Budget%20Papers%20BP3%20Budget%20Estimates.pdf>.

- due to various Machinery of Government and other structural changes, various services and functions have been included or excluded from NPWS over time, which means financial information is not comparable between years.³⁶⁶

As a result of the above factors, NPWS has advised the Inquiry it is not currently possible to provide an accurate figure for the true cost of managing national parks (both broadly and in regards to the cost of fire management within national parks).³⁶⁷ A full examination of resourcing across all fire authorities, and NPWS specifically, has not been possible due to the lack of this information, which is not considered to be acceptable.

3.5.8.4 Forestry Corporation of NSW

As a State-owned corporation, Forestry Corporation is not wholly funded through State Budget allocations. Instead, Forestry Corporation funding for fire management is sourced from a combination of its operating budget and direct NSW Government contributions. The NSW Government contributes \$18 million in Community Service Obligation funding to Forestry Corporation as a fee for service for land management activities including fire management on non-productive land, management of pests and weeds, tourism and non-commercial public roads across the estate.³⁶⁸

3.5.9 NSW RFS restructure

In May 2019, the NSW RFS announced the restructure of the existing functions of the four Regions, and that part of the Operational Mitigation Services unit would be combined to create a new Area Management Model (AMM). A number of concerns were raised with the Inquiry as to the timing of the restructure and its possible impact on the 2019-20 bush fire season.

3.5.9.1 Previous structure: Regional Model

Under the previous Regional Model, the Regional Services Group had four Regions (North, East, South and West) across the State. A Regional Manager and staff were responsible for each Region, managing eight to 15 Districts. A breakdown of these Districts is given in Appendix Five. This resulted in a large span of control, both geographically and in terms of the supervision/management of staff and volunteers, that presented extensive challenges for a highly decentralised and diverse group.

Operational Mitigation Services was made up of four parts, the Operational Resources and Transport Section, a Business Section, Remote Area Firefighting and Specialised Operations Section and State Mitigation Services which provides mitigation support to Districts.

The Inquiry heard that District and Region workload greatly increased in recent years in the areas of accountability, people management, hazard reduction performance, leadership, change and fiscal management. This increase in workload impacted upon staff's capacity to perform their core function of supporting volunteers and communities.

In 2018, the NSW RFS participated in a 'People Matter Employee Survey' that identified (inter alia) a perception of disconnect between District staff and management across all four Regions. The survey results also highlighted the fact that Operational Mitigation Services,

³⁶⁶ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 2 July 2020*.

³⁶⁷ Ibid.

³⁶⁸ FCNSW (Forestry Corporation of NSW). (2020). *Advice to the Inquiry provided 2 June 2020*.

operating under a different structure to that of the Regions and Districts, had worked in isolation from other units. In 2019 a number of initiatives were implemented to address the above issues resulting in the appointment of an additional Director.

3.5.9.2 NSW RFS restructure: Area Management Model (AMM)

The AMM structure has seen the introduction of seven Areas, each with an Area Commander who is responsible within that Area for building capability, community risk and people and business. The new AMM is demonstrated in Appendix Six.³⁶⁹ Each Area is resourced, according to the complexity and risk associated with that Area, to undertake a mixture of traditional regional roles and State Mitigation functions.

The NSW RFS Executive informed the Inquiry that the benefits of the introduction of the AMM model include:

- improved span of control for Districts, with Area Commanders responsible for a range of four to 10 Districts as compared to a range of eight to 15 Districts for Regional Managers
- increased focus on volunteers through an increase in support staff located in Areas across regional NSW
- increased localised decision-making, visibility of local issues, and enhanced direct support to Districts and brigades by reducing the geographic scope of each Area
- greater operational efficiencies through the combination of the Mitigation Crews with regional and District staff in one reporting structure within Areas
- increased localised surge capacity for major incident work, with the scheduling of mitigation crew work driven locally, providing increased opportunity to complete hazard reduction treatment programs for the Districts within the area.

It was also pointed out that AMM does not affect Rural Fire Brigades, nor change the structure or locations of Districts and Mitigation Crews. The AMM also triggered accompanying changes in the Infrastructure Directorate and other groups within the Operations Directorate.

3.5.9.3 Impact upon the 2019-20 bush fire season

The dynamic and changing nature of the 2019-20 bush fire season made it extremely difficult for the NSW RFS to implement the Area Management Model ahead of the bush fire danger period. The NSW RFS informed the Inquiry that it did undertake careful consideration and staging of recruitment to ensure operational capacity and capability were maintained both outside of and during the fire season, in addition to compliance with industrial and other consultative obligations. The Inquiry understands that this included consultations with the Public Service Association and Rural Fire Service Association.

A number of measures were implemented by the NSW RFS to ensure that the levels of operational capacity were maintained during the transition from the Regional Structure to the Area Management Model:

- postponement of the commencement of the voluntary redundancy process (where appropriate)
- re-engagement of selected members who had recently left the NSW RFS to increase operational capacity during peak fire activity
- re-scheduling or delays to implementation process to ensure focus on operational needs during peak fire periods.

³⁶⁹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 8 May 2020*.

As a result of representations by the Public Service Association, the NSW RFS maintained a vacancy rate to allow opportunity for re-assignment and retention of staff displaced from the restructure. This process was factored into the implementation stages. The NSW RFS reported 170 vacancies before the enactment of the Area Management Model. As at May 2020, the NSW RFS reported a total of 112 vacancies, of which 63 vacancies are currently subject to recruitment action.³⁷⁰

The Inquiry is of the view that the restructure did not adversely impact the operational response to the fire season.

3.5.9.4 Did NSW fire authorities have what they needed to fight the fires?

One of the most challenging issues for the Inquiry was whether there were enough firefighters, fire trucks and aircraft during the 2019-20 season. It was very clear that resources were stretched as the fires spread across the State, and numerous submissions called for additional firefighters and funding for fire authorities:

*Seems that despite assurances to the contrary resources were inadequate to fight the fires.*³⁷¹

*For the whole of 2019 we were warned that the bushfire season ahead could be a horror one. Why then, were RFS units not better equipped by government for the task ahead?*³⁷²

*The resources for simultaneously attacking widely separated remote area fires were inadequate.*³⁷³

In Chapter 5 the Inquiry examines the operational response to the 2019-20 bush fires in detail and highlights a range of challenges that were experienced. In particular, due to the extremely dangerous weather and fire conditions:

- there were numerous days when planes were ready to drop retardant/waterbomb, or remote aerial fire fighting teams were ready to be deployed, but the conditions were too dangerous for them to fly
- the NSW RFS Deputy Commissioner made it clear that the safest thing to do was to leave early on extreme and catastrophic fire danger days, and that “Don't expect a fire truck, don't expect a plane, don't wait for a warning ... We will get warnings out whenever we can, but we cannot guarantee that we will be able to get warnings out to everyone, because things move really quickly”³⁷⁴ – noting that protection of life is always the most important principle
- in some cases, fire fighting crews were pulled out of areas because it was too dangerous for them to defend properties, due to the speed and ferocity of the fires and at times a lack of preparation by property owners.

In short, while many areas would have welcomed additional resources throughout the season, there were many days when resources were available but were unable to be deployed due to the dangerous prevailing weather and fire conditions. It is therefore almost

³⁷⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 8 May 2020*.

³⁷¹ Barry Patten, Submission to the Inquiry.

³⁷² Carole Gerts, Submission to the Inquiry.

³⁷³ Dr Brian Dale, submission to the Inquiry.

³⁷⁴ Seo, Bo & Evans, Simon. (2019, 20 December). Fires engulf Australia as temperatures soar, *Australian Financial Review*. Retrieved from <https://www.afr.com/politics/federal/change-your-holiday-plans-rfs-20191220-p53lrb>.

impossible to determine with any degree of certainty how many additional firefighters/fire trucks/planes would or could have made a significant difference to the outcome of the season. Indeed, experienced fire chiefs observed that “all the firefighters in the world couldn’t have put out these fires – they were just too big”.³⁷⁵ Comparisons were made with the 2018 Californian wildfires, which were also considered to be of such a scale that no amount of firefighters could have extinguished them.³⁷⁶

The Inquiry is of the view that, on balance, the NSW RFS and other fire authorities had a reasonable understanding of the likely dangers that the 2019-20 season would bring and took appropriate action in bolstering contracted aircraft capacity (call when needed) and invoking inter-jurisdictional agreements to provide a surge capacity (to the extent other jurisdictions could provide support), which is further discussed in Chapter 5. The nature of the dry conditions and extreme weather this season, as discussed in Chapter 2, with the high level of ignitions from lightning strikes, far exceeded all expectations.

The Inquiry is also mindful that, while the 2019-20 season may represent the ‘new extreme’ (for the time being), it is not an indication of the ‘new normal’. Even if significant additional resources were provided to fire authorities, it is highly unlikely they would be used or needed every year (given that, for example, fire trucks cannot generally be repurposed for other activities) and, when the next extreme fire season does occur, conditions might not allow them to be deployed. The Inquiry does not consider this would provide NSW citizens with the most effective return on investment.

However, the Inquiry has recommended investments and strategies that would better prepare NSW for future extreme fire seasons, which are discussed in detail in Chapter 5. These investments and strategies are focused on detecting and suppressing fires early before they get too big to fight, improving firefighter safety and trialling new techniques to expand the range of options that firefighters have at their disposal.

3.5.10 Training

Key points

- Nationally recognised fire fighting qualifications and more general emergency management courses are delivered in-house by NSW government agencies, including NSW RFS, FRNSW, NPWS and Resilience NSW.
- The Inquiry noted there was a lack of trained aviation specialist personnel during the 2019-20 season and recommends the simulator capability at the NSW RFS Training Academy be expanded.
- The value of undertaking multi-agency exercises and joint training was clearly demonstrated throughout the season and should continue to be done on a regular basis.

3.5.10.1 Training / Qualifications – Fire authorities

Section 13 of the *Rural Fires Act 1997* empowers the NSW RFS Commissioner to set service standards on a range of areas, including the implementation of training standards.³⁷⁷

³⁷⁵ Meeting with Greg Mullins, Emergency Leaders for Climate Action, on 10 February 2020.

³⁷⁶ Meyer, Robinson. (2018, 13 November). The simple reason that humans can’t control wildfires, *The Atlantic*. Retrieved from <https://www.theatlantic.com/science/archive/2018/11/california-wildfire-why-humans-cant-control-them/575740/>.

³⁷⁷ Section 13, *Rural Fires Act 1997*.

NSW RFS Service Standard 6.1.2 sets out the minimum competencies and/or qualifications required safely and effectively to perform specific roles.³⁷⁸ Building these competencies within the NSW RFS is split across five bands, from foundational through to strategic.³⁷⁹

In its submission to the Inquiry the PSA noted membership views that: “Opportunity and access to training is a major issue for staff across all fire combat agencies. The main barriers include the number of sessions offered, the availability of places in the sessions, travel restrictions to the training.”³⁸⁰

As a Registered Training Organisation (RTO), the NSW RFS delivers most of its training programs in-house. A number of course components are delivered via FUEL – the online portal that provides members with access to online learning and associated learning resources. The majority of courses are coordinated at District level by Local Training Officers.

Along with internal courses focused on developing personnel in areas of operational capability, the NSW RFS offers courses linked to nationally recognised qualifications in fire fighting operations, public safety units, community safety, fire fighting supervision and management, and State Emergency Service rescue, operations and leadership.³⁸¹ As discussed later in Chapter 5, the NSW RFS also provides accreditation training to members of the media, vets and wildlife volunteers on bush fire safety so they are able to report on incidents in proximity to active .

The Inquiry heard that in 2019 Stage 1 of the NSW RFS Training Academy in Dubbo was completed and officially opened in late July. The \$23.8 million facility is designed to be used by all emergency responder agencies, including the NSW Police Force. It contains classrooms and practical training areas with a large auditorium, lecture theatre, indoor and outdoor training areas, gym and catering services with commercial kitchen.³⁸² It incorporates standard ICT functionality as well as specifically designed knowledge walls and training systems to assist in preparing for the challenges that may be encountered in an operational environment. Stage 1 included completion of one (of a planned three) accommodation blocks equipped with 31 beds. Stage 2, which included additional accommodation for almost 100, has also now been completed.

The NSW RFS also has several facilities across the State dedicated to a specific type of training, including:

- Remote Area Firefighting Training Centres, equipped with a tower, simulated helicopter airframe and a winch for training and recertification purposes, located at Mogo, Armidale, Lithgow and Glendenning

³⁷⁸ RFS (NSW Rural Fire Service). (2017). Service Standards 6.1.2 Qualifications for NSW RFS Members. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0014/9032/6.1.2-Qualifications-for-NSW-RFS-Members.pdf.

³⁷⁹ RFS (NSW Rural Fire Service). NSW RFS Training. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0013/71401/Training-Information-Booklet.pdf.

³⁸⁰ Public Service Association (PSA), Submission to the Inquiry.

³⁸¹ RFS (NSW Rural Fire Service). NSW RFS Training. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0013/71401/Training-Information-Booklet.pdf.

³⁸² RFS (NSW Rural Fire Service). (2019). Annual Report 2018-19. Retrieved from <https://www.rfs.nsw.gov.au/resources/publications/annual-reports>.

- a range of structural fire fighting properties associated with local training teams in various areas across NSW.³⁸³

The Fire and Incident Management Branch of NPWS coordinates training and accreditation of personnel. NPWS is an RTO for the purposes of delivering and assessing Certificates II, III and IV in Public Safety (Fire fighting Operations).³⁸⁴ NPWS is also registered to deliver nine other units of competency within the Public Safety training package relating to prescribed burns and incident management and response.

Similarly, FRNSW is an RTO that can deliver nationally recognised Public Safety qualifications (as does NPWS/RFS) in fire fighting and emergency operations, as well as fire fighting supervision and management.³⁸⁵ FRNSW is also registered to deliver more than 30 other Public Safety, Resources and Infrastructure Industry, and Transport and Logistics courses.

Forestry Corporation uses external RTOs for the delivery and assessment of firefighter qualifications, given the partly seasonal nature of firefighter employment. Courses are delivered in anticipation of the fire season. Training is provided to gain accreditation in fire fighting operations (both as a crew member and leader), advanced fire fighting, and role-specific Incident Management Team membership training.

3.5.10.2 Training – Resilience NSW

Generalist education and training on emergency management is delivered by Resilience NSW (formerly Office of Emergency Management), under the direction of the State Emergency Management Committee. Resilience NSW is an RTO and offers courses on general emergency management issues, as well as welfare, evacuation management, operations centres, and exercise and lessons learnt.

All courses are delivered with a multi-agency perspective, facilitated by the broad cross-agency experience of the trainers. Foundational courses are delivered online, with skills-based and nationally recognised and accredited courses delivered in a classroom setting. Most of the RTO training is delivered by the Regional Emergency Management Officers (REMOs) employed by the NSW Police Force. All REMOs must have current vocational qualifications in training and assessment or should have a development plan in place to complete/maintain these qualifications.

Resilience NSW³⁸⁶ advised that, over the last five financial years, 5,303 online foundational courses have been completed (including overviews of emergency management and WELFAC, and foundations in lessons management and the Local Emergency Management Committee (LEMC) role). Over the same period, 5,527 people participated in skills-based courses (including how to design and manage exercises, emergency and evacuation management).

³⁸³ Ibid.

³⁸⁴ Training. 4558 - Department of Planning, Industry and Environment. Retrieved from <https://training.gov.au/Organisation/Details/45558>.

³⁸⁵ Training. 6883 – Fire and Rescue NSW. Retrieved from <https://training.gov.au/Organisation/Details/6883>.

³⁸⁶ Resilience NSW. (2020). *Advice to the Inquiry provided 13 May 2020*.

3.5.10.3 Fireground supervision and aviation management

The Inquiry identified two training gaps over the course of the 2019-20 season: ensuring that Divisional Commanders receive appropriate training and have sufficient experience (further discussed in Chapter 5), and the need for more specialist aviation personnel.

The NSW State Bush Fire Plan³⁸⁷ 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 trained personnel to ensure resources operate safely and effectively in a dynamic environment.

The nature of the 2019-20 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.³⁸⁸ Trained specialist staff from other Australian and international jurisdictions were made available and sourced through the National Resource Sharing Centre (NRSC).³⁸⁹

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 Inquiry has identified that agencies and jurisdictions need to develop more personnel in these critical roles.

There is 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 Inquiry has learnt 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.

By introducing and integrating simulator-based training into existing training and certification, the NSW RFS would be able to:

- provide increased simulated flight time, giving trainees increased learning opportunities to practise and enhance their new skills – this could include but is not limited to building cockpit Crew Resource Management (CRM) skills, directing tactical aircraft at an incident, and integrating with other roles such as Air Attack working with an Air Observer, Camera Platform or a Search and Rescue (SAR) aircraft
- ensure regular competency maintenance, currency and reassessment activities
- 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 large air tankers
- undertake reviews of a trainee's aptitude for airborne work.

³⁸⁷ SEMC (State Emergency Management Committee). (2017). State Bush Fire Plan. Retrieved from <https://www.emergency.nsw.gov.au/Documents/plans/sub-plans/state-bush-fire-plan.pdf>.

³⁸⁸ Craig Lapsley, Submission to the Inquiry.

³⁸⁹ Australasian Fire and Emergency Service Authorities Council (AFAC), Submission to the Inquiry.

This has the potential to bring considerable benefits across all agencies and jurisdictions, and give many pilots an opportunity to practise and demonstrate aerial fire fighting competency. It would better place the aviation industry to support operations through the certification of additional pilots and specialist aviation personnel as described above.

The NSW RFS Training Academy at Dubbo in regional NSW is easily accessed, as it is close to the regional airport which has regular connections to Sydney, and Dubbo itself is positioned on the intersection of three major highways. To develop as a national centre of excellence, the Academy, which has existing infrastructure including training room, accommodation and catering, would require support from the NSW Government to expand its simulator capabilities.

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.

3.5.10.4 Joint exercises and training

As discussed further in Chapter 5, the extraordinary nature of the 2019-20 season tested coordinated fire fighting arrangements and highlighted the need for strong inter-agency relationships. The Inquiry notes that the major exercise for the State Emergency Management Committee (SEMC) on bush fires had been planned for 2019-20 but didn't go ahead due to the extended fire season.

The NSW Cross Border Commissioner noted the value of regular exercises in ensuring that cross-border arrangements are robust and appropriate protocols are in place,³⁹⁰ and the same applies to NSW inter-agency exercises. These enable working relationships to be formed ahead of emergency events occurring. The Cooma Incident Management Team reflected on how a coordinated fire fighting desktop exercise led to Brigade Captains agreeing on the protocols that would apply. This proved to be invaluable once the fire season began, as working relationships had already been established.³⁹¹ The Inquiry supports NSW government agencies continuing to undertake regular exercises, noting the resourcing required to do this. Ideally, multi-agency exercises should occur annually at the divisional level.

Incident Management Team (IMT) members also commented on the value of the NSW RFS Incident Controller Major Incident (ICMI) training ahead of the 2019-20 season, as it provided excellent preparation for an intense season. The Blue Mountains IMT commented that the ICMI training's focus on bush fire management assisted NPWS and FRNSW to understand the bush fire context and associated expectations, and it supported all Deputy Incident Controllers from NPWS, FRNSW and Forestry Corporation being able to access the training.³⁹² The Inquiry acknowledges the value of integrated ICMI training across all NSW fire authorities to build a strong pipeline of trained personnel who can undertake IMT leadership roles.

Beyond ICMI training, the Inquiry acknowledges the value in NSW fire authorities undertaking joint training as much as possible and emphasises the importance of consistent

³⁹⁰ Meeting with James McTavish, NSW Cross-Border Commissioner on 11 June 2020.

³⁹¹ Meeting with Cooma Incident Management Team on 27 April 2020.

³⁹² Meeting with Blue Mountains Incident Management Team on 25 February 2020.

and high-quality training outcomes, regardless of which agency is delivering the training. The Inquiry notes that Resilience NSW currently provides multi-agency training, but does not provide any Incident Management Team training, nor any hazard specific training.

3.6 THE ROLE OF LOCAL COUNCILS

Given the scale of the 2019-20 bush fire season, many local councils were required to participate in response efforts. The Inquiry acknowledges councils' essential role in the bush fire response, and the substantial efforts of council staff throughout the season.

Submissions to the Inquiry made it clear there was marked variability across councils in terms of their preparedness. The Inquiry considers this was due to a number of factors, including the size and frequency of natural disasters in particular areas. Generally speaking, councils in bush fire prone (or flood prone) areas are better practised in emergency management. Given the wealth of knowledge and expertise in these councils, it is essential that this is shared with other councils to strengthen their capacity across NSW. The Inquiry notes that Resilience NSW facilitates this peer-to-peer learning, and encourages this work to continue, particularly with the benefit of experience gained and lessons learned during the 2019-20 season.

3.6.1.1 Local Emergency Management Officer

The Local Emergency Management Officer (LEMO) role is established by the *State Emergency and Rescue Management Act 1989*³⁹³ and is a local government employee who provides executive support to the Local Emergency Management Committee (LEMC).

The *Emergency Operations Centre: Policy Document* governs the establishment, activation, operation and maintenance of Emergency Operations Centres (EOCs) at State, regional and local levels.³⁹⁴ Local EOCs are led by the Local Emergency Operations Controller (LEOCON) supported by the LEMO. The LEMO's responsibilities include:

- providing executive support and operational advice to the LEOCON as required
- ongoing management of the EOC and its facilities, including administrative measures
- providing an ongoing monitoring service to ensure the LEOCON is aware of incidents with the potential to develop into emergencies
- arranging and coordinating formal operational debriefs
- preparing post emergency report(s).³⁹⁵

The Inquiry recognises the difference in expectation between the legislated responsibility and those identified by the EOC Policy. This distinction was highlighted to the Inquiry, when anecdotal evidence was received of some LEMOs rising to the challenge and performing well, whereas others did not provide the same optimal level of service. The difference in performance may in part be attributed to councils not employing personnel to be LEMOs, but adding the LEMO responsibilities to an existing role. The seniority of LEMOs within councils is also understood to be varied.

A possible second factor in the disparity of LEMO performance during the bush fires is the generalised training that is available. Currently, training for LEMOs is found in the broader *Local Emergency Management Committee Foundations*, an online course offered by

³⁹³ Section 32, *State Emergency and Rescue Management Act 1989*.

³⁹⁴ Emergency Operations Centres: Policy Document (November 2013), page 6.

³⁹⁵ Emergency Operations Centres: Policy Document (November 2013), page 40.

Resilience NSW which covers the general elements of the NSW emergency management arrangements and the roles, responsibilities and functions of the LEMC.

To enhance the performance of LEMOs, it is recommended that specific training be developed by Resilience NSW, in consultation with local government, that focuses on the role, responsibilities and expectations of the LEMO. Depending on where the LEMO is based, natural disasters may occur infrequently, and they may have limited opportunities to put their training into practice. Training should therefore include regular 'refresher' courses to ensure LEMOs are supported to keep their skills up to date.

Councils are also encouraged to support their staff in participating in the training and ensure a person of appropriate seniority is identified as the LEMO with authority to commit resources during an emergency.

Recommendation 11: That, in order to strengthen the capability of local councils in future emergency events:

- a) Resilience NSW, in consultation with local government, develop specific training that focuses on the role, responsibilities and expected functions of the Local Emergency Management Officer (LEMO), including regular 'refresher' components
- b) Councils support their staff to participate in LEMO training on an ongoing basis, and ensure that staff who are LEMOs are appropriately senior and have the authority to commit resources.

3.7 CROSS-BORDER AND INTER-JURISDICTIONAL ARRANGEMENTS

Key points

- AFAC played a crucial national coordination role in the 2019-20 season and ensured resources could be shared among fire authorities. There is an opportunity to standardise how resources are described to minimise confusion and improve resource allocation efficiencies.
- Short-term funding arrangements limit AFAC's ability to continue to contract aviation resources and other assets well in advance of the next fire season. Long-term funding certainty is necessary to ensure resource-sharing arrangements can continue.
- The MOU with Victoria has lapsed and should be progressed as a matter of urgency.

3.7.1 AFAC

AFAC is the Australian and New Zealand National Council for fire, emergency services and land management. It operates as a not-for-profit company. There are 31 member organisations and 21 affiliate member organisations across Australasia.³⁹⁶ FRNSW, NSW RFS, Forestry Corporation, NPWS (representing DPIE) and the NSW State Emergency Service are full member organisations from NSW. The NSW Environment Protection Authority and Resilience NSW are affiliate organisations.

AFAC has no direct role in the delivery of emergency services. Rather, it facilitates member collaboration through its Collaboration Framework, with a range of groups, technical groups

³⁹⁶ AFAC (Australasian Fire and Emergency Service Authorities Council). (2019). AFAC Membership. Retrieved from <https://www.afac.com.au/teams/network>.

and networks working together on developing shared practice and research. This model has been in place for over 25 years.

AFAC's collaborative model is operationalised through its four business units: the National Resource Sharing Centre (NRSC), the National Aerial Firefighting Centre (NAFC), the Australian Institute for Disaster Resilience, and the Emergency Management Professionalisation Scheme.

The NRSC coordinates and facilitates international and interstate deployments, as authorised by the Commissioners and Chief Officers Strategic Committee. The NRSC works with the principles of:

- recognising national capability
- national coordination maximising available capacity
- efficiency through effective partnership and collaboration
- timely deployment of fit-for-purpose resources
- flexible and adaptable, meeting agency needs.

The NAFC provides a cross-jurisdictional arrangement for aerial bush fire combat. It facilitates "the coordination and procurement of a fleet of highly specialised fire fighting aircraft that are readily available for use by State and Territory emergency service and land management agencies across Australia".³⁹⁷

The Inquiry recognises the critical role AFAC played in facilitating resource-sharing during the 2019-20 season, which is further discussed in Chapter 5. The Inquiry suggests that a process improvement could be made to standardise resource descriptions and cost recovery arrangements across jurisdictions, as different descriptors across states and territories can sometimes cause confusion. Standardised descriptions and associated costs would provide clarity for all jurisdictions.

The success of AFAC lies in its collaboration model³⁹⁸ and its coordination and engagement of member combat agencies and jurisdictions. This collaboration makes the most of shared knowledge and resources and economies of scale. The Inquiry was made aware of suggestions that some or all of the functions of AFAC should be vested in Emergency Management Australia, which would then take responsibility for resource coordination and the contracting and allocation of aerial resources.

The Inquiry is concerned that changes to this overarching structure would lead to greater bureaucratisation of AFAC functions, which in turn could have a negative impact on existing flexibility and responsiveness. The Inquiry notes that NAFC and NRSC functions are largely operationally focussed, and that moving away from the current model may be perceived as contrary to the widely accepted principle that combat agencies are best placed to determine operational requirements. NSW combat agencies have informed the Inquiry that, while there are lessons to be learnt from the 2019-20 season, they are supportive of the current AFAC model and the multi-agency collaborative approach continuing.

In addition, the Inquiry is concerned about the lack of funding certainty for the NRSC and NAFC. The Inquiry considers that continued support from all participating jurisdictions

³⁹⁷ NAFC (National Aerial Firefighting Centre). About NAFC. Retrieved from http://nafc.org.au/?page_id=111.

³⁹⁸ AFAC (Australasian Fire and Emergency Service Authorities Council). Collaboration Model. Retrieved from <https://www.afac.com.au/docs/default-source/network/collaboration-model.pdf?sfvrsn=12&download=false>.

(including the Commonwealth Government) is crucial to ensure effective operational planning, including the ability for critical aviation resources and other assets to be contracted well in advance given the challenges experienced during the 2019-20 season (further discussed in Chapter 5). The Inquiry recommends the Government work with other Australian governments to provide long-term funding certainty to AFAC, including the National Resource Sharing Centre and the National Aerial Firefighting Centre.

Recommendation 12: That Government work with other Australian governments to provide long-term funding certainty to AFAC, including the National Resource Sharing Centre (NRSC) and the National Aerial Firefighting Centre (NAFC).

3.7.2 Memorandum of Understanding (MoU) with Victoria

The Inquiry has noted that Victoria is the only jurisdiction with which NSW does not have a current MoU, and that it is also the only jurisdiction that has not adopted the 'catastrophic' national Fire Danger Rating (further discussed in 3.8 below).

	MOU in place with NSW	Fire Danger Rating Catastrophic
NSW	N/A	✓
Victoria	X	X – Code Red
ACT	✓	✓
Queensland	✓	✓
South Australia	✓	✓

Table 3-2: Inter-jurisdictional comparison of MoUs and Fire Danger Ratings.

An MoU between the Victorian Country Fire Authority (CFA) and NSW RFS was executed in 2015. CFA informed the Inquiry that despite the MoU having expired in 2016, both agencies have continued to operate within the principles described in the MoU. The NSW RFS advised that, prior to the 2019-20 fire season, the NSW RFS sought to review the MoU with the CFA on several occasions. However, Victorian authorities needed to consider which agency was more appropriate to be the signatory: Emergency Management Victoria or CFA. As stated by the CFA and reinforced by the NSW RFS, notwithstanding the delays, the two agencies agreed ahead of the 2019-20 bush fire season that the arrangements in the previous MoU would be honoured during the season. This was evidenced in a letter sent from the CFA Deputy Chief Officer, Gavin Freeman, to the NSW RFS Commissioner on 2 October 2019.³⁹⁹

In discussions with the Victorian Inspector-General of Emergency Management (IGEM), the IGEM pointed out that the Victorian Department of Environment, Land, Water and Planning (DELWP) was the responsible fire authority for the largest part of the bush fires during the 2019-20 season, not the CFA, which emphasised the importance of MoUs being multi-agency in nature.⁴⁰⁰ The Inquiry agrees that this is important and recommends the NSW and Victorian Governments progress and finalise a multi-agency MOU before the next fire season commences.

³⁹⁹ Letter from the Victorian Country Fire Authority (CFA) letter to NSW RFS Commissioner dated 2 October 2019.

⁴⁰⁰ Meeting with the Victorian Inspector-General of Emergency Management (IGEM) on 16 June 2020.

Recommendation 13: That, to ensure updated resource-sharing arrangements are in place, the NSW and Victorian Governments progress and finalise a multi-agency Memorandum of Understanding before the 2020-21 fire season commences.

3.8 FIRE DANGER RATINGS AND WARNINGS

This section provides an overview of the public warning systems, including the background and development of a nationally consistent all hazards warning system. In Chapter 5, the Inquiry examines the effectiveness of the warning systems and whether they operated as intended.

Key points

- The six levels of Fire Danger Rating are close to being consistent across Australia, with the exception of Victoria and Tasmania.
- Differences in terminology can cause confusion for community members, particularly for people living close to the border of NSW and Victoria – NSW uses the national danger rating of ‘catastrophic’ for the most extreme conditions, whereas Victoria uses its own danger rating of ‘code red’.
- The inquiry is of the view the Australian Warning System should be prioritised to provide greater consistency in public information and warnings, especially in border areas.

3.8.1 Fire Danger Ratings

Public information and warnings play a critical role in community safety by empowering people to make informed and timely decisions to take appropriate protective action.

Fire Danger Ratings (FDR) are displayed on roadside signs throughout NSW, informing the community of how dangerous a bush fire could be if it did occur. The level of risk is calculated based on a number of factors, including temperature, humidity, wind speed and dryness of fuel. These factors are brought together in the Forest Fire Danger Index (FFDI), which was discussed in more detail in Chapter 2. The Bureau of Meteorology and the emergency services work closely together and use six levels of fire danger ratings to communicate the level of bush fire risk. The higher the rating, the more dangerous the conditions are likely to be.



Figure 3-1: Fire Danger Rating.⁴⁰¹

⁴⁰¹ RFS (NSW Rural Fire Service). Fire Danger Ratings. Retrieved from <https://www.rfs.nsw.gov.au/fire-information/fdr-and-tobans?a=1421>.

The NSW RFS and Bureau of Meteorology have divided the State into 21 areas, which the NSW RFS refers to as NSW Fire Areas,⁴⁰² and the Bureau refers to as Fire Weather Forecast Areas.⁴⁰³ Each day, the NSW RFS website is updated to indicate the fire danger rating by Fire Area. The map of the Fire Weather Forecast Areas is at Appendix Seven. This enables the community to identify the fire danger rating in their area and prepare accordingly.

To measure the effectiveness of the communities' understanding of the FDRs, the NSW RFS recently commissioned research to determine if there had been any shifts in recent years in attitudes or behaviours in relation to taking action during bush fire activity. The study found that awareness of the FDRs had significantly increased; however, understanding of the required behaviours and actions at each FDR level remained unchanged from previous years. Most people felt no need to act when levels ranged from low to very high. People were only likely to act when the rating reached 'Severe', but significant behaviours, such as preparing property (clearing gutters, tuning on sprinklers), preparing to leave, or actioning bush fire plans did not take place until the 'Extreme' or 'Catastrophic' ratings were reached. And people would not generally leave an area unless a fire was active.⁴⁰⁴ As discussed in Chapter 5, consistency of messaging and advice to the community on when to take action is crucial. This is particularly important in fire prone areas near state borders.

The six levels of Fire Danger Rating are close to being consistent throughout Australia. The exceptions are Tasmania, which depicts the Catastrophic rating on a black background, and Victoria, where the Catastrophic rating is called 'Code Red'.⁴⁰⁵ The CFA Victoria advises this change was made following community research that indicated the term 'Code Red' resonated more strongly with community members.⁴⁰⁶

Australian governments are working collaboratively to achieve consistency in Fire Danger Ratings. However, it will also require associated consistency in public messaging associated with the ratings given, and consistency across state and territory borders.

3.8.2 Fire Alert Levels

As noted above, Fire Danger Ratings provide the community with an indication of how dangerous a fire may be if it occurs. Once a fire has started, warnings are issued advising the community that they need to take action.

There are three alert levels for bush fire incidents in NSW, with an associated message to the community, which align with the national alert system introduced following the Victorian Black Saturday fires in 2009. These are:

1. **Advice** – A fire has started. There is no immediate danger. Stay up to date in case the situation changes (to be reassessed at 1100 and 1600 hours daily)

⁴⁰² RFS (NSW Rural Fire Service). Fire Danger Ratings and Total Fire Bans. Retrieved from <https://www.rfs.nsw.gov.au/fire-information/fdr-and-tobans>.

⁴⁰³ BoM (Bureau of Meteorology). Fire Weather Forecast Areas. Retrieved from <http://www.bom.gov.au/nsw/forecasts/fire-forecasts.shtml>.

⁴⁰⁴ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 6 May 2020*.

⁴⁰⁵ BoM (Bureau of Meteorology). Fire weather services. Retrieved from <http://www.bom.gov.au/weather-services/fire-weather-centre/fire-weather-services/index.shtml>.

⁴⁰⁶ Victorian Country Fire Authority. (2020). *Advice to the Inquiry provided 19 May 2020*.

2. **Watch and Act** – There is a heightened level of threat. Conditions are changing and you need to start taking action now to protect you and your family (for review every two hours)
3. **Emergency Warning** – An Emergency Warning is the highest level of Bush Fire Alert. You may be in danger and need to take action immediately. Any delay now puts your life at risk (to be reviewed every thirty minutes).⁴⁰⁷

Alerts may be upgraded or downgraded by an Incident Controller, and alert levels may be used in any order, based on the current fire danger and the time to impact.⁴⁰⁸ The indicators in brackets above (for when reassessment of an alert level should occur) are the recommended timeframes, though each level can be reassessed as required, as the situation changes.⁴⁰⁹ The bush fire alerts are displayed and disseminated through the NSW RFS website, traditional media, the Fires Near Me app and social media.

While these broad warning systems are consistent, each Australian jurisdiction has developed its own language and icons explaining each of the fire alert levels and the appropriate actions to be taken for each rating.

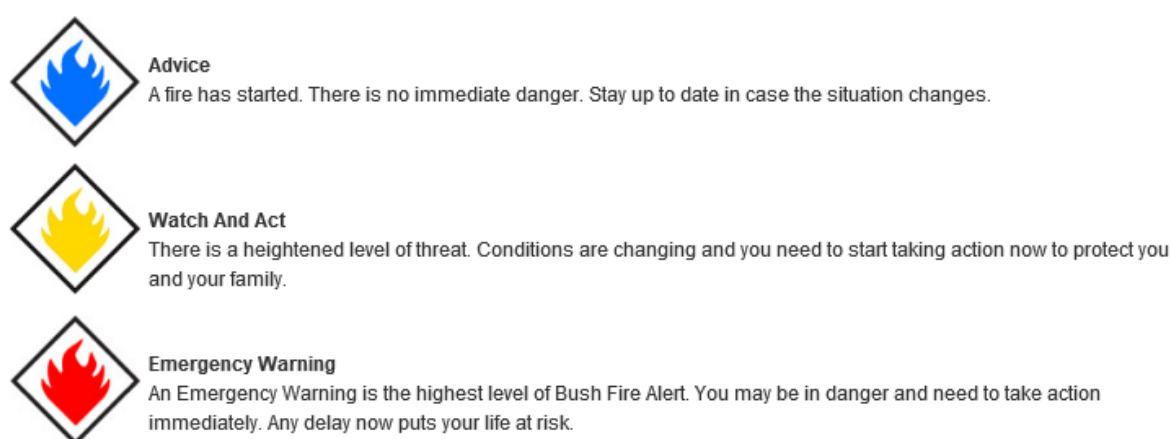


Figure 3-2: NSW Bushfire Alert Levels.⁴¹⁰

⁴⁰⁷ Victorian Country Fire Authority. (2020). *Advice to the Inquiry provided 19 May 2020*.

⁴⁰⁸ Ibid.

⁴⁰⁹ Ibid.

⁴¹⁰ RFS (NSW Rural Fire Service). Alert Levels. Retrieved from <https://www.rfs.nsw.gov.au/plan-and-prepare/alert-levels>.

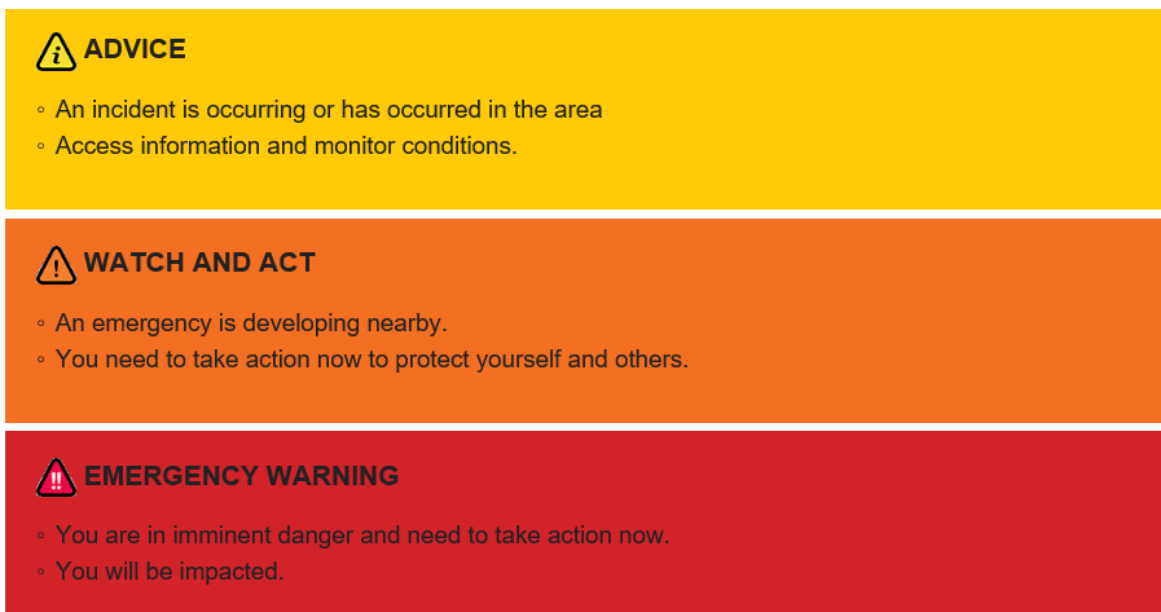


Figure 3-3: Victorian Bushfire Alert Levels.⁴¹¹

A national warning working group was established in 2016 to work towards consistency in terminology, icons, alert levels and the public display of information for all hazards inclusive of bush fire, floods, severe storm, extreme heat and cyclones. This work is ongoing and due to be finalised in 2022. During the hearings of the Royal Commission into National Natural Disaster Arrangements, on 1 July 2020, the Chair of the National Warnings Group recognised the complexity of developing messages for a community where individuals will respond differently to the same hazard, depending on their unique circumstances, but noted the National Warnings Group is seeking consistency in terminology and icons and the display of this information across a number of hazards.⁴¹²

The Inquiry heard that communities in locations where the threat is close to or crosses a state or territory boundary support the adoption of a nationally consistent three-level warning framework for all types of emergencies, using a single standard colour palette and icons, and a standard approach to assessing, communicating and displaying bush fire information, including in cross-border areas.⁴¹³ AFAC has advised that there is in principle support for a proposed Australian Warning System, and the National Public Information and Warnings Working Group will continue to progress this work.⁴¹⁴

Recommendation 14:

That in order to provide greater consistency in public information and warnings, especially in border areas:

- a) The finalisation of the Australian Warning System be prioritised to provide greater consistency in public information and warnings

⁴¹¹ Victorian Country Fire Authority. (2020). About Bushfire Warnings. Retrieved from <https://www.cfa.vic.gov.au/warnings-restrictions/about-warnings>.

⁴¹² The Chair of the National Warnings Group, Royal Commission into National Natural Disaster Arrangements. Transcript Hearing Block 2 – Wednesday 1 July 2020, p 1214. Retrieved from <https://naturaldisaster.royalcommission.gov.au/system/files/2020-07/Transcript%20Hearing%20Block%20%20-%20Wednesday%201%20July%202020.pdf>.

⁴¹³ ABC, Submission to the Inquiry.

⁴¹⁴ Australasian Fire and Emergency Service Authorities Council (AFAC), Submission to the Inquiry.

- b) The NSW State Emergency Management Committee, including the Public Information and Warnings Sub-Committee, prioritise the implementation of the Australian Warning System and data standards for relevant hazards within NSW.

3.9 COMMUNITY ENGAGEMENT

Key points

- The NSW RFS has a range of community engagement programs aimed at educating people on bush fire risk and effective mitigation strategies. Programs are aimed at the general community as well as particular cohorts (e.g. rural landholders, Aboriginal communities, people with disability, older people).
- Community engagement programs have received positive anecdotal feedback but have not been formally evaluated.
- While the Inquiry has heard through submissions that the community was generally aware of the level of danger ahead of the 2019-20 season and made preparations accordingly, the Inquiry was unable to substantiate this with objective data.
- Existing community engagement programs should be evaluated, and outcomes-based measures developed to ensure programs are effective and that their impact can be measured over time.

3.9.1 There is a nationally consistent ‘Get Ready’ message to encourage community preparedness

The purpose of community engagement is to build resilience through collaborative action, shared capacity building and development of strong relationships built on mutual trust and respect.⁴¹⁵ In NSW, community engagement is undertaken in the context of an all hazards framework, as well as specific programs managed by the NSW RFS.

In developing its community engagement strategies, the NSW RFS advised that its work is aligned with national and international strategies including the United Nations International Strategy for Disaster Reduction⁴¹⁶ through the Sendai Framework for Disaster Risk Reduction, and the Commonwealth Government’s National Strategy for Disaster Resilience.⁴¹⁷ The NSW RFS has also used Behavioural Insights (BI) to build the agency’s community engagement capability.⁴¹⁸ A guide developed by the NSW RFS Community Engagement Team and the Behavioural Insights Team Australia will assist in the use of behavioural insights to encourage behaviours that reduce the likelihood and consequence of fire.⁴¹⁹ The NSW RFS advised the Inquiry that behavioural insights have been used to develop community engagement strategies for Indigenous communities, farming

⁴¹⁵ National Strategy for Disaster Resilience: Community Engagement Framework, Australian Disaster Resilience Handbook Collection, Handbook 6, 2013, page 2. *Document is under revision and will be incorporated into an updated Community Engagement for Disaster Resilience Handbook, to be published in 2020.*

⁴¹⁶ United Nations. United Nations International Strategy for Disaster Reduction. Retrieved from <https://sustainabledevelopment.un.org/partnership/partners/?id=7615>.

⁴¹⁷ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 22 April 2020.*

⁴¹⁸ Ibid.

⁴¹⁹ Ibid.

communities and schools, including specific projects such as Project Firestorm (jointly developed by the NSW RFS, FRNSW and the Department of Education).

In 2012, Australian Police and Emergency Management Ministers agreed to the new national slogan of 'Get Ready' to promote disaster resilience. The slogan was underpinned by the National Strategy for Disaster Resilience Communication Plan, which includes the following six key messages:

- disasters will happen
- disaster resilience is your business
- connected communities are resilient communities
- know your risk
- get ready, then act
- learn from experience.⁴²⁰

Within NSW, 'Get Ready' has evolved into providing specific information or campaigns targeted at individuals, councils, community service organisations and business.⁴²¹ The NSW RFS and NSW State Emergency Service have both modified the 'Get Ready' slogan for the natural hazards they deal with.

The NSW RFS promotes an annual 'Get Ready Day' that includes open days at fire stations and information to prepare for bush fire risks. In 2019, the NSW RFS held a Get Ready Day on 16 November, which encouraged the public to visit some brigades to help them "make a plan and understand your risk".⁴²² Twenty-four brigades took part across 148 locations. The NSW RFS website noted that not all brigades would be taking part, with some "too busy dealing with fires", either locally or elsewhere in NSW.

3.9.2 The Hotspots program provides hands-on education to landholders in fire management

Since 2005, the Hotspots program has been run as a partnership of the NSW RFS and the Nature Conservation Council of NSW. Hotspots is a community engagement program that aims to give landholders the knowledge and skills to develop fire management plans and conduct burns that reduce the risk of bush fire damaging their property, while also enhancing wildlife habitat.⁴²³ Landholders participating in the program:

- gain a better understanding of risk management and fire ecology through spending time in the field with ecologists, local fire authorities, land managers and other relevant organisations
- develop their own fire management plans in cooperation with their neighbours (both public land managers and private neighbours) and begin to build a better understanding of the role of fire in their local area, resulting in a map-based fire management action plan
- get a hands-on experience in preparing a burn site, estimating fuel loads, considering weather factors, reviewing fire behaviour and undertaking a risk assessment –

⁴²⁰ Communique: Standing Council on Police and Emergency Management, 23 November 2012.

⁴²¹ Resilience NSW. (2020). Get Ready. Retrieved from <https://www.emergency.nsw.gov.au/getready>.

⁴²² RFS (NSW Rural Fire Service). (2019). Get Ready Day – 16 November 2019. Retrieved from <https://www.rfs.nsw.gov.au/news-and-media/general-news/getreadyday>.

⁴²³ Nature Conservation Council. (2019). Hotspots. Retrieved from <https://www.nature.org.au/healthy-ecosystems/hotspots-project/>.

landholders then observe a demonstration burn conducted by the NSW RFS and other agencies.⁴²⁴

The delivery of the Hotspots program is guided by advisory partners drawn from other NSW agencies (NPWS, DPIE, Forestry Corporation, NSW Local Land Service), as well as NSW Farmers, the South East Queensland Fire and Biodiversity Consortium and Local Government NSW.⁴²⁵

Since 2005, Hotspots has delivered over 144 workshops to 2,618 landholders, leading to the development of 1,377 fire management plans covering 268,059 hectares of land in NSW.⁴²⁶ The 2013 report of the Independent Hazard Reduction Audit Panel stated that submissions to it “highlighted that the Hotspots Fire Project is a good community engagement tool”.⁴²⁷ This was repeated in community consultations conducted as part of this Inquiry, with a resident on the Mid North Coast recommending that it be rolled out more widely.⁴²⁸ The Inquiry notes the benefits of this program in providing engagement and mitigation opportunities between the community and the NSW RFS and strongly supports the program being delivered in more areas more frequently.

3.9.3 The NSW RFS has targeted programs for Aboriginal communities, farmers and vulnerable people

In addition to the annual ‘Get Ready Day’, the NSW RFS has developed targeted community engagement programs including:

- **Aboriginal Communities Engagement Strategy** – aimed at reducing the risk of fire and other emergencies on Aboriginal communities in partnership with Aboriginal people, Elders, traditional owners, local Aboriginal land councils and NSW RFS members.⁴²⁹
- **Farm Fire Plan** – promotes the top five actions to make a property safer, by taking property owners through the considerations of managing their property, promoting discussion of what they will do in the event of fire, the equipment they’ll need if they decide to stay, and the importance of knowing the conditions and keeping up to date. The NSW RFS has highlighted it will work together with farming communities to ensure they are well prepared as part of its priorities for 2020-21, which includes ‘good take-up’ of the Farm Fire Plan as a measure of success.⁴³⁰ The NSW RFS has advised a quantitative measure of success is being developed.
- **The Assist Infirm, Disabled and Elderly Residents (AIDER) program** – a free, one-off support service to vulnerable community members who live in dwellings that are in bush fire prone areas, and who have limited domestic support from family and friends. This could include older people, people living with a disability, and people who are already receiving community assistance and services. Services provided by State Mitigation crews can include clearing gutters, thinning vegetation around the home,

⁴²⁴ RFS (NSW Rural Fire Service). Hotspots. Retrieved from <https://www.rfs.nsw.gov.au/plan-and-prepare/prepare-your-property/hotspots>.

⁴²⁵ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 22 April 2020*.

⁴²⁶ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 22 April 2020*.

⁴²⁷ Independent Hazard Reduction Audit Panel. (2013). Enhancing Hazard Reduction in NSW Report, p 7. Retrieved from <https://www.emergency.nsw.gov.au/Documents/publications/independent-hazard-reduction-audit-panel-report.pdf>.

⁴²⁸ Mid North Coast Community Meeting on 23 April 2020.

⁴²⁹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 22 April 2020*.

⁴³⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

removing leaf and tree debris, trimming branches that are close to the home and mowing or slashing long grass around the property.⁴³¹

3.9.4 Programs have not been evaluated and lack outcomes-based measures

While the Inquiry received positive anecdotal feedback on the NSW RFS community engagement programs, no formal evaluations have been undertaken to measure their effectiveness and identify any opportunities for improvement. In addition, as there are no outcomes-based measures for determining whether the programs achieve their purpose (i.e. ensuring the community is prepared in the event of a bush fire) or supporting data, the Inquiry was unable to assess whether these programs were effective in supporting the community to be adequately prepared for the 2019-20 season.

The Inquiry was also unable to use proxy measures because, as discussed in Chapter 4, there is no data currently available on the proportion of houses that comply with initial development approval conditions relating to bush fire preparedness. While submissions to the Inquiry reflected that there was a general level of awareness of the potential danger and preparedness in the community ahead of the 2019-20 season, the Inquiry was unable to substantiate these views with objective data sources.

I participated in the locally offered hotspots programme June 2019 offering 2 & 1/2 days of community and knowledge building about fire responses. It was empowering and valuable. At the same time the messaging was confronting – The fire risk is so great that landowners have to manage it themselves – communities will be supported not individual properties.⁴³²

The Inquiry recommends that the NSW RFS works in concert with the State Emergency Management Committee Community Engagement Sub Committee (currently examining work to measure community preparedness) to evaluate existing community engagement programs to determine the most effective and efficient method of ensuring communities are adequately prepared in the event of a bush fire, particularly in light of more frequent extreme fire seasons, and develop outcomes-based measures to enable the results of these programs to be monitored over time.

The Inquiry has noted one weakness in the Assist Infirm, Disabled and Elderly Residents (AIDER) program which should be considered as part of this evaluation. Currently, AIDER relies on self-referrals or referrals from other community members and is not integrated into Bush Fire Risk Management Plans (BFRMPs) developed by BFMCS. The Inquiry considers there is an opportunity for the capacity of the NSW RFS to be increased in this area to take a more proactive approach to program delivery, for example by overlaying community profile data with BFRMPs to identify cohorts of vulnerable people in at-risk locations (e.g. elderly people) and targeting them for participation in AIDER.

⁴³¹ RFS (NSW Rural Fire Service). AIDER. Retrieved from www.rfs.nsw.gov.au/plan-and-prepare/aider.

⁴³² Sally-Anne Brown, Submission to the Inquiry.

Recommendation 15: That Government commit to:

- a) evaluating existing bush fire preparedness programs to determine the most effective and efficient approach given increased frequency of extreme fire seasons, and develop outcomes-based measures to monitor programs' impact over time
- b) post-evaluation roll out the most effective bush fire preparedness programs to all communities and at-risk cohorts in bush fire prone areas across NSW.

3.9.5 Bush Fire Survival Plans are an important tool, but realistic expectations are required

The NSW RFS provides a comprehensive guide to assist individuals and households to plan and prepare ahead of a bush fire. The *Get Ready for a Bush Fire* guide includes four steps to assist people to get ready:

- *Discuss what to do if a bush fire threatens your home*
- *Prepare your home and get it ready for bush fire season*
- *Know the bush fire alert levels*
- *Keep all the bush fire information numbers, websites and the smartphone [Fires Near Me] app.*

The guidance is clear about what people should do at various stages of fire danger ratings, and that leaving early is the only safe option under catastrophic conditions.

The Inquiry heard that many people in fire affected communities had prepared a bush fire survival plan but were surprised at how intense the fires were when they hit – far more extreme than they had imagined when preparing their plan.

*Many in the community do not have a realistic understanding of their bushfire risk and how to prepare for that risk for themselves, their families, their properties and their businesses.*⁴³³

The Shoalhaven IMT reflected that people need a better understanding of what 'stay and defend' actually means, both physically and psychologically, and that many people who chose to stay and defend have said "they're never going to do that again" based on their experience during the 2019-20 season.⁴³⁴ This aligns with advice from Professor Sandy McFarlane AO to the Inquiry that, generally speaking, people's imagination is insufficient to capture what will happen when the fire actually hits, and emphasised the importance of practising plans to ensure people think about practical steps (e.g. placing buckets under windows, the type of clothing they will wear etc.).⁴³⁵

In light of the comprehensive experience the community now has in enacting Bush Fire Survival Plans following the 2019-20 season, the Inquiry suggests the NSW RFS reviews the current guidance to ensure it prepares people to the greatest extent possible (including emphasising the need to practise implementing plans), particularly during extreme fire seasons. This could be incorporated into the evaluation of community engagement programs recommended above.

⁴³³ Glen O'Rourke, Submission to the Inquiry.

⁴³⁴ Meeting with Green Wattle Creek fire Incident Management Team on 14 April 2020.

⁴³⁵ Meeting with Professor Sandy McFarlane AO on 6 April 2020.

3.9.6 Community Fire Units are an important element of community engagement

Both the NSW RFS and FRNSW have Community Fire Units (CFUs) made up of community volunteers. The FRNSW program has been operating since 1994.

The NSW RFS CFUs are an extension to a brigade, and provide brigades “with another resource to assist in bush fire education, preparedness and protection measures”.⁴³⁶ The FRNSW CFU is “a team of residents living in urban areas close to bushland who are supported ... to enhance their safety and resilience to bushfires”.⁴³⁷

CFU members are not firefighters. They are volunteers equipped with basic fire fighting equipment who learn how to protect and defend their homes until the fire services arrive.⁴³⁸ Both services’ CFUs assist communities to better prevent, prepare for and recover from bush fires. CFU volunteers also carry out property protection during a bush fire, complementing the fire fighting effort. They participate in mop-up activities after the fire front has passed enabling firefighters to move more readily with the fire front and continue the fire fighting effort.

As at 31 March 2020, FRNSW had 4,830 CFU volunteers attached to 507 units with each CFU typically containing 6-15 members. Because CFUs in the NSW RFS are part of a brigade, separate reporting does not occur. In rural communities many landowners are already involved with their local NSW RFS brigades and/or have their own fire units on trailers or trucks.⁴³⁹

The Inquiry was informed that CFUs both augment and support fire agency resources in encouraging self-reliance and resilience, and are a means of ensuring a local presence in community fire planning, the importance of which was expressed at all community meetings.

It is recommended in high risk bush fire areas that the NSW RFS ensures that there is an engagement model in place that actively encourages brigades and community interaction.

3.9.7 Preparedness for tourism businesses and accommodation providers

Key points

- The 2019-20 fire season had a significant impact on tourism operators and tourists in fire affected areas. There is a high probability this could happen again as the peak fire season coincides with the Christmas/New Year holiday period.
- The level of engagement between fire authorities and tourism businesses varies across NSW, and there is no tailored support to help tourism businesses prepare for bush fires.

⁴³⁶ RFS (NSW Rural Fire Service). (2011). Service Standard 2.1.13 NSW Rural Fire Service Community Fire Units. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0003/8877/2.1.13-NSW-Rural-Fire-Service-Community-Fire-Units.pdf.

⁴³⁷ FRNSW (Fire and Rescue NSW). (2020). Community Fire Units. Retrieved from <https://www.fire.nsw.gov.au/page.php?id=133>.

⁴³⁸ Ibid.

⁴³⁹ Fire Practitioners Group, Submission to the Inquiry.

- There is currently no requirement for holiday rental operators to prepare or display bush fire management and evacuation plans for their property.
- The Inquiry recommends further action to support tourism operators to prepare for a range of natural disasters and ensure tourists can access bush fire management and evacuation plans in holiday rental properties.

3.9.7.1 There is no tailored support to help tourism operators prepare for bush fires

The 2019-20 season demonstrated the impact that bush fires can have on tourists and tourism businesses, as thousands of people were forced to leave holiday destinations at short notice and sometimes navigate unfamiliar accommodation and/or surroundings.

The Inquiry found that the level of engagement between fire authorities and tourism businesses varies across the State. In the Blue Mountains, for example, the Inquiry heard of very strong local relationships, mainly driven by tourism operators' reliance on the Blue Mountains National Park and their consequent vested interest in staying up to date on bush fire danger and knowing what to do if a bush fire occurs.⁴⁴⁰ However, this was not the case in other areas.

Given the peak fire season coincides with the Christmas/New Year holiday period, there is a high probability that tourism businesses may face a similar situation again. The Inquiry has reviewed Victoria's *Tourism Business Fire Ready Kit*, developed by Tourism Victoria and the Country Fire Authority (CFA) to assist Victoria's tourism businesses. The kit provides a template for developing a bush fire plan, and helps tourism operators to understand their risks, prepare their business and employees, plan how to inform customers and identify triggers to act.⁴⁴¹ The Inquiry recommends similar support be developed for NSW tourism businesses, initially focused on bush fire preparedness with the potential to be expanded over time to adopt a multi-hazard approach (i.e. not just restricted to bush fires).

Recommendation 16: That, in order to ensure tourism businesses are prepared for natural disasters including bush fires, Resilience NSW work with NSW RFS and Destination NSW to develop bush fire preparedness support for tourism businesses, based on research into existing models. Over time, this support could be expanded to include other natural hazards.

3.9.7.2 The Inquiry endorses reforms to strengthen fire safety in holiday rental accommodation

Given the large number of tourists who stay in holiday rental accommodation during the bush fire season, it is important that they can access clear and concise information to assist them in the event of a fire.

The Inquiry notes a series of proposed reforms to short-term rental accommodation is underway, which include requirements for short-term rental operators to install smoke and

⁴⁴⁰ Meeting with Blue Mountains Incident Management Team on 25 February 2020.

⁴⁴¹ Victorian Country Fire Authority. (2020). Preparing your tourism business. Retrieved from <https://www.cfa.vic.gov.au/plan-prepare/preparing-your-tourism-business>.

heat alarms, a system of evacuation lighting and clear evacuation diagrams.⁴⁴² The reforms also propose introducing a complying development pathway for un-hosted short-term rental accommodation on bush fire prone land.⁴⁴³ The Inquiry endorses the proposed reforms and urges timely implementation to ensure all short-term rental accommodation has appropriate fire safety mechanisms in place.

3.9.8 Community fire safe zones

Key points

- There are already designated bush fire Neighbourhood Safer Places, which include open spaces (e.g. sports ovals). However, as some fires were characterised by significant spotting and ember attacks it was unsafe for people to be in the open, and they instead needed a closed shelter. In 10 communities, people sheltered in the local NSW RFS fire stations which weren't always well-equipped for this purpose.
- There is a need to ensure remote bush fire-prone areas have an indoor Neighbourhood Safer Place, so people can take shelter when open spaces are too dangerous due to fire conditions.

3.9.8.1 Neighbourhood Safer Places are places of last resort during a bush fire

The NSW Government promotes the concept of shared responsibility between government, communities and emergency service organisations to reduce the impact of bush fires. The community must 'play their part' through the development and implementation of their Bush Fire Survival Plan. A last resort option in this plan may include relocation to a designated Neighbourhood Safer Place (NSP).

The *Rural Fires Act 1997* empowers the NSW RFS Commissioner to designate a place as an NSP, provides the legislative framework for designating, inspecting, registering and signposting them, and provides protection from personal liability for owners of an NSP.⁴⁴⁴

The Inquiry acknowledges that NSPs are a place of last resort and intended to function as a backup only when individual bush fire plans are unable to be fully implemented or have failed.⁴⁴⁵ NSPs will not eliminate all risks but their existence may increase a person's chance of survival.⁴⁴⁶

3.9.8.2 The 2019-20 season demonstrated a need for closed shelters in remote communities

The Inquiry heard that during the 2019-20 fire season some NSW RFS stations, mostly in remote areas where there were no alternatives, were used by members of the public as a

⁴⁴² DPIE (Department of Planning, Industry and Environment). Short-term Rental Accommodation Fire Safety Standard. Retrieved from https://shared-drupal-s3fs.s3-ap-southeast-2.amazonaws.com/master-test/fapub_pdf/AA+Exhibitions+STRA/STRA+Fire+Safety+Standard.pdf.

⁴⁴³ DPIE (Department of Planning, Industry and Environment). State Environmental Planning Policy (Short-term Rental Accommodation) 2019. Retrieved from https://shared-drupal-s3fs.s3-ap-southeast-2.amazonaws.com/master-test/fapub_pdf/AA+Exhibitions+STRA/Draft+STRA+SEPP.pdf.

⁴⁴⁴ Part 3A, *Rural Fires Act 1997*.

⁴⁴⁵ RFS (NSW Rural Fire Service). (2017). Neighbourhood Safer Places Guidelines. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0017/26135/NSP-Guidelines.pdf.

⁴⁴⁶ EMV (Emergency Management Victoria). (2015). Community Fire Refuges Policy. Retrieved from <https://files-em.em.vic.gov.au/public/EMV-web/Community-Fire-Refuges-Policy-20151.pdf>.

safe refuge while the fire was impacting the area. Nearly half of these stations were not designated NSPs, and consequently may not have complied with the NSP guidelines.⁴⁴⁷

NSW RFS Station	NSP	No of People	Duration of use	Reason for use	Other	Alternative NSP
Belowra – Far South Coast	No	12	>1 week	Shelter & Accommm	Being upgraded to NSP	No
Nerrigundah – Far South Coast	Yes	12	>1 week	Shelter & Accommm	Drenching system in building	
Wonboyn Lake – Far South Coast	Yes	15	1 day	Shelter	Drenching system in building	
Quaama – Far South Coast	No	10	1-2 days	Shelter		Yes – open space
Balmoral – Southern Highlands	Yes	30	1-2 days	Shelter		
Bell – Blue Mountains	Yes	10	1 – 2 days	Shelter & Accommm		
Mt Wilson – Blue Mountains	Yes	10	1 day	Shelter		
Mt Tomah – Blue Mountains	No	10-15	1 day	Shelter		No
Torrington – Northern Tablelands	No	10	1 day	Shelter		Yes – Torrington Memorial Hall
Nymboida – Clarence Valley	No	6	3 hours	Shelter		No
Wondalga - Riverina Highlands	Yes	10	1 day	Shelter		

Table 3-3: NSW RFS Stations used for shelter during the 2019-20 bush fire season.⁴⁴⁸

Of the NSW RFS stations that were identified above as being used by the community for shelter, most were in remote areas where there were no alternatives. Many of the stations were not designated as NSPs and as such may not meet compliance with the NSP guidelines.⁴⁴⁹

The 2019-20 fire season demonstrated that open spaces are not always an appropriate place to shelter, as spotting and ember attacks necessitate sheltering indoors. The Inquiry agrees that NSPs are a place of last resort and should not be mandatory in all communities. However, some remote communities in bush fire prone areas have no option for shelter from bush fires, other than open spaces. Given the number of NSW RFS stations in the communities, a program should be developed to identify those that can be appropriately used as a place of last resort, and enhance them if necessary, to allow community members

⁴⁴⁷ RFS (NSW Rural Fire Service). (2017). Neighbourhood Safer Places Guidelines. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0017/26135/NSP-Guidelines.pdf.

⁴⁴⁸ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 20 February 2020*.

⁴⁴⁹ RFS (NSW Rural Fire Service). (2017). Neighbourhood Safer Places Guidelines. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0017/26135/NSP-Guidelines.pdf.

to access and take shelter during fire events. These facilities would have adequate Asset Protection Zones and active/passive protection systems to provide short term protection.

Recommendation 17: That the NSW RFS identifies remote bush fire prone areas that do not already have an indoor Neighbourhood Safer Place (NSP) and upgrades the relevant NSW RFS Stations to meet NSP guidelines. These stations would require adequate Asset Protection Zones and active/passive protection systems to provide short-term protection.

4 PREPARATION AND PLANNING – LAND AND ASSETS

4.1 INTRODUCTION

This Chapter addresses Term of Reference 2 (*The preparation and planning by agencies, government, other entities and the community for bush fires in NSW, including current laws, practices and strategies, and building standards and their application and effect*) with a particular focus on getting land, assets and services into a form such that the impact of any fire is minimised.

It also makes recommendations arising from the Inquiry in respect of the following Terms of Reference:

5. *Preparation and planning for future bushfire threats and risks.*
6. *Land use planning and management and building standards, including appropriate clearing and other hazard reduction, zoning, and any appropriate use of indigenous practices.*
7. *Appropriate action to adapt to future bushfire risks to communities and ecosystems.*
9. *Coordination and collaboration by the NSW Government with the Australian Government, other state and territory governments and local governments.*

The Chapter starts by noting that the first task in preparation is knowing what we value and want to save from bush fires and then goes on to discuss methods of planning and preparing these assets including through hazard reduction, traditional Aboriginal land management, extending the strategic aspects of the planning system, and critical infrastructure protection. It then discusses preparation of our access routes (roads and fire trails) to assets and the fire itself. After that, it addresses the problems of smoke from bush fires. The final section discusses some of the potential implications for landscapes and ecosystems of changing fire regimes and what may be needed to adapt.

4.2 WHAT WE VALUE AND NEED TO PROTECT

Key points

- There is no system for determining priorities when multiple assets of value are threatened by fire and there are insufficient resources to protect them all.
- To avoid uninformed decisions during a fire event on what to protect, a formal mechanism is needed for working out in advance the relative value of different assets that has broad community support.

Preparing for bush fire involves preparing the things we value, either by placing them in areas where they will not be affected by fire or preparing them for the effects of fire. To do this, as a first step, we obviously need to know what we value.

Knowing what we value might seem an easy task and to some extent it is. For example, there seems to be universal agreement that human life and personal safety are of high value.

Individuals and families typically value personal safety, access to food and water, and assets (i.e. homes, property, pets, vehicles). Farmers typically value equipment, sheds, stock,

crops, plantations, fencing and farm tracks as well. Owners of other businesses typically value the safety of customers and staff and their premises, stock, equipment and tools.

All agree on the value of critical infrastructure services – clean water, communications, power, sewerage, roads. From submissions and public meetings, it is clear that those surrounded by or threatened by fire particularly value communications – the ability it provides for people to find out exactly where the fire is (if possible), to alert authorities of their location, to seek information and advice, and to send messages to anxious loved ones.

When multiple items of value are threatened by fire at the same time, and fire fighting resources are limited, it is necessary to prioritise. NSW RFS cannot do this effectively without guidance (with transparency and accountability) about those items' priority.

This is different to the situation in, say, a flood where its likely course can be predicted from flood plain models and there is generally time to agree priority assets to be protected. Fire is less predictable and the NSW RFS needs clear guidance to enable it to make the best decisions possible in the allocation of limited resources.

The presence of officers from different agencies in bush fire incident management teams, and the presence of representatives of various agencies in the NSW RFS State Operations Centre during a Section 44 event, mean that these agencies all have opportunity to suggest what should be prioritised. NSW RFS crews also have a good understanding of what is important locally. However, there is no authoritative guidance prepared and documented in advance to inform prioritisation in the compressed time frames of any fire response.

One example of the difficulties faced in the 2019-20 fires is the decision to save the Wollemi Pines in the Wollemi National Park. Input from NPWS was crucial in the decision to try to save them as the park has the only stands of this important tree in the world – making them arguably something that should definitely be saved if possible.

But should the Wollemi Pines be saved at the expense of human life? And at the expense of houses, farms, towns and infrastructure? And why were the Wollemi Pines saved and not, for example, some other rare botanical species?

It is necessary to compare the value of assets/services/ecosystems in a bush fire emergency, because limited resources mean it's not always possible to protect every asset/service/ecosystem (hereinafter referred to as 'asset').

Decisions need to be made about resource allocation, and ultimately which assets should be prioritised for these resources.

What is considered critical for saving to some people may not be considered critical to others. Nevertheless, there are assets that the community generally accepts as critical and recognises as a priority for saving in a bush fire. These assets are typically those essential to the functioning of society (and the economy), particularly infrastructure such as telecommunications, power, water, sewerage treatment plants, roads and bridges. It is the other things of value – environmental and cultural assets and facilities such as community halls and sporting amenities – where prioritisation becomes more difficult. Therefore, trade-offs between the values must be made at the planning and preparation stage to protect these assets rather than rely on an arbitrary and ad hoc response when the bush fires are in progress.

The Inquiry suggests that a formal mechanism is needed for working out the relative value of different assets and that the guidance provided needs to be satisfactory to the community as a whole. Further, common units of value are required across all asset classes. A simple,

qualitative and effective value unit is the economic value (in \$) of the asset. Another simple quantitative mechanism is to create a value structure with a relatively small number of levels which can be used by different bodies (government agencies, local communities, etc.) to indicate relative value within a partial order. For example, under such a value structure, values could be assigned as follows:

- human life at Value Level 1
- critical infrastructure at Value Level 2
- individual properties, stock, top-level ecological and cultural assets at Value Level 3
- general infrastructure and lower level ecological and cultural assets at Value Level 4.

Obviously, this can be made more sophisticated, for example by applying both economic value and a value structure (and, possibly, likelihood of success if threatened by fire). But starting with a simple system such as this and ensuring that an asset's 'value' is complemented by other metadata appropriate to the asset involved, should enhance guidance on what to defend.

4.3 KNOWING WHERE ASSETS ARE AND RECORDING NECESSARY INFORMATION TO PROTECT THEM

Key points

- There is no authoritative consolidated State register/repository of things of value/assets/services (along with precise geolocation and other quality-curated, appropriate metadata) to be protected from bush fire.
- The State Infrastructure Strategy 2018 had, as part of its emphasis on building resilience against natural hazards, already made recommendations relating to much of this issue. In response to the State Infrastructure Strategy, Spatial Services is building a State Digital Twin. The Inquiry supports this approach but recommends it be accelerated and extended to address the need for comprehensive and reliable data needed for effective fire fighting.

There is no authoritative consolidated State register/repository of assets/services to be protected, let alone one with the location and information (metadata) that is necessary to provide protection of any given asset nor one kept in an up-to-date format that can be accessed with confidence during a bush fire emergency.

As noted in Chapter 2, fire fighting is inherently a spatial activity. The main custodian of spatial information in the NSW Government is Spatial Services in the Department of Customer Service. Spatial Services supplies its cadastral and topographic data dictionaries to NSW RFS along with any data updates on a weekly basis. Through this and spatial data sourced from local councils, NSW RFS has point spatial data indicating the location of many buildings, some with labels (such as "substation", "sewerage plant", etc.), to inform itself when engaging in hazard reduction and fire fighting activities. When fires are burning, Spatial Services also plays a response role by providing specific data sets to NSW RFS when it requests these at short notice to inform itself about a particular structure or structures that is burning or at risk from bush fire. Spatial Services might not necessarily have this information itself but will source it quickly and provide it to NSW RFS.

But while there is considerable spatial information and expertise available in the State, NSW RFS does not yet have comprehensive spatial data ready, available and easily accessible when it needs it to make dynamic resource allocation decisions when fighting a major fire.

This is especially so when it has to allocate limited fire fighting resources between several major fires, a situation it faced right through the 2019-20 season.

The need for much more complete and useful spatial information to assist with emergencies and disasters (among other things) has already been recognised in the *State Infrastructure Strategy* released in 2018, which “sets six cross-sectoral strategic directions, each designed to achieve ‘more with less’ from the State’s large infrastructure program and asset base.”⁴⁵⁰ The fourth of these is to:

*ensure NSW’s existing and future infrastructure is resilient to natural hazards and human-related threats by embedding consideration of risk and resilience into all project business cases, capital asset planning and assurance processes, and requiring agencies to undertake rolling assessments of the vulnerability of assets to natural disasters and human-related threats.*⁴⁵¹

The Inquiry endorses this approach strongly. It notes in particular that, in reviewing the structural challenge of climate change for the State, the Strategy states:

*An increase in the frequency and/or severity of natural disasters could impact the capacity of all types of infrastructure. ... Centrally located, reliable and accessible climate and hazard data, together with appropriate risk assessment tools, will help infrastructure operators to prepare for and mitigate these risks.*⁴⁵² ...

*To effectively manage risk, decision-makers need access to accurate and up-to-date information on the natural hazards facing existing and future infrastructure. The nature and type of natural hazard information available varies in its quality, availability and accessibility. Responsibility for the collection of natural hazard information is spread across a range of state and local government authorities. As a result, there is no efficient, coordinated approach to its collection, use and dissemination suitable for assessing risk. There is also no clear, comprehensive understanding of the potential impact of natural hazards on infrastructure or of the risks that should be prioritised.*⁴⁵³ ...

*Consistent with the recommendations of the NSW Chief Scientist and Engineer in a review of coal seam gas activities in NSW, Infrastructure NSW supports the development of a centralised data system that is accessible by everyone under open data provisions, searchable in real-time and spatially enabled.*⁴⁵⁴

In this regard the Strategy makes three relevant recommendations:

- *Recommendation 27 Infrastructure NSW recommends that by the end of 2020 the Department of Finance, Services and Innovation develop and implement an Infrastructure Data Management Framework that incorporates access to open data, is searchable in real time and is spatially enabled to support market innovation and smart asset management with sector infrastructure experts.*
- *Recommendation 28 Infrastructure NSW recommends that the Department of Finance, Services and Innovation lead the development of a data infrastructure*

⁴⁵⁰ Infrastructure NSW. (2018). Building Momentum State Infrastructure Strategy 2018-2038.

Retrieved from https://insw-sis.visualise.today/documents/INSW_2018SIS_BuildingMomentum.pdf.

⁴⁵¹ Ibid, p 7.

⁴⁵² Ibid, p 4.

⁴⁵³ Ibid, p 64.

⁴⁵⁴ Ibid, p 78.

ecosystem, starting with the Foundation Spatial Data Framework, to access the future benefits of digital mapping and modelling of infrastructure.

- *Recommendation 29 Infrastructure NSW recommends that the Department of Finance, Services and Innovation prepare a business case for upgrading the Foundation Spatial Data Framework from a map to a model (a real-time 3D model of the physical environment).⁴⁵⁵*

The Government supported all three of these recommendations with the rider on each recommendation that “further improvements to the framework will be subject to additional analysis to inform resourcing needs”.⁴⁵⁶ In addressing these recommendations, Spatial Services is in the process of constructing a State Digital Twin⁴⁵⁷ and a Digital Workbench that supports it. The Digital Workbench is particularly targeted at emergency services’ needs, with plans to incorporate private sector information, and assets (including infrastructure) both public and private. Thus, it intends to incorporate foundational spatial data and appropriate other metadata on private dwellings, as well as data for major commercial buildings and infrastructure and assets such as cultural and environmental assets. For the latter, it will be able to draw on the SEED data portal, which “brings together state-wide environment data about land, water, plants, animals and air”.⁴⁵⁸

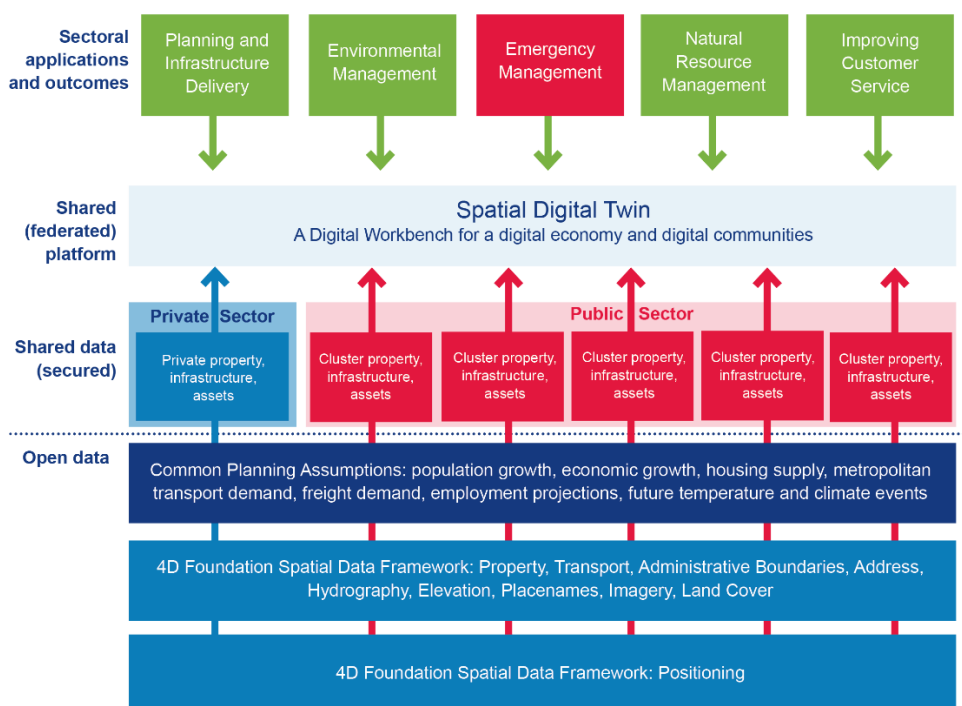


Figure 4-1: Spatial Services’ concept design of Digital Workbench supporting NSW Digital Twin. Prepared by Spatial Services.⁴⁵⁹

⁴⁵⁵ Ibid, p 79.

⁴⁵⁶ Infrastructure NSW Government response to recommendations in the State Infrastructure Strategy 2018-2038: Building the Momentum. Retrieved from <https://www.nsw.gov.au/projects/nsw-infrastructure-strategy-2018-2038/appendix>.

⁴⁵⁷ Spatial Services. Digital Twin. Retrieved from https://www.spatial.nsw.gov.au/what_we_do/projects/digital_twin.

⁴⁵⁸ DPIE (Department of Planning, Industry and Environment). SEED data portal. Retrieved from <https://www.environment.nsw.gov.au/research-and-publications/seed-data-portal>.

⁴⁵⁹ DCS (Department of Customer Service). (2020). *Advice to the Inquiry provided 23 June 2020*.

The Inquiry supports this approach, provided that:

- it covers all areas of the State
- there is a single whole-of-government procurement and acquisition program for regularly-updated imagery and LiDAR to consolidate user requirements (currency, completeness, reliability, spatial accuracy); remove duplicated acquisition and maintenance costs; and drive cost efficiencies through demand aggregation and economies of scale thus ensuring NSW RFS and other emergency services have reliable, fast and secure access to all State imagery and LiDAR resources (alongside the other Foundation Spatial Data Framework data)
- the metadata provided for each class of infrastructure and asset is comprehensive and appropriate for what is needed in dealing with bush fire risk. Thus, for telecommunications infrastructure, the communications coverage associated with it is needed in its metadata so NSW RFS understands what coverage is lost if that piece of infrastructure is damaged
- relative value of assets and infrastructure is included, using a common, consistent value framework. For example, a rare cultural asset (e.g. the unique-in-NSW example⁴⁶⁰ in the Blue Mountains World Heritage Area of indigenous rock art that is both etched and painted) would be accorded a high value
- all critical infrastructure providers are required to deposit all relevant information with the Digital Workbench and update their information on agreed timeframes not less than annually
- there is a capability to incorporate information about the quality of road verges, fire trails, APZs and other defendable space and that this is updated not less than annually so the latest information on the most important hazard reduction is captured and available when needed
- there is the capability for information (such as current local road conditions) from local sources (such as NSW RFS brigades) to be included easily; along with an assessment of the reliability of the information. One of the sets of information most lacking for NSW RFS is issues of particular importance to local communities (e.g. local landmarks, assets that have great local significance even if not considered as important to the State, etc.). This needs to be rectified so groups such as local councils, Bush Fire Management Committees and local NSW RFS brigades can add data (that will be automatically marked as coming from them on the data they entered for quality control purposes)
- the information is audited at least annually by Spatial Services working with NSW RFS for being up to date.

Given that another bad fire season is a real possibility, the build of this Digital Workbench is urgent, and it needs to be prioritised.

Recommendation 18: That, in order to equip NSW RFS with comprehensive information on all structures and assets at risk of bush fire, Government ensures that:

- there is a single whole-of-government procurement and acquisition program for imagery and LiDAR and that Government accelerate the building of the State Digital Twin and associated Digital Workbench
- owners/managers of assets (apart from private home owners whose information will be provided through local councils) in bush fire prone land are required to provide to

⁴⁶⁰ McDonald, J & Clayton, L. (2016). Rock Art Thematic Study. Report to the Department of the Environment and the Australian Heritage Council. Retrieved from <https://www.environment.gov.au/system/files/resources/90e93195-385b-4e34-89f9-14d44a189b3b/files/rock-art-thematic-study.pdf>.

the Digital Twin at least the following information/metadata with quality control certification on an annual basis (with annual census at least two months before the start of the fire season):

- precise geolocation
- description of asset including picture
- value level
- fire treatment on asset
- Asset Protection Zone (APZ) details and how it is maintained
- access details
- what redundancy is available if relevant
- any metadata requirements specific to the asset class
- emergency contact and instructions on how to access where more information is held
- any restrictions on data access and sharing.

The Digital Twin must also be able to incorporate:

- information about the hazard reduction results for road verges, fire trails, APZs and other defensible space
- local information supplied by organisations such as local NSW RFS brigades.

4.4 PROCESSES FOR PROTECTION

Key points

- Good preparation for a fire season involves a coordinated effort across all land tenures to reduce the likelihood of fire ignition; prepare land and structures for fire attack; and ensure, where possible, effective backup and redundancy arrangements are in place.
- Individuals, communities, and governments at all levels have roles to play in this preparation and all need to be willing to cooperate to be ready for a recurrence of fires of the type seen in 2019-20.
- Improving processes for protecting what we value involves deepening our understanding and practices of hazard reduction; strengthening our planning system to address fire issues including legacy issues more comprehensively; ensuring NSW RFS has full details of the location and arrangements for all critical infrastructure.
- Cultural land management has an important part to play.

4.4.1 Was NSW prepared for the 2019-20 season?

Fire is a part of the NSW landscape, which makes good planning and preparation for each fire season important to reduce any potential losses, and to help with fire suppression efforts.

Good preparation involves a coordinated effort across all types of land tenure to reduce the likelihood of fire ignition and reduce fire spread. This means that boundaries, Asset Protection Zones (APZs), Strategic Fire Advantage Zones and fire trails have to be maintained to appropriate standards. Appropriate levels of hazard reduction have to be completed including prescribed burning and mechanical clearing. Critical infrastructure has to be prioritised at a community level. Owners of land have to be identified and appropriate actions have to be taken to reduce the likelihood that assets will be affected by fire and, if a fire occurs, that they can be successfully defended.

For landholders, this involves ensuring the provision of support, information and any necessary government approvals that will enable properties to be prepared for an upcoming fire season. This includes education programs, community days and details of resources available (e.g. that the NSW RFS is available to help with prescribed burns).

For private dwellings, good preparation for the bush fire season includes clearing fallen leaves, twigs and debris around the property, having a well maintained garden, clearing out gutters, repairing the house including roofs and external walls, and if possible attaching fire sprinkler systems to gutters and having an identified water source on the property.⁴⁶¹

In respect of preparation for the 2019-20 seasons, three areas were emphasised over and over again: a perceived insufficiency in hazard reduction, shortcomings in the NSW planning system, and the importance of continuation of critical services such as communications and electricity. This section looks at those three issues in turn.

4.4.2 Hazard reduction

Key points

- The NSW Government, largely through works undertaken on national parks, has met its hazard reduction targets from 2011 to 2019, and the area over which hazard reduction activities have been done annually has on average increased since 2011. The previous State-wide targets are no longer current because the end date has passed, and they have not been replaced. However, NPWS and NSW Forestry Corporation continue to work in collaboration with NSW RFS towards State-wide area targets for hazard reduction across the estates they manage.
- While studies of the impacts of previous bush fires indicate that on balance hazard reduction can reduce the rate of spread and intensity/severity of bush fire, there is no guarantee that any particular hazard reduction activity will provide protection from bush fire in every circumstance, especially when fire weather is adverse (i.e. in Severe, Extreme and Catastrophic categories of fire danger) as was experienced on many days during the 2019-20 season. Research also shows that the potential benefits of prescribed burning activities are generally short-lived.
- The degree to which more hazard reduction burning before the 2019-20 fire season, especially broad-scale prescribed burning across the landscape, would have influenced the extent of area burnt or damage caused is not fully understood or quantified.
- However, the latest research does show that hazard reduction is most likely to provide some benefit near specific things that communities want to protect. Accordingly, the regionally based approach to planning and coordinating hazard reduction activities through Bush Fire Management Committees should be refreshed so the objectives are very clear, and to make sure that a risk-based approach is being applied rigorously across the State, informed by the best research on risk reduction.
- A suite of targeted and more strategic hazard reduction activities across all tenures, working from the perimeters of settlements outwards, and involving communities in their design and implementation, should be a feature of future fire management planning and preparation.
- We also need a much better understanding of cost-benefit and effectiveness of different hazard reduction techniques, including the public health costs associated with smoke from prescribed burning.

⁴⁶¹ RFS (NSW Rural Fire Service). Prepare your home. Retrieved from <https://www.rfs.nsw.gov.au/plan-and-prepare/prepare-your-property>.

- Public land managers could do more to become good neighbours.
- While existing approval processes are intended to support hazard reduction by private landowners, more education and community engagement is required on the purpose of the processes and how to use them effectively.

4.4.2.1 Hazard reduction is an issue of considerable community concern

As described in Chapter 1, hazard reduction, and prescribed burning in particular, was one of the major themes raised with the Inquiry in community meetings, consultations and submissions. It is clear that many people hold the view that more prescribed burning is the answer to reducing bush fire risk, or even preventing bush fires.

How much, how often, when and where prescribed burning is undertaken is a source of considerable anxiety in the community. Many people felt that their lives and properties were put at risk during the 2019-20 bush fires because fuels were not managed appropriately on public land or other neighbouring properties. In particular, there is a strong perception among many community members in most fire affected areas that inadequate fuel management, often on land managed by NPWS or NSW Forestry Corporation, was a key contributor to the size and severity of the bush fires.

Community members also reported that too much bureaucracy and ‘red tape’ and ‘green tape’ get in the way of their own hazard reduction burning on their own properties, and that this also puts them at risk. There was feedback that the application process for such burning is too onerous and cumbersome, and it takes too long to receive a permit.⁴⁶² Many landholders argued that they should be allowed to clear, burn, put in fire breaks⁴⁶³ and burn off piles of collected scrub⁴⁶⁴ on their own land without some of the requirements that apply (e.g. without the requirement to stay with the fire).

Many landowners linked their views about the need for more hazard reduction burning with widespread calls for greater use of traditional Aboriginal land management and cultural burning of the landscape. The Inquiry heard many calls for greater application of small-scale, regular, ‘cool’ burning in the landscape.

In this section, the term ‘hazard reduction’ is used in its broadest sense, to refer generally to fuel management or reduction, and it includes:

- prescribed burning⁴⁶⁵ (on public and private land)
- other techniques to change fuel amount, composition or forest structure, like mechanical treatments to remove fuel (heavy machinery, mowers etc)

⁴⁶² Lithgow Community Meeting on 25 February 2020.

⁴⁶³ Far South Coast Community Meeting 6 May 2020 and Mid North Coast Community Meeting 23 April 2020.

⁴⁶⁴ Martin Tebbutt, Submission to the Inquiry.

⁴⁶⁵ Prescribed burning is defined as “the process of planning and applying fire to a predetermined area, under specific environmental conditions, to achieve a desired outcome. Prescribed, controlled and planned burns are the same thing.” WA Department of Biodiversity, Conservation and Attractions. Prescribed burning. Retrieved from <https://www.dpaw.wa.gov.au/management/fire/prescribed-burning#:~:text=Prescribed%20burning%20is%20the%20process,burns%20are%20the%20same%20thing>.

—and includes clearing and maintenance of Asset Protection Zones and defensible space.⁴⁶⁶

Underpinning the Inquiry’s consideration of these issues is the understanding that hazard reduction, including prescribed burning, is all about trying to reduce the probability of damage to life, property and the environment from unplanned fires. No intervention can guarantee safety from bush fire, especially under the adverse weather conditions frequently experienced during the 2019-20 season.

No type of intervention to reduce the amount or change the structure of fuel (usually vegetation) is fail-safe. It was suggested to the Inquiry that it is best thought of as a “betting” strategy⁴⁶⁷ where fire authorities and land managers use their judgement to make the investments that are most likely to reduce the probability of damage to life, property, and other important assets.

The Inquiry notes that the purpose of hazard reduction is not to stop fires in their tracks, but to alter and diminish the rate of fire spread, intensity and severity and thereby increase the opportunities for safe and effective suppression. It also recognises that the most damage occurs – and the risk to life is greatest – in conditions where fire danger is Severe or higher. Therefore, the hazard reduction programs need to consider how vegetation, landscapes and communities will respond in the most extreme conditions.

This section:

- explains the current frameworks in NSW for planning and implementing hazard reduction activities across different types of land
- examines data from the 2019-20 fire season to understand what effect hazard reduction burning may have had
- describes recent research
- provides a series of recommendations for implementing a more targeted risk-based approach to hazard reduction activities across all land tenures.

4.4.2.2 What are the current frameworks for hazard reduction in NSW?

4.4.2.2.1 Hazard reduction priorities are determined at a local level through Bush Fire Management Committees and Bush Fire Risk Management Plans

The model in NSW is driven by localised identification of assets, risks to the assets and prioritisation of hazard reduction activities, and cross-tenure, multi-agency collaboration at the regional-scale, as described below.

As discussed in Chapter 3, under the *Rural Fires Act 1997* all land managers, owners and occupiers including government agencies must take steps to prevent the occurrence and spread of bush fires on or from their land. Under the Act, the NSW RFS Commissioner, Bush Fire Coordinating Committee (BFCC) and local Bush Fire Management Committees (BFMCs) are responsible for coordinated bush fire risk management across the State.

⁴⁶⁶ Defensible space is focused on providing clear access for fire fighting before, during and after the passage of a bush fire, while an Asset Protection Zone (APZ) aims to reduce bush fire behaviour and intensity in the immediate area surrounding the asset. A defensible space is normally a subset of an APZ, located immediately adjacent to the asset. RFS (NSW Rural Fire Service). (2020) *Advice to the Inquiry provided 8 July 2020*.

⁴⁶⁷ Professor Ross Bradstock (2020). *Advice to the Inquiry provided 27 July 2020*.

BFMCs are required to develop local area Bush Fire Risk Management Plans. Through these plans, each BFMC identifies the areas that need hazard reduction and assigns hazard reduction treatments (e.g. prescribed burning, mechanical thinning) to land managers or the responsible agency for completion.

Each public land manager then sets its hazard reduction priorities in line with these plans, and also its responsibilities under the *Rural Fires Act 1997* and any other specific considerations (such as other legislative objectives) and develops an annual works program. This is then submitted to the BFMC for amalgamation and prioritisation with the other land managers' programs to create a consolidated annual program of works, which is then provided back to the agencies to action.

NSW applies a system of Bush Fire Management Zones which are: ⁴⁶⁸

- Asset Protection Zones (APZs): fuel-reduced areas surrounding an asset (such as residential, industrial or heritage buildings, cultural or community assets) adjacent to bush fire hazards
- Strategic Fire Advantage Zones (SFAZs): strategically located areas that are more intensively managed for fuel load than the general landscape to enhance APZs and provide additional opportunities for fire suppression.
- Fire Exclusion Zones (FEZs): areas of vegetation from which fire (both bush fire and prescribed burns) should be excluded altogether.
- Land Management Zones (LMZs): all areas that are not mapped as APZs, SFAZs or FEZs.

The NSW RFS has advised that the NSW bush fire risk planning framework⁴⁶⁹ prioritises hazard reduction activities in APZs and SFAZs and that, due to their proximity to communities and assets, hazard reduction in APZs is generally via mechanical clearing, mowing and under-scrubbing, with a limited amount of prescribed burning. Prescribed burning is the most common hazard reduction approach for SFAZs.⁴⁷⁰

All hazard reduction activities under the plans are documented in the Bush Fire Risk Information Management System (known as BRIMS) maintained by the NSW RFS. This information system contains documented hazards, risks and hazard reduction works conducted in each BFMC area.

All public land can be subjected to hazard reduction through the priorities set by the local Bush Fire Management Committee. For example, Transport for NSW land is often hazard-reduced by NSW RFS. Operational fire management of Crown lands is devolved to other NSW government agencies, local councils and private landowners, with the NSW RFS undertaking hazard reduction burns on behalf of Crown Land Managers. These activities and priorities should be developed and coordinated by the local BFMC.

⁴⁶⁸ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 1 June 2020*.

⁴⁶⁹ RFS (NSW Rural Fire Service) Policy 01/08 – Bush Fire Risk Management. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0016/9601/Policy-1-2008-Bush-Fire-Risk-Management.pdf.

⁴⁷⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 1 June 2020*.

4.4.2.2.2 NSW did have overarching State-wide targets, but these have expired

The previous State Plan *NSW 2021* (2011) included a priority action to “limit bush fire severity” by:

- establishing annual bush fire hazard reduction works targets for land management agencies responsible for bush fire prone lands consistent with the state target
- increasing the number and area of hazard reduction activities undertaken on national parks and reserves.⁴⁷¹

The targets to go with the priority actions were to:

- increase the number of properties protected by hazard reduction works across all bush fire prone land tenures by 20,000 per year by 2016
- increase the annual average level of area treated by hazard reduction activities by 45% by 2016.⁴⁷²

In 2015, the targets were replaced by a Government commitment to protect almost 600,000 homes and treat almost 750,000 hectares across NSW through hazard reduction activities over the four-year period from 1 March 2015 to 31 March 2019.⁴⁷³

This commitment expired in March 2019, so there is not currently any overarching State target or commitment for hazard reduction across all tenures. However, the planned activities determined in each BFMC annual work program for the upcoming financial year are added together to provide a State-wide picture.

For example, the NSW RFS reported to the Inquiry that in the 2018-19 financial year, NSW RFS and partner agencies completed hazard reduction burns over a total of 199,248 hectares, compared with the accumulated target of BFMC planned activities of 187,041 hectares. This was assessed as providing protection to 113,130 properties.⁴⁷⁴ The vast majority of this is completed on national parks (approx. 135,000 hectares per annum).

4.4.2.2.3 NPWS and Forestry Corporation still work towards hectare-based hazard reduction targets

In 2011, the Government established the NPWS Enhanced Bush Fire Management Program to support an increase in hazard reduction activity in national parks and reserves.

As part of this program, the NPWS developed a target to conduct hazard reduction across a five-year rolling average of 135,000 hectares each year. This target was based on existing NPWS resources and additional resources provided by the program. In 2017, this program was extended with an additional \$92 million over five years.⁴⁷⁵

⁴⁷¹ NSW Government. (2011). *NSW 2021* p 53. Retrieved from National Library of Australia Trove https://web.archive.org/au/awa/20130523022905mp_/http://pandora.nla.gov.au/pan/132000/20130420-0002/www.2021.nsw.gov.au/sites/default/files/NSW2021_WEB+VERSION.pdf.

⁴⁷² Ibid.

⁴⁷³ NSW Treasury. (2015). *Election Commitments 2015-19*. Retrieved from https://www.treasury.nsw.gov.au/sites/default/files/pdf/2015-2016_Budget_Papers_-_Election_Commitments_2015-19.pdf.

⁴⁷⁴ Based on the number of properties within 100 m of the hazard reduction activity.

⁴⁷⁵ NPWS (National Parks and Wildlife Services). *Enhanced Bushfire Management Program*. Retrieved from <https://www.environment.nsw.gov.au/topics/parks-reserves-and-protected-areas/fire/managing-fire/bushfire-management-program>.

Forestry Corporation of NSW has a hectare-based target for hazard reduction burning which has been 22,200 hectares annually since 2015-16. This target was based on a 45% increase on an historical baseline determined by the NSW RFS in the period 2012-2016.⁴⁷⁶

For NPWS, the hazard reduction target of 135,000 hectares is mostly achieved through prescribed burning with a small amount of mechanical clearing. In order to manage fuels in State Forests, Forestry Corporation uses a combination of prescribed burning and mechanical clearing and makes 360,000 hectares available for grazing.⁴⁷⁷

4.4.2.2.4 Since 2011 there has been an overall increase in hazard reduction activities in NSW

Since 2011, there has been an increase in the number of hazard reduction activities planned and completed in NSW, and the total area treated. NPWS reported to the Inquiry that over the seven years (2012-13 to 2018-19), the average level of hazard reduction burning on national parks was more than double the average level for the previous seven years.⁴⁷⁸

Several factors will determine whether hazard reduction activities can be carried out in any given period.⁴⁷⁹ The NSW RFS has advised that, as a consequence, works are planned in the knowledge that not all will be conducted. This enables appropriate approvals to be obtained for all options: if a treatment cannot be undertaken in one area, resources can be redeployed elsewhere. It means that there are often more planned works than completed works in any given year. However, despite this, NSW RFS reported to the Inquiry that completed works as a percentage of planned works is increasing overall, as shown in Figure 4-2.

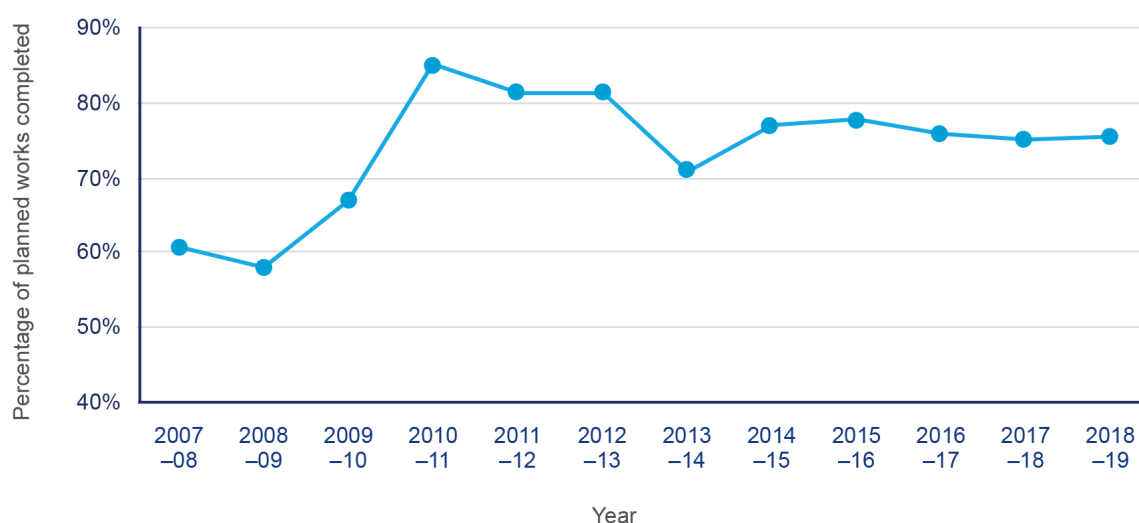


Figure 4-2: Planned and completed works 2007-2019.⁴⁸⁰

Most prescribed burning in NSW is performed on national parks. NPWS performs 79% of the hazard reduction burning across all tenures in NSW (while managing 9% of the State), in collaboration with NSW RFS and other agencies. Over the last six years (2012-13 to 2018-

⁴⁷⁶ FCNSW (Forestry Corporation of NSW). (2020). *Advice to the Inquiry provided 22 July 2020*.

⁴⁷⁷ Ibid.

⁴⁷⁸ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 14 April 2020*.

⁴⁷⁹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 1 June 2020*.

⁴⁸⁰ Ibid.

19), NPWS has met or exceeded its rolling average hazard reduction target of 135,000 hectares per year, completing on average 137,045 hectares a year.⁴⁸¹

The Forestry Corporation reported to the Inquiry that, on average over the last five years, it had achieved approximately 94% of its annual target of 22,000 hectares of hazard reduction burning.⁴⁸²

4.4.2.3 What does the latest research and the experience of the 2019-20 bush fires tell us about hazard reduction?

This section provides some preliminary analysis of the 2019-20 season and what that tells us about the effectiveness or otherwise of previous hazard reduction activities. It also identifies the key findings from recent research that should inform the approach to hazard reduction in NSW.

4.4.2.3.1 The effect of previous hazard reduction was mixed during the 2019-20 season

Overall, hazard reduction through prescribed burning appears to have had a mixed effect on reducing fire severity, spread and damage in the 2019-20 season.

As discussed in Chapter 2, there were examples in the 2019-20 bush fires of areas treated with prescribed burning that provided a strategic benefit which helped to protect lives and property (e.g. Mt Solitary slowed the rate of spread from the initial ignition and gave more time and options to protect Blue Mountains towns). However, other recently burnt areas had no effect on the fire spread or severity (e.g. area burnt by the State Mine fire). Chapter 2 also refers to Research Hub research on 2019-20 case study data which shows that, while some recent prescribed burns had an influence in reducing fire severity, many had no obvious influence on fire severity.

Another Research Hub analysis correlated various risk factors associated with house loss and damage to houses during the 2019-20 season.⁴⁸³ Noting that the importance of different factors varied across the State, this work found that weather (FFDI) was the strongest factor related to house destruction.⁴⁸⁴ It also found that prescribed burning within the vicinity of property appeared to reduce the probability of house loss, but did not remove the risk completely.

This analysis also found that prescribed burning in the broader landscape showed limited benefit in reducing risk of house loss.⁴⁸⁵ This preliminary analysis of data from the 2019-20 season aligns with the results of previous studies which show that hazard reduction in relatively close proximity to houses and other assets offers the most cost effective approach to reducing risk of loss and damage.

The Research Hub has also completed some initial analysis to examine the degree to which more hazard reduction could have influenced the extent of area burnt or damage caused during the 2019-20 season. The Research Hub used large-scale fire behaviour simulations to estimate the likely effect of prescribed burning in the lead up to the season on risk to

⁴⁸¹ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 1 April 2020*.

⁴⁸² NSW Forestry Corporation. (2020). *Advice to the Inquiry provided 22 July 2020*.

⁴⁸³ NSW Bushfire Risk Management Research Hub (2020) 'Probability of house destruction'.

⁴⁸⁴ Ibid.

⁴⁸⁵ Ibid.

various things of value (people, and assets such as property, infrastructure, the environment), and compared this with what alternative amounts of burning may have achieved. It also analysed these examples using estimates of weather conditions reflecting long-term weather records, as well as the worst weather that was experienced in the case study areas during the 2019-20 season.⁴⁸⁶

This analysis, which examined case study areas of Casino, Gloucester, Blue Mountains and Jervis Bay, found that:

- results varied across the different landscapes, but overall the levels of prescribed burning leading up to the 2019-20 fire season were estimated to leave considerable residual risk for most values
- by comparison, treating 5% of the landscape per annum could have reduced risk, but still would have left high residual risk
- there was significant variation in the estimated levels of risk reduction between the case study landscapes
- the severe weather conditions experienced during the 2019-20 fire season were estimated to result in higher risk than the long-term scenarios based on the full range of weather conditions from the historical record.

In general, the analysis found that, while increasing rates of prescribed burning treatment was estimated to decrease risks to people, property and infrastructure, it also found that increasing rates of prescribed burning was likely to increase the area burnt below minimum tolerable fire interval, which presents risk to some elements of biodiversity.

As explained later in this section, the Inquiry also notes that models used to predict fire progression do not yet adequately account for dynamic fire behaviour so may underestimate risk.

The Research Hub reports that these findings align with previous studies which have found that:

- plausible levels of prescribed burning may offer partial risk mitigation, not risk elimination⁴⁸⁷
- there is not a 'one size fits all' solution to prescribed burning treatment, and the potential risk mitigation resulting from any particular prescribed burning strategy varies significantly between landscapes⁴⁸⁸
- prescribed burning is likely to be less effective at mitigating risk to lives, property and infrastructure under Severe, Extreme or Catastrophic fire weather conditions.⁴⁸⁹

⁴⁸⁶ NSW Bushfire Risk Management Research Hub (2020) 'Estimated risk mitigation from prescribed burning prior to the 2019/20 fire season'.

⁴⁸⁷ Cirulis B, Clarke H, Boer M, Penman T, Price O and Bradstock R (2019) Quantification of inter-regional differences in risk mitigation from prescribed burning across multiple management values. *International Journal of Wildland Fire*. doi: [10.1071/WF18135](https://doi.org/10.1071/WF18135); Penman, T, Clarke, H, Cirulis, B, Boer, M, Price, O & Bradstock, R (2020) Cost-effective prescribed burning solutions vary between landscapes in eastern Australia. *Frontiers in Forests and Global Change*. doi: [10.3389/ffgc.2020.00079](https://doi.org/10.3389/ffgc.2020.00079).

⁴⁸⁸ Cirulis et al (2019).

⁴⁸⁹ Price, O, & Bradstock, R. (2012) The efficacy of fuel treatment in mitigating property loss during wildfires: insights from analysis of the severity of the catastrophic fires in 2009 in Victoria, Australia. *Journal of Environmental Management* 113: 146-157.

4.4.2.3.2 Future hazard reduction must consider the extent of the 2019-20 bush fires

Previous hazard reduction activities have focussed on creating a mosaic pattern of different fuel ages and levels across the State.⁴⁹⁰ However, the extent of the 2019-20 fires has largely 'reset' the landscape in the fire affected areas which makes future hazard reduction more challenging. For example, areas adjacent to heavily burnt areas are likely to have become wildlife refugia, and therefore the environmental impacts of burning these areas is greater.⁴⁹¹ As reported by the Research Hub, "there is a limit to the amount of prescribed burning that can be undertaken if vegetation is to remain within its tolerable ecological threshold after the 2019-20 fire season".⁴⁹²

As most hazard reduction activities are conducted on the national park estate, this becomes even more important. Typically, unplanned bush fires affect approximately 1% of the national park estate whereas the 2019-20 fires saw approximately 37% of the estate affected.⁴⁹³

4.4.2.3.3 Extreme conditions tend to overwrite hazard reduction (fuel amount or age)

Studies of previous fires have shown that the majority of damage to life and property occurs on Severe, Extreme or Catastrophic fire weather days. These are the same days when fuel reduction treatments are likely to be least effective in reducing the rate of spread and intensity of fire.

As explained in Chapter 2, beyond a certain level of fire weather (FFDI), fuel load and fuel age has a diminished influence on fire intensity/severity.

Research on fires in the Sydney region showed that in extreme weather even patches that had been burnt within the previous 12 months had a low likelihood of stopping unplanned fires.⁴⁹⁴ This pattern also held for NSW in the 2019-20 fires with recent burns, both previous bush fires and prescribed burning, having a mixed effect on reducing fire intensity, spread and damage.

Work by Penman et al (2013) also concludes that very large areas would need to be treated annually to achieve meaningful reductions in the probability of lightning ignitions across the landscape during weather conditions that are likely to lead to destructive fires.⁴⁹⁵ McRae and Sharples (2015) reached similar findings in the context of extreme bush fires (those that may produce fire-generated thunderstorms as described in Chapter 2).⁴⁹⁶

Therefore, it is important to acknowledge and plan for the likely eventuality that worse fire seasons may make hazard reduction, especially prescribed burning, increasingly less effective. As noted by the Research Hub, based on simulation modelling, "the increase in

⁴⁹⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 1 June 2020*.

⁴⁹¹ Ibid.

⁴⁹² NSW Bushfire Risk Management Research Hub (2020) 'Future risk analysis'.

⁴⁹³ NPWS (National Parks and Wildlife Services). (2020). *Advice to the Inquiry provided 1 April 2020*.

⁴⁹⁴ Price, O & Bradstock, R (2010) The effect of fuel age on the spread of fire in sclerophyll forest in the Sydney region of Australia. *International Journal of Wildland Fire* 19: 35-45. doi: 10.1071/WF08167.

⁴⁹⁵ Penman, T, Bradstock, R & Price, O. (2013) 469-478.

⁴⁹⁶ McRae, R, & Sharples, J. (2015) Assessing mitigation of the risk from extreme wildfires using MODIS hotspot data." In MODSIM2015, 21st International Congress on Modelling and Simulation (pp 250-256). Modelling and Simulation Society of Australia and New Zealand p 255.

risk due to extreme weather typically strongly outweighs the decrease in risk associated with even the highest rates of prescribed burning.”⁴⁹⁷

4.4.2.3.4 Hazard reduction frameworks need to be guided by risk-reduction, rather than area-based targets

In response to the 2009 Black Saturday Bush fires, the Victorian Royal Commission recommended that that state fund and commit to implementing a program of prescribed burning based on an annual rolling target of 5% minimum of public land. This built upon previous Victorian inquiries which noted the benefits of prescribed burning and recommended setting a hectare-based target for public land.

But this has since been changed to focus on risk reduction. In 2015, the Victorian Government replaced the area-based hazard reduction target with a strategic, risk-based system. The Victorian Inspector General for Emergency Management concluded that the 5% hectare-based target had created perverse incentives to undertake burns to maximise the land area treated at the lowest cost regardless of the strategic value for protecting life and property.⁴⁹⁸ Instead, the Inspector General recommended a “risk reduction target as the most effective form of performance target for bush fire fuel management on public land to protect life and property and guide investments in fuel reduction burning.”⁴⁹⁹ Victoria currently has a 70% residual risk target. This target aims to reduce the impacts of fire in the landscape by almost a third, and all activities can be measured against this target.⁵⁰⁰

This Inspector General explained that such a target would:

- consider the wide variation in bush fire risk across Victoria
- direct investment in planned burning to reduce risk to life and property
- encourage planners to consider the contributions to risk on private land
- help engage communities on the most effective ways to address risks
- support the integration of planning and investment efforts across bush fire management activities.⁵⁰¹

The Inspector General also found that a hectare-based prescribed burning target does not incentivise pursuing alternative forms of risk reduction where and when prescribed burning cannot be conducted.⁵⁰²

4.4.2.3.5 Actions close to what you are trying to protect can help

Available research consistently finds that hazard reduction activities in proximity to houses and towns will be most effective in managing risk to life and property (i.e. within 2-3 km).

⁴⁹⁷ NSW Bushfire Risk Management Research Hub (2020) ‘Estimated risk mitigation from prescribed burning prior to the 2019/20 fire season’.

⁴⁹⁸ Victorian Inspector-General for Emergency Management (2015) Review of performance targets for bushfire fuel management on public land. Retrieved from https://www.igem.vic.gov.au/sites/default/files/embridge_cache/emshare/original/public/2020/04/e8/39acbe947/Reviewofperformancetargetsforbushfirefuelmanagementonpublicland.pdf.

⁴⁹⁹ Ibid., p 4.

⁵⁰⁰ Victorian Safer Together. Understanding Risk. Retrieved from <https://www.safertogether.vic.gov.au/understanding-risk>.

⁵⁰¹ Victorian Inspector-General for Emergency Management (2015). Review of performance targets for bushfire fuel management on public land. Retrieved from https://www.igem.vic.gov.au/sites/default/files/embridge_cache/emshare/original/public/2020/04/e8/39acbe947/Reviewofperformancetargetsforbushfirefuelmanagementonpublicland.pdf.

⁵⁰² Ibid.

Research by Gibbons, van Bommel, Gill, Cary, Driscoll, Bradstock, Knight, Moritz, Stephens and Lindenmayer (2012) on fires from 2009 found that “all fuel treatments were more effective if undertaken closer to houses”.⁵⁰³ It showed that presence of fuels within 40 metres of a house was found to be important in determining whether the house survives and that “15% fewer houses were destroyed if prescribed burning occurred at the observed minimum distance from houses (0.5 km) rather than the observed mean distance from houses (8.5 km)”,⁵⁰⁴ all of which suggests that a focus on intensive fuel treatments close to properties will be more effective than broadscale hazard reduction.

Professor David Bowman argues that fuel management is “most likely to be maximally effective using carefully designed and targeted interventions on the wildland urban interface”.⁵⁰⁵

However, prescribed burning in proximity to houses and communities is more risky and costly than burning in the wider landscape, with associated risks to public health from smoke (see section 4.6 for more on this issue). Therefore, a wide range of fuel reduction techniques needs to be considered for these areas (see section 4.4.2.4.4).

Professor Bradstock explained to the Inquiry that a set of complementary measures should be applied together: clearing and vegetation management close to properties for defensible space, supported by appropriate hazard reduction and effective access trails in the nearby landscape, so that the suppression advantages created by fuel management can be capitalised on.⁵⁰⁶

4.4.2.3.6 We can strategically target high risk areas based on our improving understanding of fire behaviour under extreme conditions

As Professor Ross Bradstock told the 2020 Royal Commission into National Natural Disaster Arrangements, our ability to understand the effectiveness of fuel manipulation in response to extreme fire behaviour is limited.⁵⁰⁷

Available models used to predict fire progression do not yet adequately account for dynamic fire behaviour or for fire/terrain/atmosphere interactions that can lead to rapid escalation and spread of bush fire, so they likely underestimate risk.

However, this understanding is improving, as described in Chapter 2. With emerging research it should be possible to determine where bad fires are more likely to start and spread rapidly (for example, ridges in remote areas) or where they may be more prone to escalate (for example certain ridges, lee slopes susceptible to vorticity-driven lateral spread that might lead to fire-generated thunderstorms, or other windward slopes that burn intensely) and prioritise these areas for fuel treatment. The aim would be to:

⁵⁰³ Gibbons, P, van Bommel, L, Gill, A, Cary, G, Driscoll, D, Bradstock, R, Knight, E, Moritz, M, Stephens, S and Lindenmayer, D (2012) Land Management Practices Associated with House Loss in Wildfires. PLoS ONE 7(1): e29212. doi: [10.1371/journal.pone.0029212](https://doi.org/10.1371/journal.pone.0029212), p1.

⁵⁰⁴ Ibid.

⁵⁰⁵ Professor David Bowman (2020). Royal Commission into National Natural Disaster Arrangements Response to Notice to Give 29 April 2020. Retrieved from <https://naturaldisaster.royalcommission.gov.au/system/files/exhibit/PDB.500.001.0002.pdf>.

⁵⁰⁶ Professor Ross Bradstock. *Advice to the Inquiry provided 21 July 2020*.

⁵⁰⁷ Professor Bradstock Royal Commission into National Natural Disaster Arrangements. Transcript Hearing Block 2 – Tuesday 16 June 2020. Retrieved from <https://naturaldisaster.royalcommission.gov.au/publications/transcript-hearing-block-2-tuesday-16-june-2020>.

- give firefighters more time to get there (i.e. slow the initial spread and hopefully get to the fire before it gets too big to suppress)
- reduce the risk of dynamic, extreme fire behaviours that we know are associated with damage and risk to firefighters and the community.

4.4.2.3.7 What does this all mean for hazard reduction planning and prioritisation in NSW?

Overall, the framework in place for hazard reduction planning in NSW has a sound foundation in that it:

- enables planning at a local/regional scale through multi-agency committees to coordinate across tenures
- aims to take a risk-based approach based on the particular landscapes, assets and risks in each region
- prioritises activities closer to assets (Asset Protection Zones and Strategic Fire Advantage Zones).

The 2013 Independent Hazard Reduction Audit Panel (2013) reached similar conclusions, stating that the multi-agency, tenure-blind approach enabled by local Bush Fire Management Committees was considered to be best practice in Australia, and that the prioritisation of treatments of Asset Protection and Strategic Fire Advantage Zones, along with appropriate maintenance of yards and gardens close to buildings, “provides a highly cost-effective means of reducing risk to people and property”.⁵⁰⁸

However, Government should ensure that this model is being rigorously and consistently implemented at a high level of quality across NSW, and that communities are closely involved with the planning processes. Also, it is more appropriate for any hazard reduction targets to be set at a regional level, based on a quantitative assessment of risk and the level of risk reduction to be achieved through hazard reduction works. This should also include provision for re-prioritisation and reallocation of resources subject to ongoing assessment of risk.

Both NSW RFS and NPWS have told the Inquiry that current modelling and systems do not yet enable a quantification of risk, and therefore do not allow quantification of a residual risk profile as a result of proposed hazard reduction works. However, the Inquiry is advised that a new model is under development for Bush Fire Risk Management Planning, and that this will soon be possible. Importantly, this is intended to incorporate improved data to quantify risk and provide decision support to BFMCS when developing and designing treatment strategies.⁵⁰⁹

However, Professor Bradstock explained that methods for quantifying risk and the likely change in level of risk as a result of alternative risk management options, as well as how this varies according to the configuration of developments, infrastructure and ecosystems across NSW, are available to be used now.⁵¹⁰ The Inquiry recommends that this work to refresh and update hazard reduction planning and methodologies in NSW should be prioritised. Further,

⁵⁰⁸ Independent Hazard Reduction Audit Panel. (2013). Enhancing Hazard Reduction in NSW Report. Retrieved from <https://www.emergency.nsw.gov.au/Documents/publications/independent-hazard-reduction-audit-panel-report.pdf>.

⁵⁰⁹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 1 June 2020*.

⁵¹⁰ Professor Ross Bradstock. *Advice to the Inquiry provided 21 July 2020*.

the methodologies and frameworks should be formally reviewed every three years to ensure the best available research is informing the risk reduction approach.

Also, the objectives of hazard reduction activities and the level of risk reduction to be achieved in each region should be very clearly communicated to the community. There is a clear need for better communication about the risks and priorities, and transparent reporting on what hazard reduction has been implemented, its cost, and the level of risk-reduction achieved. This methodology should also provide for the development of and reporting against ecological objectives. NPWS advised the Inquiry that it is planning further work to develop metrics for evaluating the impact of different fire outcomes on the ecological health of national parks, but such metrics could be applied across the landscape.

Prioritisation of hazard reduction works should also take account of the latest research into extreme fire behaviour so that, beyond the local level priorities for hazard reduction in proximity to assets, hazard reduction in the broader landscape is targeted towards areas that can help to prevent the ignition or escalation of bush fires into extreme fires.

Communities should also have a more significant role in the planning, prioritisation and implementation of local hazard reduction. Hazard reduction strategies should be place-based and local, and need greater buy-in from affected communities. Everyone needs the opportunity to contribute to priorities and to understand what activities are being undertaken, why and at what cost, and have a clear understanding of the overall risk even after hazard reduction activities are implemented.

Mr Justin Leonard (CSIRO),⁵¹¹ told the Inquiry that collaborative, community-led preparation and adaptation at the local level to address local bush fire hazards will be increasingly important. Models in the US support this concept, for example, the US Forest Service talks about ‘fire adapted communities’ – a term and concept that the Inquiry thinks should become common in Australia.⁵¹²

Recommendation 19: That Government re-commit to the current, regionally based approach to planning and coordinating hazard reduction activities across all tenures through Bush Fire Management Committees but ensure that it is actually being implemented at a high-level of quality across NSW. Getting it to a high-level of quality requires:

- a) implementing the Inquiry’s recommendation about performance auditing of Bush Fire Risk Management Plans
- b) prioritising implementation of revised processes for bush fire risk management planning that incorporate new modelling and methods for quantifying risk and the residual risk profile as a result of proposed hazard reduction works
- c) ensuring regional priorities for hazard reduction, and how they are determined, are communicated clearly to the community, and their implementation is reported on transparently. This will include being very clear about the objectives of hazard reduction activities and communicating that hazard reduction does not eliminate the risk of fire affecting properties
- d) the methodology for assessing and planning for risk reduction becomes an ongoing area of research and the frameworks are formally reviewed every three years.

⁵¹¹ Meeting with CSIRO on 15 May 2020.

⁵¹² U.S. Forest Service, United States Department of Agriculture. ‘Fire Adapted Communities’. Retrieved from <https://www.fs.usda.gov/managing-land/fire/fac>.

4.4.2.4 We need to know more about hazard reduction techniques and practices on the ground (technique and implementation)

Strategic targeting of hazard reduction activities to areas of greatest risk needs further attention as does the level of quality and technique used for executing these activities. As Professor David Bowman told the Royal Commission, it is important that we “should be treating all of our fuel management approaches as giant experiments that we’re still evaluating”.⁵¹³

4.4.2.4.1 There are increasingly limited windows for prescribed burning

The NSW RFS advised the Inquiry that it is operating under the assumption that windows for conducting hazard reduction burns may be decreasing, and the conditions are becoming more complicated to manage. Due to the dry autumn and spring, the bush fire danger period commenced earlier in July 2019 in many areas. Drought conditions make hazard reduction difficult, as the dryness of the fuel increases the risk of hazard reduction burns.⁵¹⁴ Research is also indicating that the hazard reduction window may be shifting more towards winter, away from the typically used window of autumn and early spring.⁵¹⁵

NSW RFS provides assistance to land managers across the State to undertake hazard reduction works, particularly on Crown land, local government land and for private landowners.⁵¹⁶ NSW RFS has advised that its members predominantly do prescribed burning on weekends, comprising 90% of their burning activities. It estimates that, if weekend burning rates were expanded to cover the entire week, the number of burns could increase potentially by around 50%.⁵¹⁷

On 31 May 2020, the Government announced a \$10.7 million commitment to enhance mitigation crews for 12 months, creating 100 jobs across 25 crews. The commitment supports and supplements volunteers by increasing capacity to undertake mid-week hazard reduction burning.

The Inquiry commends this initiative and recommends that it should be expanded and continued beyond 12 months so that hazard reduction activities can be undertaken when conditions are optimal (throughout the week and potentially at night).

The Government has also committed funding for 12 months for 125 additional NPWS field officers, some of whom will support targeted hazard reduction activities.⁵¹⁸

⁵¹³ Professor David Bowman – Royal Commission into National Natural Disaster Arrangements. Transcript Hearing Block 2 – Tuesday 16 June 2020. Retrieved from <https://naturaldisaster.royalcommission.gov.au/publications/transcript-hearing-block-2-tuesday-16-june-2020>.

⁵¹⁴ RFS (Rural Fire Service). (2020). *Advice to the Inquiry provided 1 June 2020*.

⁵¹⁵ Di Virgilio, G, Evans, J, Clarke, H, Sharples, J, Hirsch, A, & Hart, M. (2020). Climate change significantly alters future wildfire mitigation opportunities in southeastern Australia. *Geophysical Research Letters*, 47, e2020GL088893. doi: 10.1029/2020GL088893.

⁵¹⁶ RFS (Rural Fire Service). (2020). *Advice to the Inquiry provided 1 June 2020*.

⁵¹⁷ Ibid.

⁵¹⁸ Minister for Energy and the Environment (2020). Firefighter Funding Boost for Next Fire Season. Retrieved from <https://www.environment.nsw.gov.au/news/firefighter-funding-boost-for-next-fire-season#:~:text=NSW%20is%20set%20to%20benefit,the%20next%20fire%20season%20hits>.

4.4.2.4.2 Prescribed burning techniques need attention and further research

Professor David Bowman told the Royal Commission, in two separate statements, that:

- *further research and evaluation are required to understand optimal designs of burning to both reduce hazard but sustain biodiversity ...*⁵¹⁹
- *continuous monitoring, collection of data, data analysis and evaluation are essential to understand the cost benefit trade-offs of prescribed burning in terms of economics, biodiversity and human health*⁵²⁰
- *inappropriate management could drive a system to become more combustible*⁵²¹

There are differing views about how much vegetation should be burnt and how frequently. Conflicting evidence was presented to the Inquiry:

- some argued that cycles of hazard reduction burning are making landscapes more flammable, and that mature forests are less flammable but they are not being allowed to get to that stage⁵²²
- others argued that landscapes need more fire than we are giving them based on current guidance thresholds.

Some stakeholders, including cultural burning practitioners, argue that hazard reduction burns are too hot for the landscape, and over time actually increase forest flammability by preferencing particular plant species.⁵²³ Others argue that current techniques do not always remove enough fuel or are 'incomplete' burns that are ineffective.

We also need to understand better the thresholds that, when breached, render previous fuel treatment ineffective (i.e. fuel moisture thresholds), as well as how thresholds in the completeness of fuel removal influences effectiveness.

Professor Bowman articulated an important point to the Royal Commission, explaining that the spatial pattern of prescribed fires is a critical issue that may not receive enough attention. He pointed out that the ecological impacts of numerous small fires are different to a single large fire of the same total size, because a fragmented burning pattern will create unburnt refugia for plants and animals. He stated that it has been shown through simulations that small, overlapping patches can maximise reductions in the rate of fire spread, but there has not been much empirical research about this.⁵²⁴

He further explains that many people suggest that prescribed burning is about restoring Aboriginal patterns of fire management, but he suggests that this is rarely the case given the different methods employed, with traditional Aboriginal land management characterised by

⁵¹⁹ Professor David Bowman (2020). Royal Commission into National Natural Disaster Arrangements Response to Notice to Give 29 April 2020. Retrieved from <https://naturaldisaster.royalcommission.gov.au/system/files/exhibit/PDB.500.001.0002.pdf>.

⁵²⁰ Ibid.

⁵²¹ Professor David Bowman, Royal Commission into National Natural Disaster Arrangements. Transcript Hearing Block 2 – Tuesday 16 June 2020. Retrieved from <https://naturaldisaster.royalcommission.gov.au/publications/transcript-hearing-block-2-tuesday-16-june-2020>.

⁵²² For example, Professor Philip Zylstra, Submission to the Inquiry.

⁵²³ Firesticks Alliance Indigenous Corporation, Submission to the Inquiry.

⁵²⁴ Professor David Bowman (2020). Royal Commission into National Natural Disaster Arrangements Response to Notice to Give 29 April 2020. Retrieved from <https://naturaldisaster.royalcommission.gov.au/system/files/exhibit/PDB.500.001.0002.pdf>.

highly patchy landscape burning, whereas what he calls ‘ industrial’ prescribed burning typically treats large blocks of the landscape, creating a coarse mosaic.

The Inquiry supports Professor Bowman’s view that we need to improve the understanding of both the ecological and bush fire mitigation benefits of different scales and configurations of patchy burning, and this is best achieved through landscape scale prescribed fire experiments, further simulation experiments and a commitment to adaptive management.

4.4.2.4.3 *There are some serious cost benefit questions to be grappled with*

Hazard reduction burning also has broader costs to the community, in particular, from the public health impacts of smoke. As discussed in section 4.6.2, research in Western Australia has shown that in a comparison of hazard reduction burning and bush fire, the estimated health-related costs of hazard reduction burning were in many years higher than those attributable to bush fire.⁵²⁵ A better understanding of the full health impacts of these types of fires is required so that it can be incorporated into appropriate control strategies.

4.4.2.4.4 *Prescribed burning is not the only option*

Hazard reduction activities need to encompass the full mix of tools and techniques – and avoid defaulting to burning being the only or best option. More research is needed to understand better the cost versus benefit and effectiveness of different fuel reduction techniques and practices in different circumstances and, again, this may require large-scale trials of different approaches.

Particularly close to settlements, fuel reduction methods that do not rely on burning will become increasingly important, including mechanical methods such as slashing, mowing etc.

A downside of these approaches is that they produce a great deal of green waste which needs to be disposed of efficiently. The Inquiry suggests that consideration be given to turning this into biofuels or bioenergy through a network of small, distributed processing plants, in such a way as to make the disposal task as easy as possible for landholders and other land managers while at the same time producing something useful. Making bioenergy/biofuel systems work from commercial and environmental perspectives has been challenging in Australia to date but the combination of public policy and commercial imperatives might make them viable in this case.

Some submissions to the Inquiry identified biomass recycling as an alternative to current fire and forest management practices.⁵²⁶ They called for green waste and biomass produced by mechanical hazard reduction and in the management of forest plantations and national parks to be recycled and used for energy or for other beneficial by-products.⁵²⁷

The Inquiry acknowledges the potential for bioenergy and biofuels to be given greater consideration as a useful by-product of sustainable fire and land management practices, and notes NSW Government’s proposed development of a 20-Year Waste Strategy and the

⁵²⁵ Borchers Arriagada, N, Palmer, A, Bowman, D & Johnston, F. (2020, 20 April) Exceedances of national air quality standards for particulate matter in Western Australia: sources and health-related impacts, *The Medical Journal of Australia*. doi: 10.5694/mja2.50547.

⁵²⁶ For example, Arnold McLean, Baden Cameron, Ralph Rabbidge, Submissions to the Inquiry.

⁵²⁷ Ibid.

release earlier this year of an issues paper, *Cleaning Up Our Act: The Future for Waste and Resource Recovery in NSW*, which closed for public consultation in May 2020.⁵²⁸

The Inquiry suggests that the 20-Year Waste Strategy should contain recommendations about energy from waste technologies, including green waste generated by fire and land management practices to reduce bush fire risk. Further, the Strategy should consider how to optimise green waste outcomes in both metropolitan and regional areas of NSW. This could include a regional hub-and-spoke model for waste and resource recovery. The Inquiry considers that there is scope for local councils to engage more in green waste management and this too should be captured in the Strategy.

A number of submissions and comments to the Inquiry suggested that grazing should be used in national parks to reduce fuel loads, with some claiming that fuel loads were better managed when grazing was allowed than they are now.

Currently grazing is allowed as a licensed activity on some Crown land, and 360,000 hectares of the Forestry Corporation estate is available for grazing. In national parks, grazing is permitted in a small number of specific locations (three sites currently) where it is used as a conservation tool, consistent with the objectives of the *National Parks and Wildlife Act 1974*, and in some river red gum and south west cypress parks and reserves as a transitional existing use right.

However, grazing has limited application as a fuel reduction technique. As noted by NSW RFS, while:

*grazing may be used to reduce the grass and shrub layer, which assists with risk management ... it does not address other fuel sources, such as suspended fuel and bark. Grazing is predominantly used for agricultural reasons, with risk mitigation as a secondary purpose or as a consequence.*⁵²⁹

Forestry Corporation reports that it uses grazing as a fuel management tool in white cypress and river red gum forests as these are sensitive to prescribed burning.⁵³⁰

Animals can alter the amount, structure or condition of fuel.⁵³¹ Professor Ross Bradstock informed the Royal Commission that domestic stock, such as cattle and sheep, predominantly consume grasses and herbs and not litter fuels such as dead leaves and twigs from woody plants.⁵³² Professor Bradstock summarised the available evidence which indicates that typical grazing practices have limited potential to alter fuel loads in native forests in ways that will significantly alter bush fire behaviour across the landscape.⁵³³

⁵²⁸Department of Planning, Industry and Environment (2020, March). *Cleaning Up Our Act: The Future for Waste and Resource Recovery in NSW, Issues Paper*. Retrieved from <https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.nswdpi-your-say.files/7515/8501/6285/19p2036-cleaning-up-our-act-20yr-waste-strategy.pdf>.

⁵²⁹RFS (NSW Rural Fire Service). (2020) *Advice to the Inquiry provided 22 June 2020*.

⁵³⁰FCNSW (Forestry Corporation of NSW). (2020). *Advice to the Inquiry provided 22 July 2020*.

⁵³¹Foster C, Banks, S, Cary, G, Johnson, C, Lindenmayer, D, & Valentine, L (2020). Animals as Agents in Fire Regimes. *Trends in Ecology and Evolution*, 35(4), 346-356 : doi 10.1016/j.tree.2020.01.002.

⁵³²Professor Ross Bradstock. (2020). Requested Submission to the Royal Commission into National Natural Disaster Arrangements. Retrieved from <https://naturaldisaster.royalcommission.gov.au/system/files/exhibit/PRB.500.001.0014.pdf>.

⁵³³ Ibid.

Further, a study in semi-arid woodlands indicates that livestock grazing these systems “will not achieve practical reductions in biomass and or fuel hazard”.⁵³⁴

The Inquiry was also referred to studies which showed that grazing can have adverse ecological outcomes such as increased soil compaction and erosion and accelerate weed invasions.⁵³⁵

However, Professor Bradstock explains that grazing might play a role in fuel reduction in more agricultural areas such as paddocks around buildings and infrastructure to provide defensible space.⁵³⁶ Better understanding the potential effectiveness of grazing as a fuel reduction technique in particular circumstances, especially in proximity to assets, should be the subject of further research.

In summary, knowledge in this area is incomplete – especially with respect to how the landscape will respond in extreme weather conditions – and some traditional assumptions about the best approaches to fuel reduction need to be challenged. This needs to be an area of urgent and continuous research, and hazard reduction programs must be continuously evaluated so that approaches can be adapted in response to improved knowledge.

Recommendation 20: That Government, noting that hazard reduction targeted in proximity to assets is on balance more likely to provide help than hinder, should:

- a) support local councils and partner agencies to implement more comprehensive hazard reduction at a local level around towns/cities, communities and local infrastructure assets, and provide incentives for communities to organise themselves to prioritise and implement local hazard reduction initiatives. This will involve a suite of hazard reduction techniques depending on the landscape including prescribed burning, clearing, mowing, and mechanical treatments, and easy disposal of green waste into processors turning it into bioenergy or biofuels
- b) beyond the local level priorities for hazard reduction, prioritise prescribed burning in parts of the landscape where fuel treatment may help reduce probability of fires escalating quickly and where terrain and potential atmospheric interactions are likely to escalate fires into fire-generated thunderstorms. This will likely involve a proactive program of treating ridge tops that are prone to dry lightning where reduced fuels may help reduce speed of spread when the fire first starts, or particular windward or lee-slopes that are susceptible to generating extreme fire behaviour and drive fire towards towns.

Recommendation 21: That, in order to improve understanding of optimal hazard reduction techniques and their application in the landscape:

- a) Government extend the recently introduced program of mitigation crews so that hazard reduction activities can be undertaken when conditions are optimal (throughout the week and potentially at night)
- b) all fire authorities review prescribed burning techniques and their implementation, and commission further research into optimal prescribed burning regimes and techniques.

⁵³⁴ Travers, S, Eldridge, D, Koen, T, Val, J, & Oliver, I (2020) Livestock and Kangaroo grazing have little effect on biomass and fuel hazard in semi-arid woodlands' *Forest Ecology and Management* 467: doi: 10.1016/j.foreco.2020.118165.

⁵³⁵ NPWS (National Parks and Wildlife Services). (2020). *Advice to the Inquiry provided 8 May 2020*.

⁵³⁶ Professor Ross Bradstock. (2020). Requested Submission to the Royal Commission into National Natural Disaster Arrangements. Retrieved from <https://naturaldisaster.royalcommission.gov.au/system/files/exhibit/PRB.500.001.0014.pdf>.

- This should include research to understand critical thresholds that, when breached, may render fuel treatment ineffective (i.e. fuel moisture thresholds), and the short, medium and long-term outcomes of hazard reduction burning regimes
- c) Government commission research into a range of other hazard reduction techniques to understand better the cost versus benefit and effectiveness of different practices in various circumstances, including grazing.

4.4.2.5 Using technology to monitor

To mitigate against bush fire events and to assist with the identification of at-risk areas, it is necessary to understand the spatial extent of fires across landscapes as well as relevant environmental and vegetation indices, such as fuel loads and moisture.⁵³⁷ This intelligence can be used to support operational decision making, including decisions about hazard reduction activities and techniques.⁵³⁸

Fire and land management agencies alike described to the Inquiry their use of remote sensing technologies for this purpose. Chapter 2 of this report explores in greater detail the current uses of this sensing technology, its limitations and the opportunities to increase its use in fire management more broadly.

Particularly relevant to monitoring hazard reduction activities better is the work of the NSW Department of Planning, Industry and Environment's (DPIE) Remote Sensing Team, in collaboration with NSW RFS, to design and implement the Fire Extent and Severity Project (FESM) project.⁵³⁹

For the purposes of supporting hazard reduction techniques and activities, the FESM work could be used to monitor the implementation of prescribed burning and allow fire and land management agencies to see how much fuel actually burns and at what severity.

Current use of remote sensing and picture processing technologies could also be extended to identify and monitor land use more comprehensively. This should include how well Asset Protection Zones and defendable space are being maintained at a landscape scale. Such automated intelligence would allow for the implementation of a compliance regime based on early detection and the prioritisation of high-risk areas for treatment, such as exposed peri-urban areas.

Recommendation 22: That, as part of the spatial technology acceleration program, Government support deployment of remote sensing and picture processing technologies to monitor and audit how well Asset Protection Zones and defendable space are being maintained, especially around towns.

⁵³⁷ Meeting with Department of Planning, Industry and Environment on 29 June 2020 and Nolan, R, Blackman, C, Resco de Dios, V, Choat, B, Medlyn, B, Li, X, Bradstock, R, Boer M (2020). Linking forest flammability and plant vulnerability to drought. *Forests*, 11, 779; doi:10.3390/f110707.

⁵³⁸ Australian Space Agency. (In preparation) Bushfire Earth Observation Taskforce Report 2020. Draft to the Inquiry provided 18 May 2020, p 7.

⁵³⁹ Meeting with DPIE (Department of Planning, Industry and Environment) on 29 June 2020 and RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 8 July 2020*.

4.4.2.6 The community feels that public land managers do not manage fuel hazard well and are not good neighbours

Despite the increase in prescribed burning in NSW described above, there appears to be a strong community perception that public land managers do not do enough to manage fuel loads, especially where public land borders private land.

It is evident that, in many parts of NSW, public land managers have a reputation as ‘bad neighbours’ and that communities have little trust in current land management practices. Community members criticised public land managers as failing to address bush fire hazards on their land, including fuel load management and boundary maintenance.

Many community members expressed the view that NPWS had failed to perform adequate hazard reduction burning and allowed fuel loads to be too high. There was also criticism that NPWS was not undertaking hazard reduction burning because it was captured by a ‘green agenda’.

Among some land holders there was a view that when particular State forests were converted into national parks the management of the areas deteriorated and fuel loads became higher. As stated above, some landowners argued that allowing grazing in national parks would manage fuel loads better and reduce the spread and severity of the fires. Firewood collection, allowed when the land was a State forest, was also suggested as a fuel reduction measure.

There were similar criticisms of the Forestry Corporation and private forestry operations, particularly that leaving woody debris (slash) from after-harvesting activities causes an unreasonable fire risk. This criticism was especially heard from submissions received from the South Coast,⁵⁴⁰ and in the Shoalhaven community meeting. A small number of submissions argued that timber harvesting contributed to drying out the forested areas, and that replacement of old-growth forests with more fire-prone, younger, dense forests increases the bush fire risk.⁵⁴¹ This sentiment was also expressed by some participants in the Far South Coast community meeting.

Crown land and council reserves and roadside verges were also criticised for having high fuel loads, and for the relevant land managers not responding to residents’ requests that they be cleared or prepared for the upcoming bush fire season.

4.4.2.6.1 Bush fire hazard complaints – data for the last five years

There was strong feedback to the Inquiry that many people feel there is ‘no point in complaining as nothing got done’ and that public land managers are not ‘good neighbours’.

The *Rural Fires Act 1997* provides for certain persons to make a complaint when a bush fire hazard exists because of the failure of an owner, occupier or public authority to carry out bush fire hazard reduction work.

NSW RFS told the Inquiry that between 1 July 2015 and 25 March 2020 a total of 2,654 complaints had been upheld – 2,065 about private land and 589 about public land. Letters were sent advising those landowners/managers of the need to undertake bush fire hazard

⁵⁴⁰ For example, Gayle Mildren, Jacqueline Cantle, Dr James Porter, Nick Hopkins, Peter Clark, Phil Mayberry, Robert Thorburn, Sam Newman, Susie Header, Submissions to the Inquiry.

⁵⁴¹ For example, Dr Rosemary Beaumont, Gillianne Tedder, Harriett Swift, Ian Cruickshank, Kerry Davies Submissions to the Inquiry.

reduction. Of the complaints about private land, 430 were not addressed by the landowner, and notices were subsequently issued.⁵⁴²

Under the Act, a complaint about public land⁵⁴³ is to be made directly to the NSW RFS Commissioner. For any other land, a complaint is made to the “local authority of the local government area in which the land is located”, and that local authority must refer any such complaint to the Commissioner within 14 days of receipt.⁵⁴⁴ In both circumstances, the Act gives the Commissioner powers to enforce the reduction of bush fire hazards.⁵⁴⁵

However, the Act does not require information received by a public land manager – for example, a complaint to a local NPWS office about a perceived hazard on national park land – to be forwarded onto the NSW RFS Commissioner.

As stated above, the Inquiry heard many concerns about the management of national parks. Data provided by the NPWS shows that, between 2010-11 and 2018-19 NSW RFS only received an average of 24 complaints per year about NPWS land – approximately 1.3% of all complaints.⁵⁴⁶ However, these statistics may not reflect all bush fire hazard complaints made about land managed by NPWS or other public land managers, because there is no requirement for a complaint made directly to a public land manager to be forwarded to the Commissioner.

NPWS advises that many complaints it receives are about land that is assumed to be national park land, but that further investigation shows is not land managed by it. To date, NPWS’ practice has been to forward complaints it receives to the relevant local office for addressing in accordance with NSW Government customer service guidelines. However, there is no central register of all bush fire hazard complaints received. Recognising the considerable public concern that has emerged following the bush fire season, NPWS has advised the Inquiry that it will establish a central register of all formal bush fire hazard complaints received, along with information about the response and time taken to respond. The register will be in place by the end of August 2020.⁵⁴⁷

The Inquiry’s view is that complaints about all landowners and managers should be treated in the same way, regardless of who the land manager is, and that all complaints must be promptly provided to the RFS Commissioner for action.

Recommendation 23: That Government amend the *Rural Fires Act 1997* so that all public land management agencies be required to forward complaints received about bush fire hazards to the Commissioner of the NSW RFS. As an interim measure, heads of agencies should commence this practice immediately.

⁵⁴² RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 22 April 2020*.

⁵⁴³ That is, “unoccupied Crown land or managed land for which a public authority is responsible”: s.74C(1)(a).

⁵⁴⁴ S.74C(1)(b) and (3) of the *Rural Fires Act 1997*.

⁵⁴⁵ Division 2 of the *Rural Fires Act 1997*.

⁵⁴⁶ NPWS advised that this figure is derived from data sourced from the NSW RFS BRIMS database as at 7 February 2020. NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 7 July 2020*.

⁵⁴⁷ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 7 July 2020*.

4.4.2.6.2 Public land managers should be the best neighbours

Almost 90,000 kilometres of boundary fencing was damaged during the season.⁵⁴⁸ The Inquiry recognises the recent Government commitment of \$209 million to help bush fire affected landholders with the cost of rebuilding boundary fences adjoining private land.⁵⁴⁹ The Inquiry also recognises the long-standing NPWS policy to contribute to boundary fencing through the supply of materials, as set out in the NPWS *Boundary Fencing Policy*, which also includes a provision for similar provisions in natural disasters. However, these programs have fallen short, and are likely to keep falling short, of addressing community expectations of public landholders unless actions are undertaken to improve government as a good neighbour.

There is a clear need to develop a shared understanding of what it means to be a good neighbour, regardless of land tenure. To do this, the following needs to be developed:

- agreed expectations
- good relationships
- transparency about decision making from Government
- mutual understanding about priorities
- mutual understanding and agreement about obligations.

In practice, this could involve establishing ongoing, two-way and transparent communication about land management activities and decisions taken to prepare for the upcoming fire season to minimise bush fire risk. This could include details of:

- hazard reduction burning undertaken and proposed access track and APZ maintenance
- pest and weed control activities
- and providing private landowners who have boundaries with public land with a local contact within the responsible agency with appropriate authority to make decisions about fire management activities which may affect private property.

Recommendation 24: That government agencies managing land (at all levels and through all agencies) be the best neighbours possible by considering their neighbours when undertaking activities related to bush fire preparation and having clear, two-way communication about these activities, with the aspiration that government landholders will be seen as highly desirable neighbours.

4.4.2.7 Hazard reduction on private land

In preparing for fire seasons generally, community feedback suggested government could also do more to facilitate private property maintenance. There was criticism about a lack of government enforcement to ensure private property compliance with fire preparedness and maintenance. Residents expressed frustration that neighbours who failed to undertake necessary action to protect themselves and others were not held responsible for their own or the broader community's safety.

Bureaucracy, 'red tape' and 'green tape' were blamed for many hazard reduction activities not being undertaken on private property, such as hazard reduction burns and clearing. The

⁵⁴⁸ Agriculture and Animal Services Functional Area Coordinator 20 July 2020. *Advice to the Inquiry provided 20 July 2020*.

⁵⁴⁹ Local Land Services (2020). Supporting Our Neighbours – Public Land Boundary Fencing Program. Retrieved from <https://www.lls.nsw.gov.au/what-we-do/our-major-projects/supporting-our-neighbours-public-land-boundary-fencing-program>.

Inquiry was told of some occasions when landholders performed these activities anyway and credited the actions with saving the properties; in other cases, landholders who did not perform the activities they thought necessary were of the view that this lack of action resulted in the loss of properties. Some landowners told the Inquiry they were fearful of fines and legal action if they took action to protect their properties when their requests for immediate permission to clear vegetation were not immediately granted. This led to some landholders blaming the permission pathways and costs as the reason for property, stock and business losses.

All landholders have the responsibility to manage bush fire hazards on their property. However, some hazard reduction activities require approvals.

There are three main pathways for hazard reduction activities on private land:

1. the 10/50 vegetation clearing scheme, which enables clearing close to houses without approvals
2. hazard reduction certificates where the NSW RFS facilitates environmental approvals for hazard reduction activities, if required, in accordance with the Bush fire Environmental Assessment Code
3. fire permits that are issued by NSW RFS, depending on the time of year.

4.4.2.7.1 10/50 Vegetation Clearing Scheme

This scheme enables people in a designated area to:

- clear trees on their property within 10 metres of a home
- clear underlying vegetation such as shrubs (but not trees) on their property within 50 metres of a home

—without seeking environmental approval.⁵⁵⁰

The scheme applies to people living in a 10/50 Vegetation Clearing Entitlement Area (which can be determined using an online tool) and is supported by a 10/50 Vegetation Clearing Code of Practice.⁵⁵¹

Whilst the 10/50 Scheme provides a relatively simple methodology for clearing vegetation close to homes, the Inquiry heard that:

- many question the effectiveness of the scheme, given that many properties cleared in accordance with the scheme were still affected by the fires
- residents may abuse the scheme by carrying out excessive vegetation clearing, including damaging endangered ecological communities which should be approved under other legislation
- some people are concerned that the cumulative impacts on vegetation across an area are not fully appreciated when the scheme is applied.

4.4.2.7.2 Hazard reduction certificates

The Act also provides for the NSW RFS to issue Bush Fire Hazard Reduction Certificates for burning or vegetation clearance that is specifically for bush fire hazard reduction

⁵⁵⁰ RFS (NSW Rural Fire Service). 10/50 vegetation clearing. Retrieved from <https://www.rfs.nsw.gov.au/plan-and-prepare/1050-vegetation-clearing>.

⁵⁵¹ Ibid.

purposes.⁵⁵² These are intended as “a single approval process for planned hazard reduction works”.⁵⁵³

Issuing of the certificate depends on the following considerations:

- areas of significance such as coastal wetlands, littoral rainforests and critical habitat
- smoke management
- protection of creeks, rivers and wetlands
- soil erosion
- flora, fauna, biodiversity
- Aboriginal cultural heritage
- vegetation clearing.⁵⁵⁴

As noted in the instructions for applying for a Hazard Reduction Certificate,⁵⁵⁵ if an original Development Application provided for an APZ or other hazard reduction activity, a Certificate is not required. Certificates are also not required for agricultural activities that do not require approvals (for example, stubble burning).

4.4.2.7.3 Fire permits

Fire permits are required during the Bush Fire Danger Period, or all year around if the burn is likely to put a building at risk. The aim of the permit is to ensure fires are managed safely, and a permit may impose conditions on the way a fire is lit and maintained.⁵⁵⁶ The Fire Permit is about using fire safely, and does not override any other legislation or provide environmental approvals which may be required depending on the reason for burning.⁵⁵⁷

The Bush Fire Danger Period is legislated as 1 October-31 March but, as mentioned in Chapter 3, these dates can be varied by the NSW RFS Commissioner – and in 2019-20 the Bush Fire Danger Period in 21 local government areas began in August. The Inquiry heard that this reduced time to apply, coupled with what is seen as a cumbersome and time-consuming process, meant that many landholders did not apply.

Fire permits do not allow burning when a total fire ban order is in force.⁵⁵⁸ Further, the Inquiry was told that in a number of areas, the issue of Fire Permits was suspended due to the underlying dry conditions and the susceptibility of fire to escape.⁵⁵⁹ Table 4-1 shows the number of fire permits issues over the last five years. These figures indicate that only a relatively small proportion are not approved.

If a fire permit is granted, landowners are required to provide a minimum of 24 hours' notice (or as specified in the Fire Permit) to the local fire authority (NSW RFS or Fire & Rescue NSW), and all adjoining landowners (or occupiers).⁵⁶⁰

⁵⁵² Section 100F, *Rural Fires Act 1997*.

⁵⁵³ RFS (NSW Rural Fire Service). Application Instructions for a bush fire hazard reduction certificate. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0009/13320/Application-Instructions-Bush-Fire-Hazard-Reduction-Certificate.pdf.

⁵⁵⁴ Ibid.

⁵⁵⁵ Ibid.

⁵⁵⁶ RFS (NSW Rural Fire Service). Before you light that fire. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0013/12451/BeforeYouLightThatFire.pdf.

⁵⁵⁷ Ibid.

⁵⁵⁸ Section 90, *Rural Fires Act 1997*.

⁵⁵⁹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 4 May 2020*.

⁵⁶⁰ RFS (NSW Rural Fire Service). Before you light that fire. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0013/12451/BeforeYouLightThatFire.pdf.

In the NSW RFS, a Fire Permit is issued locally by an authorised Permit Issuing Officer. This role can be delegated to either staff or volunteers, with volunteers generally only issuing permits for their own brigade area. The current system of application is a manual process with the application lodged at a NSW RFS District Office. The paperwork is entered into the BRIMS system (Bush Fire Risk Information Management System), which also captures Hazard Reduction Certificates. BRIMS is approximately 15 years old and no longer meets the requirements of the NSW RFS. The permit remains in force for a period specified on the permit (not exceeding 21 days).

NSW RFS told the Inquiry that upgrading the NSW RFS system from BRIMS to 'Guardian' will allow for the application, issuing, cancelling or suspension of fire permits to be made online, which should make the process more efficient. However, the Inquiry understands that this upgrade is not included in Phase One, but that future phases of Guardian will also encompass the management of Hazard Reduction Certificates.

Year	Active Permits	Cancelled/Denied/ Deleted Permits	Agricultural Permits
2015-16	25,293	637	170
2016-17	24,107	405	211
2017-18	20,881	299	349
2018-19	24,192	458	376
2019-20	13,036	221	170

Table 4-1: Permits issued between 2015-16 and 2019-20.⁵⁶¹

4.4.2.7.4 Expanding local knowledge about the processes

While there are processes in place to enable private landholders to undertake hazard reduction – including burning and clearing – there appears to be a need to expand the mechanisms for working with private landholders to ensure everyone understands the approval processes and why they are necessary.

In Chapter 3, the Inquiry noted the success of the Hotspots community engagement program that aims to give landholders the knowledge and skills to develop fire management plans and conduct burns. This type of collaborative community engagement activity, which also has direct bush fire risk management outcomes, should be further invested in as a mechanism for addressing the concern and confusion that is evident to the Inquiry about the approval processes for hazard reduction. As explained in Chapter 3, the Inquiry recommends that Hotspots, along with other community engagement programs, be evaluated with a view to expanding the support provided to private landholders to prepare their properties.

Further comment on some additional issues raised with the Inquiry about vegetation clearing outside of these pathways is made in section 4.4.4 in the context of the planning system.

4.4.2.7.5 Illegal or careless fires

The NSW RFS advised the Inquiry⁵⁶² that from 1 July 2015 to 31 March 2020 8,713 incidents were recorded as illegal and careless fires. The recorded causes were: burning off (illegal); escaped hazard reduction; escaped permit burn; and escaped pile burn.

⁵⁶¹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 4 May 2020*.

⁵⁶² Ibid.

This has resulted in police referral/action (60), Penalty Notices (114), warning/caution letter (2,762), or a note of 'exceptional circumstances' (3,435).⁵⁶³

In 2018 the NSW RFS created the Fire Investigation and Compliance Unit, that included the recruitment of an analyst to examine data/trends within Districts to assist members. In 2019, workshops were conducted in Districts that have recorded high numbers of legal process incidents, to explain policies and procedures regarding legal process. The Inquiry supports these ongoing workshops, coupled with education on new policies, service standards and reference materials to assist Districts.⁵⁶⁴

4.4.3 Traditional Aboriginal land management

Key points

- There have been widespread calls for Aboriginal cultural fire practices to be employed in hazard reduction.
- The Inquiry heard that cultural burning is one component of a broader practice of traditional land management and does not necessarily have fuel reduction as its primary objective.
- The Inquiry heard that cultural burning is about caring for country and maintaining healthy and ecologically diverse and productive landscapes. It is also about practising cultural traditions.
- It is important that this principle is used by Government, and that wider implementation of Aboriginal land management practices is by Aboriginal people, supported by Government agencies.

The Terms of Reference ask the Inquiry to make recommendations on land use planning and management, including any appropriate use of Indigenous practices.

This is an important topic which goes beyond planning and preparation for bush fires. It is also about the ability of Aboriginal people to practice cultural traditions and the role of Aboriginal people in decision making about land management issues more generally.

This section outlines the key issues raised with the Inquiry on this topic and provides recommendations for supporting and increasing the practice of traditional Aboriginal land management.

4.4.3.1 There is widespread support for increasing Aboriginal fire management in NSW

One of the issues most commonly raised with the Inquiry by stakeholders was the use of fire by Aboriginal people to manage the land, with widespread calls for these practices to be more widely used.

⁵⁶³ NSW RFS advised that exceptional circumstances "include insufficient evidence to proceed, incorrect suspected cause entered into ICON, financial hardship, age and personal circumstances or other mitigating circumstances deemed appropriate by District Manager". RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 4 May 2020*.

⁵⁶⁴ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 4 May 2020*.

The Inquiry was referred to several examples where cultural burning is credited with saving property during the 2019-20 season, including around Tabulam, Ulladulla, Bundanon on the Shoalhaven River⁵⁶⁵ and Mangrove Mountain.^{566 567}

Many submissions and attendees at community meetings suggested that governments and land managers need to listen more to and learn from the people who managed the land for tens of thousands of years before British colonisation. It was also argued that removal of Aboriginal people from the landscape through colonisation and the ending of traditional land management, including practices commonly referred to as cultural burning, are part of the reason for the landscape now being more prone to fire.

The Firesticks Alliance told the Inquiry in its submission that:

Genuine Cultural Fire Management is an adaptive management technique developed and practiced over thousands of years by our Aboriginal ancestors. It is a practice which continues today in many parts of Australia. This knowledge and practice has shaped ecosystems and landscapes through reciprocal resource and kinship relationships. These cultural practices must be led by knowledge holders with appropriate Cultural authority for that place to maintain their authenticity and cultural integrity. ...

Genuine Cultural fire management will protect, maintain, heal and enhance ecosystems and cultural values as they have done for thousands of years, while also reducing fuel loads that help to mitigate inappropriate impacts of bush fire in multiple ways. Firstly, all burning reduces fuel loads during the burning process. Cultural burning often involves more patchy, frequent and low intensity fire regimes which may not reduce as much fuel during each fire burn event compared to some hazard reduction, backburning or bush fires. However, over time, the cumulative effect of Cultural burning can lead to longer-term fuel reduction and more resilient ecosystems and communities.

4.4.3.2 Aboriginal fire management is more than hazard reduction

Many community members who attended online meetings and provided submissions to the Inquiry tended to discuss Aboriginal land management and cultural burning as being a form of hazard reduction practice but did not necessarily recognise it as a broader cultural practice of caring for country.

The Inquiry heard very clearly from cultural fire practitioners that cultural burning is one component of a broader practice of traditional land management and does not necessarily have fuel reduction as its primary objective. Though hazard reduction can often be an outcome of cultural burning, the Inquiry heard that, more broadly, cultural burning is about

⁵⁶⁵ Knowles, Rachael. (2020, 10 January) Talk is cheap, time for action: Yuin man promotes traditional fire management practices, *National Indigenous Times*. Retrieved from <https://nit.com.au/talk-is-cheap-time-for-action-yuin-man-promotes-traditional-fire-management-practices/>.

⁵⁶⁶ Archibald-Binge, Ella & Wyman, Rhett. (2020, 6 January) 'It's miraculous': Owners say cultural burning saved their property, *Sydney Morning Herald*. Retrieved from <https://www.smh.com.au/national/nsw/it-s-miraculous-owners-say-cultural-burning-saved-their-property-20200103-p53okc.html>.

⁵⁶⁷ Firesticks Alliance Indigenous Corporation, Submission to Inquiry.

caring for country and maintaining healthy and ecologically diverse and productive landscapes. It is also about practising cultural traditions.

The Inquiry heard a clear message that, despite the widespread support for the practice that has emerged following the bush fires, it is important to ensure that Aboriginal traditions are not co-opted or appropriated by institutions for a narrow set of outcomes, and that the practice of Aboriginal land management needs to maintain cultural integrity and respect cultural authority. For example, the Firesticks Alliance explained in its submission that:

Government agencies, institutions, organisations and individuals must be stopped from applying parts of this knowledge system without following, understanding or respecting the appropriate cultural protocols, Indigenous Cultural Intellectual property and practical methodologies associated with cultural burning. In many cases these bodies have caused damage to communities, the environment and increased fire risks.

In notes provided to the Inquiry, Mick Beltran, Acting Manager of the Blue Mountains Aboriginal Culture and Resource Centre, stated that:

Viewed in the isolation of burning only for the sake of fuel reduction, both Aboriginal burning and non-Aboriginal burning rely simply on a 'prescription' of fire lighting and spread management to achieve that intended goal. It is often said that Aboriginal cultural burning is 'cool' burning: that achievement of a cool burn is achieved by following a prescribed method of ignition and management.

For Aboriginals, fire is part of the heritage and tradition, thus is both cultural and spiritual – incredibly deeply so.

Recommendation 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.

4.4.3.3 There are several barriers to greater use of these practices

In examining this issue, the Inquiry held an online meeting to understand better the barriers and opportunities to the appropriate use of Aboriginal land management and cultural burning practices in NSW. Attendees of the workshop were fire practitioners and researchers who had provided submissions, and representatives from Government agencies that partner with Aboriginal communities: NPWS, Department of Planning, Industry and Environment, NSW RFS, Local Land Services, Forestry Corporation and Aboriginal Affairs.

There are many Aboriginal-led organisations leading a “grass roots revival”⁵⁶⁸ of cultural burning in NSW, and elsewhere. A recent paper⁵⁶⁹ identified 70 documented cultural burning case studies from south-east Australia, which included 42 projects in NSW.

However, during the online meeting, and as reflected in submissions received by the Inquiry, participants explained that current regulatory frameworks and the short-term nature of

⁵⁶⁸ Ibid.

⁵⁶⁹ McKemey, M, Costello, O, Ridges, M, Ens, E, Hunter, J. T, & Reid, N. C. H. (2020). A review of contemporary Indigenous cultural fire management literature in southeast Australia. EcoEvoRxiv. doi:10.32942/osf.io/fvswy.

funding arrangements for cultural burning activities are limiting the application of Aboriginal land management, including cultural burning.

Cultural burning practitioners and researchers highlighted regulatory requirements and approval processes as one of the biggest barriers to Aboriginal land management in NSW. The Inquiry heard that it is challenging to navigate and negotiate the bureaucratic framework in order to conduct cultural burning.

Some fire practitioners informed the Inquiry that there is a perception that Aboriginal people can't or shouldn't conduct burning because they haven't been trained by the NSW RFS. There was a general frustration that while the 'paperwork' can be completed, the reason why burns can't occur often seems to return to training. This links to issues of insurance, liability and Workplace Health and Safety that were also raised as barriers to greater application of cultural burning. These issues need to be worked through collaboratively with Government and cultural fire practitioners.

The Inquiry also heard that it often falls to Aboriginal people, communities and fire practitioners to initiate the engagement with Government agencies, and that because there are a number of different public land managers in NSW, it is resource intensive for practitioners and communities to navigate the different approval processes.

Fire practitioners acknowledged that there have been some good examples of NSW government agencies supporting projects to enable cultural burning, and Local Land Services in particular was acknowledged as investing in and supporting communities in this area. NPWS informed the Inquiry that the Energy, Environment and Science Division of DPIE has supported 16 cultural fire management projects; eight include burns on NPWS managed lands, with the others on Aboriginal land or local government land.

Nevertheless, the Inquiry heard that Aboriginal land management activities in NSW are typically allocated only short term, project-based funding, through processes that often involve lengthy application processes. It is challenging for communities and organisations who implement cultural burning and Aboriginal land management practices to invest in training, education and capacity building without sustained long term funding to build capability, and this ultimately limits the ability to demonstrate outcomes over the long term.

The Inquiry heard that the Department of Planning, Industry and Environment (DPIE), in partnership with NSW Aboriginal Affairs and Regional NSW, has initiated a Cultural Fire Management approach to coordinate cultural fire practices already in place across government agencies better.⁵⁷⁰

DPIE is now working with the NSW Rural Fire Service and other government agencies to develop an Aboriginal community working group, which aims to establish an independent body that:

- preserves the cultural integrity of cultural fire management in NSW
- serves as a single contact point
- works to broaden cultural fire management, and
- establishes policies and protocols to ensure cultural safety principles are embedded.⁵⁷¹

⁵⁷⁰ DPIE (Department of Planning, Industry and Environment). (2020). *Advice to the Inquiry provided 16 July 2020*.

⁵⁷¹ Ibid.

4.4.3.4 Aboriginal land management programs have demonstrated a range of benefits

Aboriginal land management programs that incorporate cultural burning have been shown to result in a wide range of social, environmental, cultural and environmental benefits.

An evaluation of the Commonwealth Indigenous Ranger programs that are funded on nine of the Indigenous Protected Areas (IPAs) in NSW shows significant social return on investment. The social return on investment analysis for the Minyurnai Indigenous Ranger group in NSW found that for every \$1 invested, a \$1.50 social, economic, cultural and environmental value was created for stakeholders involved.⁵⁷²

Currently NSW has 11 Indigenous Protected Areas. There are 18 Indigenous Ranger Groups in NSW but currently only nine Ranger groups are funded in NSW, among a total of 120 ranger groups that is funded nationally.⁵⁷³

It is also important for NSW to look to and learn from the successful models in the Northern Territory and Far North Queensland where the practice is more widely adopted and supported than in NSW, with due regard to the different landscapes, vegetation-types and settlement and land use patterns in those parts of Australia.

The Victorian Traditional Owner Cultural Fire Strategy released in 2019⁵⁷⁴ has an overall purpose to “reinvigorate cultural fire through Traditional Owner led practices across all types of Country and land tenure; enabling Traditional Owners to heal Country and fulfil their rights and obligations to care for Country”. It also recognises that a period of transition is needed to ensure better alignment of current fire management practices in Victoria and cultural burning, noting the complex regulatory and operational environment of contemporary fire management.

The strategy also identifies a range of actions which are equally applicable in NSW including, for example (p.17):

- identify, establish and grow key partnerships with fire agencies and land managers
- identify pilots over the next five years to showcase and test different institutional arrangements that enable Traditional Owners to lead practice and develop proof of concept on different Countries
- identify regulatory barriers to practicing cultural burning and workshop and trial methods of removing these barriers in partnership with relevant agencies and stakeholders
- monitor and evaluate the process of resetting and healing in different types of Country through cultural burning.

In summary, as explained in Chapter 2, the size and severity of the 2019-20 fire season provides a huge amount of data and information that requires careful examination, and potentially means revisiting some long-held assumptions about what works and what doesn't.

⁵⁷² SVA Consulting for Department of the Prime Minister & Cabinet. (2016). Social Return on Investment analysis of the Minyurnai Indigenous Protected Area. Retrieved from <https://www.socialventures.com.au/assets/Minyurnai-SROI-Report.pdf>.

⁵⁷³ NSW Aboriginal Affairs. (2020). *Advice to the Inquiry provided 10 June 2020*.

⁵⁷⁴ The Victorian Traditional Owner Cultural Fire Knowledge Group. (2019). The Victorian Traditional Owner Cultural Fire Strategy. Retrieved from <https://www.ffm.vic.gov.au/fuel-management-report-2018-19/statewide-achievements/cultural-fire-strategy>.

There appears to be great opportunity for restoration and revitalisation of cultural practices in south-eastern Australia and improvements in landscape health, along with benefits in managing bush fire risk. But wider implementation of traditional land management practices will require review of policies and procedures, and potentially regulatory change, clear acknowledgement of the cultural basis for the practices and Aboriginal ownership of knowledge, and a commitment from Government to invest in building knowledge and capacity for Aboriginal communities to have a greater role in land management, including planning and preparation for bush fire. This should be accompanied by a long-term commitment to monitoring and evaluation and Aboriginal-led research to quantify and communicate better the outcomes of these activities, including the potential benefits for hazard reduction purposes.

Taking these steps should be founded in strong partnerships between Aboriginal people and Government agencies. As noted by the NSW Aboriginal Land Council in its submission, “an approach that draws on the strength of both Western and Indigenous Knowledge systems will be key to delivering appropriate and beneficial outcomes”.⁵⁷⁵

The Inquiry also notes that Aboriginal people were disproportionately affected by the 2019-20 bush fires. The Research Hub examined demographics of bush fire affected communities and reported that populations with high proportions of Indigenous people experienced significant house loss.⁵⁷⁶ Government should also consider the role of Aboriginal land management initiatives in supporting community and landscape recovery, including to support the need for greater on ground monitoring and data collection.

Recommendation 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.

4.4.4 Using the planning system for greater bush fire protection

Key points

- While the planning system incorporates extensive and generally effective bush fire resilience into all developments on designated bush fire prone land, there is an opportunity to develop a more proactive and strategic approach to managing the increasing risk presented by bush fires.
- To overcome this in the longer term, Government should move towards a model based on the NSW Flood Prone Land Policy so that it can take a whole-of-government strategic planning approach to transition those buildings and places at the greatest risk of an event to other more appropriate uses, including potential acquisition, and provide greater certainty when deciding where new development should be located.

⁵⁷⁵ NSW Aboriginal Land Council, Submission to the Inquiry.

⁵⁷⁶ NSW Bushfire Risk Management Research Hub (2020). ‘Demographic characteristics of populations affected by the 2019/2020 bushfires in NSW’.

- In the shorter term, Government should take a range of measures to improve education, compliance, auditing and enforcement in respect of bush fire standards for local developments and assets.

This section examines specific issues in bush fire protection arising from the operation of planning and environment legislation. It describes the operation of the relevant legislation, and limitations of the legislation with respect to bush fires that have been identified through the Inquiry's investigations informed by consultations, public meetings and submissions made to the Inquiry. It also makes recommendations for future action.

The summary outcome of this section is that Government can make use of existing legislation to shift to a longer-term strategic approach to bush fire planning and introduce some shorter-term improvements to address some legacy issues in the meantime.

4.4.4.1 How planning legislation applies

The *Environmental Planning and Assessment Act 1979* (EP&A Act) and its associated regulations, codes and environmental planning instruments constitute the primary legislation regulating land use planning assessment and development approvals within NSW. The Act's remit is broad, and aims to promote economic growth and development, enhance social welfare and protect the environment for the benefit of present and future communities.

Bush fire provisions were included in the EP&A Act for the first time in 2002 (in response to the 2001 bush fire event), shifting the focus of bush fire assessment from a matter to be considered with other environmental issues to a legislated assessment requirement, the intention being to balance tolerable risk and mitigating those risks through building specifications and vegetation management.

The Act provides for the NSW RFS Commissioner to designate land as bush fire prone land. In practice, this happens through the preparation of bush fire prone land maps by councils which are approved by the NSW RFS Commissioner, in accordance with the NSW RFS *Guide for bush fire prone land mapping*.

When land is designated as bush fire prone land, the NSW RFS's *Planning for Bush Fire Protection* (PBP)⁵⁷⁷ document must be applied:

- at a strategic level, in the preparation of Local Environment Plans or planning proposals that apply to such land, and
- at a specific development level, i.e. to residential dwellings and residential subdivision of land.

In accordance with the Act, application of the PBP is only triggered when there is a planning proposal or a development application.

The PBP requires consideration of the application of a range of Bush Fire Protection Measures (BPM) according to the development type and level of bush fire risk. The required methodology for determining the risk is linked to the methodology for determining the Bush Fire Attack Level (BAL) in AS3959:2009, the Australian Standard for *Construction of buildings in bush fire-prone areas*, which is referenced in the PBP. This is based primarily on distance to vegetation and use of Asset Protection Zones (APZs), internal access arrangements, building materials and topography. In certain specified circumstances,

⁵⁷⁷ Previous editions of PBP were published in 2001 and 2006, and an Addendum Appendix 3 to PBP 2006 was published in 2010. The Pre-Release version of PBP 2018 was published in August of 2018 which was available for use until PBP 2019 was made available in December 2019.

developments are referred to the NSW RFS for consultation, concurrence or integrated approval.

Once a development consent has been granted by a consent authority (e.g. a council), it is the responsibility of the principal certifying authority (e.g. a council or a private building certifier) to ensure the bush fire controls outlined in the conditions of consent have been met. But maintenance of those conditions into the future becomes the responsibility of the landowner.

The Inquiry notes that sufficient evidence and data sets are not available to enable an in-depth analysis of the performance of the PBP and bush fire construction standards during the 2019-20 bush fire event. However, drawing on a 2020 analysis of houses in the 2013 Linksview bush fire event (see Box 4-1), the Inquiry acknowledges that it is likely that application of the PBP has led to greater protection of lives and property; and that changes to the PBP in late 2019 to improve rezoning requirements and strengthen the BPMs will further improve protection. It also acknowledges that the application of bush fire sensitive *urban* design measures possibly assisted in the mitigation of bush fire impacts in some communities.

The Inquiry further notes that CSIRO has been engaged by the NSW RFS to undertake a 'State-wide post bush fire impact study' with preliminary findings expected 3 August 2020.⁵⁷⁸

Box 4-1: Linksview study of role of construction standards on building impact

Price and Roberts conducted an in-depth analysis of 466 houses exposed to the 2013 Linksview fire, and the role of construction standards on building impact.⁵⁷⁹ Their analysis shows that older houses built before 2001 experienced more damage than houses built after the 2001 introduction of the PBP (so long as they were not built in the flame zone, which experienced a much higher level of impact) and that every amendment to the PBP and AS3959 since 2002 has further improved dwellings' chances of survival (again, except those in the flame zone).

The report also highlights:

- older houses had higher vegetation cover in the garden (within 10 m)
- older houses had other risks, due to the state of the house because of the standard it was built to, or to the house's degradation over time (noting there is no requirement to maintain building standard compliance), or to both
- year of modification was a poorer predictor of impact than was year of construction – the implication is that old houses are more vulnerable, and modifications do not improve that vulnerability even if the modification itself was built to a higher construction level
- the small sample of houses with a designated APZ (cleared Asset Protection Zone) showed that larger zones were more effective.

From a policy perspective, the analysis highlighted four issues:

- i. construction standards are clearly useful, in particular the more recent ones and cases where the APZ greater than 30 metres
- ii. despite construction standards, houses in the flame zone are vulnerable
- iii. lack of maintenance is a problem, partly because of vegetation growth in the garden over time, but possibly also because houses become more vulnerable over time – this

⁵⁷⁸ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 16 July 2020*.

⁵⁷⁹ Price, O. & Roberts B. DRAFT The role of Construction Standards on Building Impact of the 2013 Linksview Bushfire, 2020, Centre for Environmental Risk Management of Bushfire, University of Wollongong, a report to the Rural Fire Service NSW.

- could be helped by requiring ongoing maintenance of the standards and/or promoting retro-fitting of houses to improve their resilience (but both these could be expensive, e.g. retro-fitting costs an average of \$24,000 per house)⁵⁸⁰
- iv. construction standards for building modifications do not improve house resilience – it may be better to impose new standards to the whole house or to require modifications only to meet the standard for the original house.

The authors also suggest that a similar analysis be undertaken for the 2019-2020 event, with a larger sample set and time to collect the required data from each of the council areas – noting this is not an easy task. The authors point out that details of house construction dates and construction levels are scattered among databases, microfiche and paper records in local government offices; each council may have different systems; and some records go missing. They state that there is a need to collate this information for research purposes, but it would be preferable to implement State or nation-wide systems for collating these details for all houses, both historically and in the future.

4.4.4.2 How planning legislation has limitations when it comes to bush fire protection

The consultations, submissions and evidence, when assessed as a whole, have highlighted a number of issues with the current legislative planning framework. These can be summarised as follows.

- a. There are no provisions in the NSW Act and Planning instruments to prohibit development in areas where bush fire risks are too great and cannot be mitigated.
- b. The planning system needs to respond to accommodate changing climate conditions and the increasing likelihood of catastrophic bush fire conditions. Many areas throughout NSW were not considered a significant bush fire risk at the time of development, but their risk levels have now changed – for example, rain forest areas near Port Macquarie and Nymboida, which traditionally have been too damp to carry fire.
- c. There were 387 homes destroyed, as well as many other buildings damaged or destroyed, that were not located on designated bush fire prone land⁵⁸¹ or within the buffers as prescribed by the NSW RFS *Guide for bush fire prone land mapping*, and so the requirements specified in the PBP did not apply. This raises questions as to the efficacy of vegetation mapping across NSW and the susceptibility of buildings to ember attack.
- d. The Act is heavily reliant on statutory plans and development controls, to enable a comprehensive understanding of bush fire planning across local government boundaries, particularly on the urban fringe of Greater Sydney growth areas. The cumulative impacts of State and locally approved developments across each LGA place pressure on regionally significant infrastructure (evacuation routes, water resources, etc.), during a catastrophic bush fire event.
- e. Many older facilities and dwellings, even on designated bush fire prone land, were developed before 2002, when the then Australian Building Standard (1991 and 1999) applied. Its bush fire controls and measures were less rigorous than those prescribed in

⁵⁸⁰ Penman, TD, Eriksen, C, Horsey, B, Green, A, Lemcke, D, Cooper, P, Bradstock, RA (2017) Retrofitting for wildfire resilience: What is the cost? *International Journal of Disaster Risk Reduction* 21, 1-10.

⁵⁸¹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided* 16 July 2020.

the PBP. Consequently, many existing buildings do not meet the minimum standards in the PBP and there is no legislative mechanism to require the upgrading of buildings to meet current bush fire protection standards or provide opportunity to relocate residents from inappropriate locations in a fair and transparent way.

- f. For land in bush fire prone zones, particularly those houses in areas with older subdivisions, the system places a heavy reliance on site-by-site mitigation against bush fire through application of the PBP, AS3959 and subsequent conditions of consent to an individual development application. This has allowed development to be scattered across a landscape without a thorough understanding of infrastructure thresholds, emergency services, bush fire behaviour, environmental values and assets, and existing land use management practices (at the landscape level), or consideration of the evacuation capacity of communities. This has led to unintended consequences, such as major tourism sites (attracting seasonal population surges) backing on to heavy vegetation, or areas with limited evacuation capacity, e.g. via a single road in and out.
- g. Even the highest Bush Fire Attack Level (BAL) construction specifications (as specified in AS3959:2009 and required by the PBP) are not designed to withstand fires in catastrophic conditions and are based on quasi-steady fire behavioural principles which were not adequate for the 2019-2020 season.
- h. Development approval conditions for Building Attack Levels, Asset Protection Zones, design and site layout are based on a single point in time and there is no centralised bush fire construction level database in which to record them. This has at least six consequences:
 - it places responsibility on individual landowners to maintain (in perpetuity) bush fire protection measures as per conditions of development consent, a responsibility which it is easy to lose sight of as time goes by
 - small scale alterations and modifications, landscaping and vegetation regrowth implemented by landholders are not formally monitored and may make the building fire prone and detract from the development's approved bush fire protection measures
 - when land ownership changes, new owners can be unaware of their obligations in an original development consent which may be decades old
 - there is no way to ensure the consent incorporates improvements in bush fire protection methods
 - there is no capacity to pass on cumulative knowledge on the overall effect of climate changes and worsening bush fire seasons
 - it makes it difficult to understand and review the performance of BALs and APZs associated with development after a bush fire event.
- i. There is an inference, leading to a false sense of security, that if a landowner in a bush fire prone zone can comply with building standards and put in appropriate APZs and other measures specified in the development consent made under the Act, then it will be safe to live there.
- j. The system is not well equipped to identify and deal with unapproved developments, i.e. those which landholders construct without development consent (dwellings, campgrounds, etc.). These are often not built to the appropriate fire protection standard; may in themselves constitute a fire hazard; and at times house vulnerable people.
- k. Designing, building and upgrading existing dwellings in bush fire prone areas is becoming more difficult and, in some instances, adds as much as \$100,000 to overall costs.

- I. Strategic planning is not given sufficient emphasis, particularly given projected population growth in bush fire prone areas due to expanding city boundaries and more people choosing to live permanently or semi-permanently in coastal or regional/rural towns. NSW is expected to grow by an additional 1.85m in the Greater Sydney Region, with 822,013 people in Sydney's Western growth area by 2041.⁵⁸² There will also be 307,000 additional people in regional NSW by 2041⁵⁸³ with 256,331 people along coastal regions. The Act does not require bush fire protection to be understood across a landscape and considered through council-led master planning and land use strategies. This has resulted in residential development areas being approved by the planning system without proper consideration or understanding of the bush fire risk across an entire Local Government Area.

Box 4-2: Use of bush fire shelters

A particular issue raised in the planning context relates to bush fire shelters (often known as bunkers). It is discussed here, as use of shelters is governed by planning legislation.

Since the Victorian Black Saturday Fires, there has been an increase in interest in private bush fire shelters,⁵⁸⁴ and the Inquiry anticipates that interest will increase as a result of the 2019-20 bush fires.

In NSW, bush fire shelters require development approval, in consultation with the NSW RFS, under the EP&A Act. However, the Inquiry was told that gaining approval is difficult. This is at least in part because, although the relevant standards⁵⁸⁵ provide performance-based requirements for bush fire shelters, they do not include a comprehensive 'Deemed-to-Satisfy' building solution for the design of these shelters.

The NSW RFS does not promote the use of bush fire shelters because it:

- has limited confidence in the performance of bush fire shelters, having regard to construction material and maintenance, and
- is concerned that people will rely on the shelter as a 'plan A' and disregard more effective bush fire survival strategies, such as reducing fuel loads, preparing houses against bush fire assault and making appropriate decisions about when to leave.

The Inquiry heard anecdotes that property owners in NSW have built bunkers without approval or sought approval of a building for a different use with the unstated intention of using it as a fire shelter. This has led to potentially unsafe shelters, such as dugouts in the ground, shipping containers, or cellars that only meet fire-resistant, rather than fireproof, standards.⁵⁸⁶

The Inquiry notes that Victoria has a formal accreditation system for certifying a shelter design, which enables private companies to pre-make and purpose-build shelters to the relevant standards, and then sell them to the public for installation on their land.

⁵⁸² DPIE (Department of Planning, Industry and Environment) Population Projections. Retrieved from <https://www.planning.nsw.gov.au/Research-and-Demography/Population-projections/Projections>

⁵⁸³ DPIE (Department of Planning, Industry and Environment) Population Projections. Retrieved from <https://www.planning.nsw.gov.au/Research-and-Demography/Population-projections/Projections>

⁵⁸⁴ Australian Building Codes Board (ABCB) – Final Regulation Impact Statement, 2011.

⁵⁸⁵ National Construction Code Volume 2, P2.7.6 *Private bushfire shelters* in conjunction with the ABCB *Performance Standard: The Design and Construction of Private Bushfire Shelters* (developed in response to the November 2009 Interim Report of the Victorian Bush Fires Royal Commission).

⁵⁸⁶ ABC News. Retrieved from <https://www.abc.net.au/news/2020-06-18/pressure-mounts-on-states-to-support-bushfire-bunkers/12316836>.

The Bushfire Building Council of Australia (BBCA) is concerned that, if other states do not soon implement a simpler process for accrediting fire shelters like Victoria has done, they will leave people relying on unsafe shelters.⁵⁸⁷

The Inquiry was told that six people survived fires in Victoria in 2019-20 due to the use of accredited fire shelters. However, it notes that there is limited evidence available on the success rate of such shelters.

An analysis by the Australian Building Codes Board suggests that, even with a well-built shelter, the chance of survival may still be low due to improper use, and it shares the NSW RFS's concern that people may place too much faith in shelters over more effective bush fire survival strategies.⁵⁸⁸

The Inquiry makes no recommendation on the use of bush fire shelters, but suggests that the NSW RFS consider providing a clear and definitive position on their usage in NSW.

4.4.4.3 Vegetation clearing for asset protection

As discussed above in the Hazard Reduction section above, many landowners and communities told the Inquiry that they felt unable to manage and prepare for the 2019-20 season effectively because of the complexity of approval processes for vegetation management.

As outlined above, where an original Development Application provided for an Asset Protection Zone or other hazard reduction activity, further environmental approvals are not required, while the 10/50 Vegetation Clearing Code of Practice enables clearing close to houses without approval.

However, the Inquiry was alerted to some examples that do not fit into these existing pathways, where vegetation clearing may be desirable for bush fire protection purposes. In these cases, the approvals processes for vegetation clearing can become very complex to understand and navigate, and it is possible that biodiversity objectives may conflict with bush fire risk reduction concerns. Commonwealth biodiversity legislation may also come into play in some circumstances, further complicating the picture for an individual landowner. For example:

- the Housing Industry Association⁵⁸⁹ submission raised concerns about the Biodiversity Offsets Scheme under the Biodiversity Conservation Act 2016. It referred to an example where "\$50,000 in levies would be required to be paid under the scheme to clear enough land on a single lot to provide an adequate APZ to ensure the dwelling was not a higher risk than BAL 40". It argues that this would encourage people to build to a higher risk level and "creates a financial disincentive for reducing bush fire risk for new development on land already zoned for residential purposes"
- Eurobodalla Shire Council⁵⁹⁰ in its submission explained that for many older homes in rural areas that were constructed before contemporary bush fire standards applied, the APZ allowance may not adequately reflect the lower standard of building construction and may need to be improved or increased in size, which can be a difficult and costly process to navigate if biodiversity assessments and offsets are required. This may also be an issue for properties being rebuilt after the fires.

⁵⁸⁷ Ibid.

⁵⁸⁸ ACBC (Australian Building Codes Board). (2011). Final Regulation Impact Statement, 2011.

⁵⁸⁹ Housing Industry Association, Submission to the Inquiry.

⁵⁹⁰ Eurobodalla Shire Council, Submission to the Inquiry.

The Inquiry also notes that new owners of properties with existing APZ allowances that enable hazard reduction clearing without approvals may not be readily able to find out what conditions apply and what they can and can't do. It should be much simpler for new purchasers of property to find out what the existing approvals allow.

4.4.4.4 Moving towards a bush fire resilient community through changes to the planning system

With the benefit of hindsight and the 2019-20 experience, the Inquiry acknowledges that there are some existing towns and areas where residential development would not be permitted if proposals were initiated today. However, these areas' strong, historical, community, social and cultural connections, together with their economic contribution to the NSW economy, makes it impractical and unreasonable to relocate them and/or restrict their growth and development.

Nevertheless, it is important to make sure that the planning system supports and strengthens the bush fire resilience of existing properties and towns. An ideal planning system should:

- adapt to new and increased risks caused by continued population growth in bush fire prone regions, particularly in coastal regions that are significantly affected by catastrophic bush fire events and changing climate conditions
- adopt avoidance as the first priority, and mitigation of the risk to an acceptable or tolerable level as the second
- be upfront about the bush fire risk across a landscape, taking into account the specific environmental conditions of that landscape, when identifying future land uses and areas; and, rather than making assessments on a site-by-site basis, using standardised quasi-steady bush fire behaviour principles
- deal with legacy bush fire issues arising from previous planning decisions transparently and equitably, using a suite of tested mitigation methods
- build bush fire-resilient communities where towns and individuals fully understand the threat of bush fire and the potential fire behaviour specific to local circumstances
- make operational planning, preparation, mitigation and eventual protection for bush fire easier and more effective, reducing the stress on resources and infrastructure and protecting firefighters.

4.4.4.5 Longer term strategic approach

To improve the strategic bush fire provisions of current planning and environment legislation, the Government can draw on the leadership it has already shown in natural hazard planning through the 2015 introduction of the NSW Flood Prone Land Policy. Although this policy is made under the *Local Government Act 1993*, it encompasses a lot of activity under the EP&A Act, such as section 9.1 Ministerial directions and Local Environment Plan flood clauses, that requires an early strategic planning approach. This provides a good model for adoption and tailoring for bush fire planning. It allows for:

- an integrated strategic planning approach to managing flood impacts in both new and existing development
- an understanding of flood behaviour specific to the environmental conditions of a certain area
- analysis of existing, future and continuing risk at a strategic level rather than on an ad hoc, individual proposal basis
- technical expertise at both the local and state level to inform the preparation of flood risk management plans
- strong community engagement processes to inform and educate flood residents of the risks from flooding
- a financial and technical assistance framework from State Government

- a series of acceptable mitigation measures developed with extensive community consultation to build resilience into existing and future communities, such as, zoning and building and development control, voluntary purchase and house raising, flood access, community awareness/readiness and recovery plans.

A similarly structured 'NSW bush fire policy' would include strategic measures to be used throughout the planning system to build more bush fire resilience. It would ensure all relevant factors were fully considered when deciding where new development should be located, and also strengthen bush fire resilience in existing urban and settlement areas. The policy would include operational and land management programs, governance arrangements, the future impact on emergency services (minimising fragmentation of resources during a bush fire event), environmental characteristics of an area (topography, vegetation, environmental assets), community values, history of bush fires in the area, infrastructure thresholds (water, road networks for evacuation), and the effects of climate change and worsening conditions.

The framework would include:

- better bush fire mapping which accurately depicts the bush fire environment of an area, and takes bush fire risks into account when identifying the most appropriate places to build
- defensible spaces on the edges of towns which incorporate perimeter roads. And it would provide community facilities (e.g. recreation areas); consider biodiversity values; be linked to bush fire operational plans for response agencies; and provide connection to bush lands, whilst being economical and incorporating best practice BPMs
- urban planning policy and landscape design principles and practices that create buffers between flammable landscapes and urban areas without compromising amenity and biodiversity values⁵⁹¹
- a strategic planning model which provides mitigation and adaptation measures, including opportunity for people to relocate out of extreme risk bush fire communities, i.e. swaps and buy back schemes for developments that are incompatible with a tolerable bush fire risk level
- proper consideration of the impact on new development of bush fire across different LGAs near each other
- funding for compliance, education and enforcement programs to enable local councils to establish and undertake proper preparation and preparedness processes within their communities, which would ultimately become self-reliant/funded and future proof
- investment in research for innovative building design, materials and protection solutions, including alternative construction options including, possibly, bush fire shelters
- more appropriate standards for constructing/upgrading all new and existing developments, to reflect the worsening bush fire environment
- building sufficient bush fire fighting and evacuation capacity into new and existing towns
- ensuring that new development does not exceed the operational capacity of the NSW RFS to protect it
- strong community engagement processes to inform and educate bush fire prone land residents of the risks from bush fire.

⁵⁹¹ Professor David Bowman (2020). Royal Commission into National Natural Disaster Arrangements Response to Notice to Give 29 April 2020. Retrieved from <https://naturaldisaster.royalcommission.gov.au/system/files/exhibit/PDB.500.001.0002.pdf>.

Such a shift will take time. It will be important to engage the community fully in understanding historic and potential future bush fire events and proposals to manage new development, particularly if outcomes directly affect where people can and cannot live in the future.

4.4.4.6 Shorter term resilience measures

In parallel with the commencement of a new strategic planning process, there are more immediate measures which the Government, the community and the insurance sector can take to build community resilience for upcoming bush fire seasons.

These include:

- providing increased consistency across legislation, and consequent certainty for landholders on the extent of hazard reduction and vegetation clearing activities permissible on their land to create and enlarge APZs around existing developments
- incorporating new technology to perform enforcement and compliance regimes (updated satellite mapping, drones etc.) to undertake more effective (cheaper) auditing of defendable spaces around towns and cities which are under the control or ownership of a public authority
- increasing enforcement, compliance and educational activities by local councils in high risk areas to identify existing non compliances e.g. non-compliant alterations and additions, non-approved dwellings, APZs and BAL maintenance
- providing land use bush fire planning education in conjunction with community engagement processes outlined in the Hazard Reduction section above and including existing initiatives such as Get Ready Day and the HotSpots program
- creating incentives for bush fire protection by developing, with the Insurance Council, a list of Government-subsidised, verifiable activities that can be undertaken by landholders to increase bush fire protection, with consequent potential for lower insurance premiums and increased community participation and safety
- developing a centralised BAL and APZ database with local government to ensure information regarding BALs and APZs is easily accessible by insurance companies and existing and future landowners.

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 28: That Government, acknowledging that a strategic approach to planning for bush fire will take time, and in order to protect, prepare and build resilience into existing communities better, should immediately:

- prepare, in association with the insurance sector, a model framework and statutory basis for the establishment of an enforcement, compliance and education program which adopts a risk-based approach to routine inspection of local bush fire prone developments to ensure that every local development on bush fire prone land is prepared for future bush fire seasons in accordance with bush fire protection standards of the day, that account for worsening conditions
- ensure local government is resourced to enable effective audit, enforcement and compliance powers in respect of local developments and assets on bush fire land
- consider the introduction of subsidies for property owners to undertake site mitigation works to reduce bush fire risk and work with the Insurance Council of Australia to develop an agreed set of measures to insure against with a view to risk reductions resulting in lower insurance premiums

- review vegetation clearing policies to ensure that the processes are clear and easy to navigate for the community, and that they enable appropriate bush fire risk management by individual landowners without undue cost or complexity.

4.4.5 Preparing critical infrastructure for bush fire or providing a workaround

Key points

- Telecommunications was the service most valued by members of the community during the 2019-20 bush fire, and the impact of the loss of this service because of damage to telecommunications infrastructure or, more commonly, power infrastructure needs to be anticipated and prepared for.
- Actions that can be taken in the preparation phase that help minimise service disruptions during a bush fire include:
 - ensuring infrastructure assets are adequately identified, protected and prepared
 - making the electricity network more resilient
 - ensuring reliable backup plans are in place as part of bush fire planning, including energy supplies to telecommunication towers and expanded roaming arrangements between telecommunications carriers
 - understanding and mitigating risks associated with the interdependencies of other parts of the emergency management service system.

Critical infrastructure includes different asset types from different sectors which often have strong interdependencies. When one critical asset fails, it can have an inordinate or compounding impact on other vital services. The 2019-20 bush fires demonstrated that three services are particularly vital in bush fires: telecommunications, electricity and water supply. It follows that the infrastructure providing these services is critically important and must be adequately prepared for and protected against bush fire.

To ensure this, it is essential to:

- know where critical infrastructure is located, so that comprehensive planning to protect it can occur
- have good protections in place so that the infrastructure is well placed to withstand a fire event
- have good backup plans in place to ensure services can continue to be provided if the infrastructure does get damaged
- understand and mitigate risks associated with the interdependencies of other parts of the emergency management service system.

4.4.5.1 Government approaches to the protection of critical infrastructure

Government has emphasised the importance of the State's infrastructure being resilient in recent years. As noted above, the fourth of the six cross-sectoral strategic directions of the *NSW State Infrastructure Strategy 2018-2038* is to "ensure NSW's existing and future infrastructure is resilient to natural hazards".⁵⁹² Recommendations 17-22 of this Strategy

⁵⁹² Infrastructure NSW. (2018). Building Momentum State Infrastructure Strategy 2018-2038. Retrieved from https://insw-sis.visualise.today/documents/INSW_2018SIS_BuildingMomentum.pdf.

particularly address resilience and were all supported by Government⁵⁹³ and all are in the process of implementation.

In line with these recommendations and specifically addressing critical infrastructure, the then NSW Office of Emergency Management (now Resilience NSW) released a *Critical Infrastructure Resilience Strategy* in September 2018, to help infrastructure “withstand the shocks of natural, technological, and malicious hazards” and “address long-term stresses such as climate change and population growth”.⁵⁹⁴ It broadly defines critical assets as “the assets, systems and networks required to maintain the security, health and safety, and social and economic prosperity of NSW”.⁵⁹⁵ The strategy’s three priorities are “Partner, Prepare, Provide”. All Government agencies are required to maintain an asset register and develop asset management plans. These plans must undertake an assessment of the resilience and vulnerability of assets to the effects of climate change, natural disasters, and human-related threats and propose appropriate mitigation.⁵⁹⁶

This strategy “encourages leaders in business and government to support the NSW community by improving critical infrastructure resilience (CIR) across NSW,”⁵⁹⁷ and a set of User Resources are being developed to support the strategy’s implementation. The strategy’s success “is largely dependent on infrastructure providers applying the strategy outcomes to generate real-world infrastructure resilience”.⁵⁹⁸

The Commonwealth Government also has increased its emphasis on critical infrastructure with a particular focus on human-related national threats (e.g. espionage, sabotage and coercion) arising from foreign involvement in Australia’s critical infrastructure. The *Security of Critical Infrastructure Act 2018* applies to “approximately 200 assets in the electricity, gas, water and ports sectors,”⁵⁹⁹ with a mandatory requirement on owners of such assets to register them.⁶⁰⁰ Key elements of the Act include mandatory registration of assets covered by the Act to “support more proactive management of the risks” (the register is not available to the public), and an ability for the Minister for Home Affairs to direct an asset owner/operator to mitigate against a national security risk.⁶⁰¹

The Inquiry endorses this strong State and Commonwealth Government focus on critical infrastructure resilience but notes that, notwithstanding this, current regulatory settings for the telecommunications and electricity sectors do not ensure that the NSW RFS (or any part of NSW government including emergency services) is provided with comprehensive information about where at-risk critical infrastructure is located. This illustrates the

⁵⁹³ Ibid.

⁵⁹⁴ NSW Office of Emergency Management. (2018). NSW Critical Infrastructure Resilience Strategy. Retrieved from <https://www.emergency.nsw.gov.au/Documents/NSW-Critical-Infrastructure-Resilience-Strategy-Summary.pdf>.

⁵⁹⁵ Ibid, p 8.

⁵⁹⁶ Resilience NSW. (2020). *Advice to the Inquiry provided 13 May 2020*.

⁵⁹⁷ NSW Office of Emergency Management. (2018). NSW Critical Infrastructure Resilience Strategy. Retrieved from <https://www.emergency.nsw.gov.au/Documents/NSW-Critical-Infrastructure-Resilience-Strategy-Summary.pdf>.

⁵⁹⁸ Resilience NSW (2018). Critical Infrastructure Resilience Strategy. Retrieved from <https://www.emergency.nsw.gov.au/criticalinfrastructure>.

⁵⁹⁹ Department of Home Affairs. (2020). About the [Security of Critical Infrastructure] Act. Retrieved from: <https://www.homeaffairs.gov.au/about-us/our-portfolios/national-security/security-coordination/security-of-critical-infrastructure-act-2018>.

⁶⁰⁰ Ibid.

⁶⁰¹ Ibid.

importance of finalising the Spatial Services Digital Twin, in the way described above, and testing the Digital Twin as an adequate mechanism for the provision of critical telecommunications infrastructure information.

4.4.5.2 Telecommunications most valued

The Inquiry heard that, during the 2019-20 bush fires, telecommunications was the service most valued by the community. It provided the means for people to seek emergency assistance via Triple Zero and other emergency numbers, to communicate with family, and for Government to provide community warnings via emergency alert services. Once the immediate danger passed, the community relied on the telecommunications network for access to post-emergency information.⁶⁰²

The large-scale loss of communications and power during the fires had significant implications for:

- people's ability to know whether they were directly threatened by fire
- people's ability to make decisions about preparing their properties, whether to evacuate, and evacuation options (such as knowing the safest evacuation route and which roads are open, and being able to get and pay for essential supplies such as fuel to evacuate – e.g. when tourists were evacuating the South Coast over New Year), adding the potential for panic, anxiety and distress to an already stressful situation
- fire fighting efforts (for example, operation centres losing contact with fire fighting teams on the ground, outages to operation centres, and distribution of warnings to the public).

4.4.5.3 Telecommunications depend on electricity supply

Telecommunications services require power to operate. Most communication outages (across Australia) were due to power outages rather than direct fire damage to communication assets.⁶⁰³

The 2019-20 fires caused significant fire damage to power infrastructure, with damage to poles, pole-mounted substation sites, and hundreds of kilometres of overhead high voltage powerlines. This resulted in thousands of customers experiencing power outages throughout the bush fire season.⁶⁰⁴ The biggest consequence of power outages was the loss of communications, as most telecommunication towers are connected to electricity by transmission lines.

NSW had 818 telecommunication facilities affected by the bush fires, with 514 of them experiencing outages of four hours or more.⁶⁰⁵

⁶⁰² NSW Telco Authority. (2020). *Advice to the Inquiry provided 16 April 2020*.

⁶⁰³ Statement based on data between 19 December 2019 and 31 January 2020. ACMA (Australian Communications and Media Authority). (2020). Impacts of the 2019–20 bush fires on the telecommunications network: Report for the Minister for Communications, Cyber Safety and the Arts. Retrieved from <https://www.acma.gov.au/publications/2020-04/report/impacts-2019-20-bushfires-telecommunications-network>.

⁶⁰⁴ EUSFA (Energy and Utility Services Functional Area). (2020). *Advice to the Inquiry provided 26 February 2020*.

⁶⁰⁵ ACMA (Australian Communications and Media Authority) (2020) Impacts of the 2019–20 bush fires on the telecommunications network: Report for the Minister for Communications, Cyber Safety and the Arts. Retrieved from <https://www.acma.gov.au/publications/2020-04/report/impacts-2019-20-bushfires-telecommunications-network>.

When the main electricity supply to telecommunications infrastructure fails, backup power such as from diesel generators kicks in, but these require re-fuelling after a relatively short time by power supply company technicians who must wait until it is safe to access the sites. To help with this, several telecommunication carriers provided generators and deployed temporary facilities to maintain some level of communications through bush fire affected areas.

Ideally in a bush fire, critical services would keep going during an emergency even in a degraded form. When outages are experienced, it is imperative to get some level of service up and running as quickly as possible.

The current regulatory frameworks for both power networks and telecommunication carriers include mandatory performance standards for reliability and service.⁶⁰⁶ However, mass outages caused by major events such as natural disasters are not counted towards the performance standards (and the providers are thus exempt from fines/payments for failing to meet the standards).⁶⁰⁷ These frameworks do not include requirements for services to continue, or minimum timeframes in which services must become operational again after an event. Therefore, revised arrangements are needed to minimise service disruptions in a bush fire. These new arrangements should consider collaborative ways of identifying the level of protection from major disasters in a way that is most cost effective in trading off costs and benefits to the public. To do this well, conversations need to happen collaboratively between government and telecommunication and energy providers.

4.4.5.4 National roaming could help but doesn't when one carrier's power is out

When there is failure in one communications carrier's network, it is still theoretically possible for another carrier to 'fill the gap'. Already, national roaming agreements between carriers allow Triple Zero to be made regardless of the caller's contracted carrier. However, there are currently no national roaming agreements between carriers enabling people to make calls, send SMS or access data during a crisis situation. The Inquiry understands this is primarily due to commercial rather than practical considerations.⁶⁰⁸ Roaming arrangements between carriers during a bush fire, replicating the arrangements for Triple Zero calls, would help maintain a minimum level of telecommunications coverage for affected communities when there is reduced coverage due to telecommunications asset damage.⁶⁰⁹

⁶⁰⁶ Commonwealth Government. *Telecommunications (Consumer Service Standards) Act 1999*. Retrieved from <https://www.legislation.gov.au/Details/F2011L00413>; and IPART (Independent Pricing and Regulatory Tribunal) (2019) Annual Compliance Report Energy network operator compliance during 2018-19. Retrieved from <https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/licensing-compliance-energy-distribution-licences-annual-compliance-report/annual-energy-networks-compliance-report-2018-19.pdf>.

⁶⁰⁷ Commonwealth Government. *Telecommunications (Consumer Service Standards) Act 1999*. Retrieved from <https://www.legislation.gov.au/Details/F2011L00413>; IPART (Independent Pricing and Regulatory Tribunal) Licence Conditions and Regulatory Instruments. IPART licence conditions for Essential Energy, Endeavour Energy and Ausgrid, Schedule 4. Retrieved from <https://www.ipart.nsw.gov.au/Home/Industries/Energy/Energy-Networks-Safety-Reliability-and-Compliance/Electricity-networks/Licence-conditions-and-regulatory-instruments>.

⁶⁰⁸ Royal Commission into National Natural Disaster Arrangements. (2020). Transcript Hearing Block 2 – Thursday 2 July 2020. Retrieved from <https://naturaldisaster.royalcommission.gov.au/publications/transcript-hearing-block-2-thursday-2-july-2020>.

⁶⁰⁹ NSW Telco Authority. (2020). *Advice to the Inquiry provided 16 April 2020*.

4.4.5.5 How can we achieve no or minimal service disruptions in a bush fire?

In the preparation for bush fire phase, there are three main sets of actions that can be taken aimed at minimising service disruptions during a bush fire. They are:

- ensuring infrastructure assets are adequately identified, protected and prepared
- making the electricity network more resilient, for example by putting overhead powerlines underground or by having power sources that are not dependent on the network – so-called stand-alone power systems
- ensuring reliable backup plans are in place, including energy supplies to telecommunication towers and expanded roaming arrangements between telecommunications carriers.

While the Inquiry acknowledges the work being done under the *NSW Infrastructure Strategy* and the *NSW Critical Infrastructure Resilience Strategy* discussed above, it considers that more specific actions should be taken now to ensure bush fire preparedness and protection of communications and power infrastructure.

4.4.5.5.1 Better asset identification and protection

Currently there is no systematic or coordinated approach to ensure accurate information about key infrastructure assets, including their location, owner, criticality and status, is available to NSW RFS before a fire (and hence such information is not available to BFMCS when preparing for fires or the State Operations Centre or Incident Management Teams during the fires). Thus, it is not possible to see at a glance on a map where all critical infrastructure assets are in a particular region. This lack of comprehensive information on infrastructure assets led to difficulties in planning for fire suppression; knowing what to protect; how important the assets were; and the impact if they were lost due to fire. At present there is essentially an ad hoc process, highly dependent upon local individual knowledge.

The importance of providing such information and building a detailed partnership with NSW RFS over the years is highlighted by the success in protecting Sydney's drinking water (described below), where adequate information was provided and the relationship between Sydney Water and NSW RFS is strong.

As noted previously, metadata collected for critical infrastructure in the State Digital Twin (currently being developed) must be comprehensive in providing all needed information for effective fire fighting. For communications infrastructure, this needs to include the spatial coverage provided, as well as standard metadata such as precise geolocation, value, any fire treatment, APZ and how it is maintained, access details, backup capacity, redundancy arrangements available, and emergency contact person.

Despite the need for it, there is no mechanism for Government to compel asset owners to provide information about their assets, including location and criticality. The Inquiry heard that some information was provided to Incident Management Teams when the asset was under threat and needed protection. But this information needs to be known well in advance of any bush fire emergency to inform decision making in a timely manner. Without it, an inappropriate approach may be taken to saving the asset. It also means that assets are considered individually, and not as part of a network of interconnecting vulnerabilities.

Government has information about its own assets, but even if that information were systematically provided to NSW RFS, the picture would be incomplete since critical infrastructure comprises a mix of private and public assets. Government needs to be able to mandate that all infrastructure asset owners provide the needed metadata (geolocation,

contact information, access roads and conditions of APZs, reliability, etc.). Depending on the asset type, other information may also be required.

It is not enough to know where assets are. They also need to be adequately protected, with well-maintained APZs and good access on well-maintained roads and fire trails for appropriate fire fighting equipment. Ideally, the condition of these access roads needs to be, at least partially, the responsibility of the asset manager. The Inquiry heard that APZ preparation and maintenance for critical assets varies across the State.

Recommendation 29: That, in order to maximise the protection of critical infrastructure in a bush fire, Australian governments revise the regulatory framework for the provision to government authorities of information about all critical infrastructure (public and private) including a possible change to compel the owners of critical assets to provide all needed metadata, updated annually, for appropriate planning, preparation and response for bush fire. This would include information about location, ownership, access, details of service the infrastructure supports, and fire treatments of building and surrounding zones.

4.4.5.5.2 Improving the resilience of the electricity network for bush fire prone areas

The Inquiry notes that high voltage overhead powerlines are a hazard that can lead to bush fires.⁶¹⁰ Electricity providers do have statutory obligations to prevent their assets from starting a bush fire through appropriate vegetation management.⁶¹¹ It appears that in the 2019-20 season they performed these.⁶¹² However, there did not seem to be preparations to a level that might be expected given the signs that a very bad bush fire season was likely.

Putting power lines underground makes them more resilient to bush fire damage and therefore more reliable during a bush fire. However, this is significantly more expensive than installing them overhead.⁶¹³ An underground network is also more complicated to repair, potentially increasing the time it takes to restore power and to re-energise the network after a blackout event.⁶¹⁴ For bush fire prone areas, underground networks could be considered when the current overhead lines reach the end of their service life and need replacing.

⁶¹⁰ NSW Chief Scientist & Engineer. (2017). Final Report from the Energy Security Taskforce. Retrieved from https://www.chiefscientist.nsw.gov.au/_data/assets/pdf_file/0019/136711/171219-MASTER-NSW-Energy-Security-Taskforce-report-FINAL-SIGNED.pdf.

⁶¹¹ *Electricity Supply Act 1995* (NSW); *Electricity Supply (Safety and Network Management) Regulation 2014* (NSW); Department of Planning and Environment. (2015). NSW Code of Practice for Authorised Network Operators. Retrieved from <https://www.planning.nsw.gov.au/-/media/Files/DPE/Guidelines/nsw-code-of-practice-for-authorised-network-operators-2015-09-04.pdf?la=en>; Energy NSW. (2016). Guide for the Management of Vegetation in the Vicinity of Electricity Supply Infrastructure. Retrieved from <https://energy.nsw.gov.au/sites/default/files/2018-09/ISSC3-guideline-for-managing-vegetation-near-power-lines.pdf>.

⁶¹² Essential Energy, Submission to the Inquiry.

⁶¹³ Ibid.

⁶¹⁴ ACMA (Australian Communications and Media Authority). (2020). Impacts of the 2019–20 bush fires on the telecommunications network: Report for the Minister for Communications, Cyber Safety and the Arts. Retrieved from <https://www.acma.gov.au/publications/2020-04/report/impacts-2019-20-bushfires-telecommunications-network>; NSW Chief Scientist & Engineer. (2017). Final Report from the Energy Security Taskforce. Retrieved from https://www.chiefscientist.nsw.gov.au/_data/assets/pdf_file/0019/136711/171219-MASTER-NSW-Energy-Security-Taskforce-report-FINAL-SIGNED.pdf.

Stand-alone power systems (SAPS) are another alternative to traditional ‘poles and wires’ supply for customers in rural, remote and bush fire prone areas. These are not connected to the national electricity grid but may include local microgrids supplying electricity to multiple customers or individual power systems supplying electricity to a single customer. There are currently no regulatory barriers to network providers using SAPs on a temporary basis to respond to short-term need, including during natural disasters. The Inquiry notes that the COAG Energy Council has agreed to develop and introduce legislative amendments to implement a new regulatory framework for SAPS provided by electricity distributors in the National Electricity Market.⁶¹⁵ While it was intended that this occur in 2020, it is likely to be delayed due to the COVID-19 pandemic.

Like underground power lines, SAPS are generally initially more expensive due to the capital outlay, but there can be some long-term cost savings in operating them.⁶¹⁶ Technological developments mean SAPS are becoming more economically efficient and, in time, could be a viable option for replacing existing network assets after a bush fire, especially in areas that are costly to serve.⁶¹⁷ The Inquiry notes that SAPS have been used temporarily to restore power where bush fire has caused extensive and unreparable damage to existing infrastructure.⁶¹⁸ The cost to consumers of each option needs to be considered, as the potential increased reliability also generally means a higher cost for consumers overall.⁶¹⁹

Other resiliency options include the use of fire-resistant materials (such as composite power poles) and coating existing treated-timber poles with non-toxic fire retardant.⁶²⁰ However, these options also increase costs for customers.

The Inquiry notes the broader question: is it worth investing in these ways, and charging consumers commensurately, to a level that can withstand low-likelihood but high-consequence events? The trade off between these costs and benefits is best addressed in a collaborative manner between the utilities sector and government in order to come to agreement about the level of investment that best reflects the value placed on protection versus consumer cost.

⁶¹⁵COAG Energy Council (Council of Australian Governments). (2019). Australian Energy Market Commission Review of the Regulatory Frameworks for Distributor-Led Stand-Alone Power Systems – Priority 1 Final Report. Retrieved from http://www.coagenergycouncil.gov.au/sites/prod.energycouncil/files/publications/documents/COAG%20Energy%20Council%20Response%20-%20AEMC%20Review%20of%20the%20Regulatory%20Frameworks%20for%20Distributor-Led%20Stand-Alone%20Power%20Systems_2.pdf.

⁶¹⁶ Energy Networks Australia. Why stand-alone power systems are a no brainer. Retrieved from <https://www.energynetworks.com.au/news/energy-insider/2019-energy-insider/why-stand-alone-power-systems-are-a-no-brainer/>.

⁶¹⁷AEMC (Australian Energy Market Commission). (2020). Final Report Updating the Regulatory Frameworks for Distributor Led Stand-Alone Power Systems. Retrieved from https://www.aemc.gov.au/sites/default/files/documents/updating_the_regulatory_frameworks_for_distributor-led_stand-alone_power_systems_final_report_28_may_2020.pdf.

⁶¹⁸ Essential Energy, Submission to the Inquiry, p 20.

⁶¹⁹ AEMC (Australian Energy Market Commission). (2020). Reliability. Retrieved from <https://www.aemc.gov.au/energy-system/electricity/electricity-system/reliability>.

⁶²⁰ Essential Energy, Submission to the Inquiry.

4.4.5.5.3 Reliable backup plans during an emergency

Telecommunications

Reliable backup plans are essential to ensure that services continue during an emergency. There are many examples of backup systems being mobilised in the 2019-20 bush fire season. For example, Essential Energy provided large generators to power evacuation centres and council-owned critical infrastructure such as water supply and sewage treatment works at the Government's request.⁶²¹ Essential Energy also provided some customers who were experiencing extended outages (generally more than 10 days) with generators and fuel vouchers until power was restored.

In the telecommunications domain, there were also good examples of backup through the deployment of generators and other temporary facilities services (discussed further in Chapter 5). The Inquiry heard feedback from the community that the provision of backup communications by the telecommunication carriers was greatly appreciated.

However, there were also many occasions when no backup systems were in place, and people in bush fire zones were left without critical services for unacceptable periods of time.

For telecommunications, generally there are 10-16 hours of battery or generator backup for communication towers.⁶²² ACMA reported that, nationally, the average communication outage during the bush fires was 3.5 days.⁶²³ Taking this into account, ideally there should be 4-7 days backup based on site criticality and coverage,⁶²⁴ to ensure maintenance of communication services during power outages.

In addition to backup power plans, all communication providers should have mobile asset deployment strategies in place before an emergency.

The Inquiry also was told about other potential backup technologies, such as using unmanned aerial vehicles as telecommunication repeaters during the emergency,⁶²⁵ and/or ensuring a supply of satellite phones is available to maintain communication capabilities during bush fires.

As described above, the Inquiry sees merit in the current Triple Zero roaming arrangements between carriers expanded to include making calls, sending SMS, or accessing data during a bush fire emergency when there is reduced coverage due to asset damage.

The Inquiry notes the work being undertaken by the NSW and Commonwealth Governments on improving regional connectivity through the NSW Connecting Country Communities Fund, the Regional Digital Connectivity Program, and the Commonwealth's Mobile Black Spot Program. These programs are important as they will lead to a significant improvement of the communications network in regional NSW. The network will be further improved by the

⁶²¹ Ibid.

⁶²² This refers to NSW Telco Authority sites and not carriers. NSW Telco Authority. (2020). *Advice to the Inquiry provided 16 April and 21 July 2020*.

⁶²³ ACMA (Australian Communications and Media Authority). (2020). Impacts of the 2019–20 bush fires on the telecommunications network: Report for the Minister for Communications, Cyber Safety and the Arts. Retrieved from <https://www.acma.gov.au/publications/2020-04/report/impacts-2019-20-bushfires-telecommunications-network>

⁶²⁴ NSW Telco Authority. (2020). *Advice to the Inquiry provided 16 April 2020*.

⁶²⁵ Meeting with the Australian Centre for Field Robotics, University of Sydney, 4 March 2020.

Commonwealth Government's Telecommunications Emergency Resilience funding of \$27.1 million and an additional \$10 million from the Mobile Blackspots Program.⁶²⁶

Power

The community has a general expectation that backup power will be provided somehow. Electricity distributors are not legally obliged to provide backup power such as generators in situations such as the 2019-20 bush fires.⁶²⁷

An effect of this was uncertainty about who should provide and pay for backup services. Thus there was no coordinated approach to ensuring services still operated during the emergency. The Inquiry heard of some instances where multiple generators were deployed to the same location while some evacuation centres had none.⁶²⁸

Extensive comments to the Inquiry on this issue suggest that there is a strong community expectation that, in NSW, electricity distributors should be required to provide backup power in natural disasters. The Inquiry recognises that this expectation may not reflect the community's willingness to pay for this through electricity tariffs, and that any discussion of providing backup power must consider this. The Inquiry also recognises the disruption that power outages cause during a bush fire emergency, but also acknowledges the need to balance service reliability against the safety of workers while they are trying to get power back on.

The Inquiry notes that IPART received its relevant safety functions in 2015 under the *Electricity Supply (Safety and Network Management) Regulation 2014* (NSW)). IPART commenced bush fire preparedness compliance audits at this time and continued performance reporting requirements. These have been enhanced over time. These audits are designed to assess whether network operators are compliant with their safety and reporting obligations under the regulation, their licence conditions and IPART's published requirements.

IPART told the Inquiry that the level of engagement and performance of the four network operator licence holders, Ausgrid, Essential Energy, Endeavour Energy and Transgrid, has significantly improved since 2015. This was also noted in the most recent Annual Compliance Report for 2018-19.⁶²⁹ It is clear that bush fire preparedness is taken very seriously by the licence holders.

The Inquiry acknowledges IPART is currently conducting a Review of Distribution Reliability Standards, which includes looking at the types of events that are included/excluded in measuring reliability standards. The IPART review will also consider customers' willingness to pay for reliability and the interaction between incentives under the national electricity rules and licence conditions on network reliability. The national regulatory framework provides an incentive for distributors to deliver distribution services at least cost, and to maximise the value customers receive from consuming electricity. IPART will also make a

⁶²⁶ Prime Minister of Australia (2020). Boost for Bushfire Recovery Media Release. Retrieved from <https://www.pm.gov.au/media/boost-bush-fire-recovery>.

⁶²⁷ Essential Energy, Submission to the Inquiry.

⁶²⁸ Shoalhaven City Council, Submission to the Inquiry.

⁶²⁹ Noted throughout IPART Annual Compliance Report: Energy network operator compliance during 2018-19. Retrieved from <https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/licensing-compliance-energy-distribution-licences-annual-compliance-report/annual-energy-networks-compliance-report-2018-19.pdf>.

recommendation to the Minister in relation to a licence review which, if undertaken, will involve consultation with industry, the Department of Planning, Industry and Environment, and the community.⁶³⁰ The Inquiry suggests that there could be merit in considering whether the regulatory safety framework could be revised to include electricity resilience/preparation in relation to bush fires (i.e. in addition to bush fire prevention) – either by amending legislation or licence conditions, or by other means.

Recommendation 30: That, in order to minimise communication outages and extend basic communication coverage during bush fires, the NSW Government work directly, or together with other Australian governments and/or their relevant power and telecommunications regulatory, policy and market bodies, to:

- ensure there are sufficient redundancy options available (e.g. backup diesel generators, deployed temporary telecommunications facilities, etc.) to supply power to essential telecommunication infrastructure or alternative telecommunications infrastructure
- ensure that the telecommunication entities' and electricity network providers' Bush Fire Risk Management Plans are updated annually and reported on in the NSW RFS Commissioner's annual statement to Parliament on the upcoming bush fire season and include details of all actions taken to mitigate those risks including maintenance of APZs and access roads
- ensure there is appropriate auditing of distributors' preparedness for risks arising from network assets being affected by bush fire, as well as the risk of networks initiating a bush fire
- facilitate cross-carrier roaming arrangements between carriers and the public for basic text, voice and data during the period of emergency in areas directly affected by fire
- enable NSW RFS to require carriers to provide regular information on the status of outages and areas affected by fire.

4.4.5.6 Protection of water supplies to maintain water quality

Protecting water supplies and surrounding catchment areas from bush fires is important to prevent contamination of drinking water by phosphates, nitrates and suspended solids.⁶³¹ With the drought, this risk was exacerbated due to lower storage and dry inflows into key drinking supplies.⁶³²

WaterNSW manages and operates 42 water supply dams across NSW, and a range of other assets, including weirs, pipelines, catchment lands and monitoring equipment. Operating under the framework established in the *WaterNSW Act 2014* and the *Rural Fires Act 1997*, it is responsible for protecting these assets from bush fire. In Sydney's drinking water catchment, it has additional statutory obligations to manage water quality in the raw water supplied for treatment to Sydney Water and other customers.⁶³³

WaterNSW and the response agencies were largely successful in preventing critical damage to essential water supply and related electricity infrastructure, despite 33,355 hectares of

⁶³⁰ IPART (Independent Pricing and Regulatory Tribunal). (2020). *Advice provided to Inquiry 20 July 2020*.

⁶³¹ Meeting with Professor C J D Fell on 4 May 2020.

⁶³² WaterNSW. (2020). *Advice to the Inquiry provided 22 April 2020*.

⁶³³ Ibid.

WaterNSW land being burnt, including 90% of the Warragamba Special Area (WSA) (330,000 hectares) and 62% of the Shoalhaven Special Areas (900 hectares).⁶³⁴

Overall the bush fires had little impact on drinking water quality. Sydney's major water supply, Warragamba dam and its catchments, was proactively well prepared by land use planning, hazard reduction burning, and active membership of the local Bush Fire Management Committees. Considerable NSW RFS effort was devoted to protecting the dam and its catchments when under threat during this fire season. There was also a sustained effort to protect dams and catchments in regional areas such as Grafton and Bega

NSW RFS made efforts to keep the fire out of the metropolitan catchments, ensuring a proportion of the supply remained unaffected by fire. This was important for the short and long-term management of water quality in the Greater Sydney supply. Due to the heavy rainfall after the bush fire events, WaterNSW had to configure the system to source water from alternative sources for a short time. This helped avoid major impacts on water supply. However, there are still likely to be ongoing water quality impacts and increased risks to water quality for the water stored in Warragamba Dam.⁶³⁵

The planning and preparation of Warragamba dam and catchments by WaterNSW and NPWS in the special areas seemed to work well due to the factors specified below:

- active membership by WaterNSW and NPWS of the relevant Bush Fire Management Committees ensured that WaterNSW had a comprehensive hazard reduction program and well-coordinated hazard reduction activities, which ensured that essential water supplies were well prepared and protected
- fire towers, manned as needed through the fire season (October-March) and strategically located to detect fires early through smoke sightings in the special areas of the catchment, assisted with early fire detection and suppression
- WaterNSW's partnership with NSW RFS and NPWS for fire preparation and response was well established before the start of the season and resulted in the quick deployment of personnel to remote areas, and containment of fires through air resources (helicopters), effective use of fire towers, and advance ancillary works (for example APZs and fire trail clearances) – water was always available for the fire fighting effort
- during the 2019-20 bush fires, NSW RFS ensured that the application of all fire fighting chemicals was tracked and recorded spatially, and that the records were shared with WaterNSW following the bush fires to enable it to manage any residual risks.⁶³⁶

It is clear that for Sydney and its catchment, efforts put into preparation and planning to maintain and minimise fire impacts on drinking water quality were successful during the bush fire season. However, the Inquiry understands that with over 83% of the WSA burnt and a large proportion (over 100,000 hectares) burnt with high intensity, any potential longer term water quality impacts will need to be carefully monitored.

However, this was not always the case for regional areas which draw their water from streams that are not as well protected as Warragamba Dam and its catchment and, unlike Sydney, do not have inbuilt flexibility for managing supply.⁶³⁷ The bush fires did highlight the vulnerability of some regional water supplies during drought conditions, particularly areas

⁶³⁴ Ibid.

⁶³⁵ Ibid.

⁶³⁶ Ibid.

⁶³⁷ Meeting with Professor C J D Fell on 4 May 2020.

where a single supply source has to service a large residential population and fire fighting activities.

As discussed in Chapter 5, in some regional communities there were water quality issues. Mostly these related to the failure of power to water treatment facilities, highlighting again the importance of power infrastructure to water supply.

Consideration could be given to ways of improving the quality of regional water treatment infrastructure, such as by improving filtration systems, especially in high risk bush fire areas. The cost of any new filtration systems would need to be weighed up against the cost of fire fighting.

Overall a combination of preparation efforts and the strategic location of most water assets meant that water infrastructure across the State fared well.

The Inquiry recognises the work currently being undertaken by the NSW Government to develop a State Water Strategy and associated strategies, including the Greater Sydney Water Strategy, the Lower Hunter Water Security Plan and 12 regional strategies. These will consider the capability of town water supplies to provide secure supplies during periods of extended drought, both currently and under plausible climate change. This consideration could be extended to include the need for water for bush fire related activities.

4.4.5.7 Sewage treatment works

Temporary interruptions to power supply to sewage treatment plants and pumping stations were the primary concern for the regulator of these plants, the Environmental Protection Authority, again illustrating the importance of preparedness for backup power. Overall, with minimal interruptions and proactive supply of backup power, all licensed sewage treatment plants remained operational during the bush fires

Further details are provided in Chapter 5.

4.5 GETTING TO WHAT NEEDS PROTECTION AND LEAVING WHEN PROTECTION NOT POSSIBLE

4.5.1 Roads and roadside vegetation

Key points

- Although the road system in NSW overall worked well throughout the fires, road closures caused a great deal of stress and impeded fire fighting, evacuations and the supply of goods and services. Anticipating how to deal with this is important in planning before bush fires.
- Roads with good bush fire resilience (dual carriageway, wide road shoulders and construction from fireproof materials) were better protected from fire and able to reopen more quickly if fire affected.
- It is not practical to 'fire proof' all NSW roads – in these circumstances, timely public communications systems are required to ensure communities have enough time and information to relocate safely before an emergency.
- A formal bush fire risk assessment is required of all State roads and bridges to identify 'high-risk' communities; ensure all possible access and egress options are built into bush fire planning processes; and identify priorities for State road upgrades, regardless of who manages the road.
- Having systems for how to deal with trees that fall across roads is important.

- The management of roadside vegetation is complex, with bush fire risk and safety considerations needing to be balanced against multiple other factors (e.g. conservation, geotechnical, infrastructure corridors, cultural values, grazing, recreational uses and development).
- An outcomes-based approach to roadside vegetation management would provide a consistent framework for analysing road priority, utility, amenity, strategic value and risk and could tie in with other existing strategic land use and biodiversity processes.

Our road network is a lifeline for communities, and many submissions and comments were received about the adverse impact of road closures during the 2019-20 fires. Road closures form choke points, preventing fire agencies from moving operational resources, people from evacuating dangerous areas safely, and freight movers from delivering essential goods.

The Inquiry acknowledges that the overall road network in NSW continued to work well through the fires, due in part to the collaborative efforts of NSW RFS and Transport for NSW, particularly through its Transport Management Centre.⁶³⁸

However, the scale and intensity of the 2019-20 fires demonstrated the constrained capacity of some highways and roads linking regional areas to provide critical access during a fire event. About 880 km of roadside network assets were affected, with an estimated \$77 million worth of damage to State infrastructure across the transport network.⁶³⁹ As a result, between late August 2019 and February 2020, a great many State roads along the east coast and inland NSW were affected, with closures varying from several hours to a number of months.⁶⁴⁰

Factors such as the number of access roads into a town, the type of road carriageway, the ability of road infrastructure such as bridges to withstand fire damage, actual or likely fallen trees on roads, fires in roadside vegetation, and smoke impacts all contributed to the number and duration of road closures.

This section looks at these factors in two parts: issues arising out of road management and preparation for bush fire, and issues arising from the management of roadside vegetation.

The Inquiry notes that bush fire resilience requires road amenity, safety and access considerations to be balanced against environmental considerations, all within a complex legislative framework and competitive funding environment.

4.5.1.1 Roads

4.5.1.1.1 Roads management and bush fire planning and preparation

The Minister for Transport and Roads and the Minister for Regional Transport and Roads are jointly responsible under the *Roads Act 1993* (the *Roads Act*) for road transport policy and regulation in NSW.

⁶³⁸ The Transport Management Centre collects and distributes information about current and planned events on the NSW Road Network and, during incidents, provides real-time information and reporting on road conditions and management activities.

⁶³⁹ TfNSW (Transport for NSW). (2020). *Advice to the Inquiry provided 14 May 2020*.

⁶⁴⁰ TfNSW (Transport for NSW). (2020). *Advice to the Inquiry provided 7 July 2020*.

The *Roads Act* classifies roads, which are then administratively grouped into three categories for the purposes of road management: State, Regional and Local Roads.⁶⁴¹ State Roads are managed and financed through Transport for NSW (TfNSW), and Regional and Local Roads are managed and financed through the relevant local council. Given the network significance of Regional Roads, which perform an intermediate function between the main arterial network of State Roads and council-managed Local Roads, TfNSW provides financial support to councils for the management of Regional Roads.⁶⁴²

Under the *Rural Fires Act 1997*, Bush Fire Risk Management Plans (BFRMP) must contain all relevant information on assets, bush fire risk and treatment options that have been identified and approved by the relevant Bush Fire Management Committee (BFMC) for the area. As such, roads and road infrastructure, e.g. bridges, may be identified in local BFRMPs as an asset at risk, with a consequent strategy for protection in a fire. Some communities may also develop and implement Community Protection Plans (CPP), a more detailed tactical bush fire planning document prepared at a community level. These are developed either as an asset-specific treatment for a “very high to extreme risk human settlement asset” identified in a BFRMP, or by the NSW RFS in consultation with stakeholders, independently of the BFRMP.⁶⁴³ A CPP can empower communities to make decisions and take responsibility for their own safety by increasing their understanding of bush fire threats and identify, assess and describe contingency options (including evacuations) available before and during a fire.⁶⁴⁴ As noted in previous sections, the Inquiry heard⁶⁴⁵ in some instances that often information about key infrastructure, including bridges and roads, was missing from community bush fire planning and preparations.

Under the *Environmental Planning and Assessment Act 1979*, the *Planning for Bush Fire Protection* (PBP) document (discussed at 4.4.4 above) specifies performance criteria and acceptable solutions for access arrangements to different types of development, including strategic planning for the road system. Regional and Local roads broadly fit under the PBP as non-perimeter roads, which the PBP acknowledges are critical to fire fighting operations by providing access for fire agencies and emergency vehicles, as well as a safe space for conducting property protection and a suitable road network for the evacuation of residents.⁶⁴⁶

4.5.1.1.2 Road network resilience

The Inquiry was informed by both the Australian Road Research Board and Transport for NSW that the features of an ideal bush fire resilient road network are dual carriageway configuration with wide road shoulders and wide separation of opposite-travelling lanes, and

⁶⁴¹ TfNSW (Transport for NSW). (2018). Roads classification, RMS. Retrieved from <https://www.rms.nsw.gov.au/business-industry/partners-suppliers/lgr/arrangements-councils/road-classification.html>.

⁶⁴² Ibid.

⁶⁴³ RFS (NSW Rural Fire Service. (2019). Community Protection Planning, Guideline. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0004/110983/NSW-RFS-CPP-Guideline_May-2019.pdf.

⁶⁴⁴ Ibid.

⁶⁴⁵ Kangaroo Valley Community Bushfire Committee, Submission to the Inquiry.

⁶⁴⁶ NSW RFS (NSW Rural Fire Service. (2020). Planning for Bush Fire Protection. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0005/174272/Planning-for-Bush-Fire-Protection-2019.pdf.

construction from fireproof materials.⁶⁴⁷ [A third feature is clear verges, which is discussed under Roadside Vegetation below.]

Shoalhaven City Council told the Inquiry that the Princes Highway presents ongoing significant risks to the safety and protection of human life, because it is of single carriageway configuration for most of its length between Nowra and Gippsland in Victoria. Throughout the 2019-20 fire season, various sections of the Princes Highway between Victoria and Nowra experienced multiple closures in December 2019 and January 2020 extending from several hours through to three weeks.⁶⁴⁸ Impediments to reopening these sections included the risk of falling trees and active strategic fire fighting operations, including backburning. Closure of the Princes and Kings Highways on the South Coast prevented people from evacuating dangerous areas. This left locals and tourists isolated and vulnerable, and also put greater pressure on local businesses' supplies of fuel and food. Some of these businesses had to close because they were unable to restock, further contributing to the distress of the stranded community which could not access essential supplies. For example, Woolworths Bermagui was closed from 2-7 January as a result of road closures into the town and power outages. In a public statement, Woolworths reported that, though other stores in the region were open, the flow of trucks with replenishment stocks was a problem.⁶⁴⁹

By contrast, where road corridors were built or upgraded to a higher standard of resilience, key sections of road were able to remain open, or to be cleared and reopened, much faster.⁶⁵⁰ This enabled more efficient evacuation and the transportation of essential services and supplies. The Pacific Highway and M1 were closed and reopened reasonably quickly, within a matter of 3-5 hours.⁶⁵¹ Transport for NSW provided the Pacific Highway as a case study in a resilient road corridor.⁶⁵²

The Pacific Highway is a prime example of a key road corridor that has been upgraded, and as a result greater fire resilience has been achieved:

- *dual carriageway enabled some lanes to reopen while ongoing recovery and repair activities were being completed, particularly where the road surface was damaged*
- *dual carriageways, with their additional cleared width, can act as a fire break, serve as a platform to control fires or provide safer access to and from a fire zone*
- *structures along the route comprise concrete bridges, concrete pipe culverts and steel signposts with aluminium facing. This increased fire resistance of assets reduced the propensity for damage and increased the ability for sections of road to be reopened faster.*

TfNSW reported to the Inquiry that up to \$14 million was expended during the 2019-20 fires on preparing roads for reopening (such as traffic control and staff response) and rail replacement coach transportation for public transport customers.⁶⁵³

⁶⁴⁷ Meeting with the Australian Roads Research Board on 8 May 2020.

⁶⁴⁸ TfNSW (Transport for NSW). (2020). *Advice to the Inquiry provided 7 July 2020*.

⁶⁴⁹ Woolworths. (2020). Bushfire Updates. Retrieved from <https://www.woolworths.com.au/shop/discover/community/bushfires>

⁶⁵⁰ TfNSW (Transport for NSW). (2020). *Advice to the Inquiry provided 14 May 2020*.

⁶⁵¹ TfNSW (Transport for NSW). (2020). *Advice to the Inquiry provided 7 July 2020*.

⁶⁵² TfNSW (Transport for NSW). (2020). *Advice to the Inquiry provided 14 May 2020*.

⁶⁵³ Ibid.

Though alternate road routes for many of the key corridors affected and closed were pre-planned by TfNSW and identified where necessary by the relevant BFMC, in conjunction with Local Emergency Management Committees, as part of the local bush fire risk management planning, the scale and sheer footprint of the 2019-20 fires meant that even these alternate routes were sometimes also closed. For example, the planned alternate route for the Great Western Highway is via Bells Line of Road. During the 2019-20 fires, on one occasion both the Great Western Highway and Bells Line of Road were simultaneously under direct bush fire threat and were closed. TfNSW provided other examples:⁶⁵⁴

On 12 November 2019 all north-south and east-west routes between the North Coast and New England were closed simultaneously including the Pacific Highway (near Taree and Maclean to Ballina), Oxley Highway (Wauchope to Walcha), New England Highway (north of Tamworth) and Gwydir Highway (Grafton to Glen Innes). This also occurred on the afternoon of 21 December 2019, where four major highways were closed (Princes, Hume, Illawarra and Great Western Highways), in addition to the Western and Southern rail lines being closed and unable to run rail replacement coaches due to the highway closures.

4.5.1.1.3 Road alternatives

A similar story applies to alternate rail freight networks, which are used for less time-critical supplies, and to support passenger movements when key road freight and passenger routes are closed.⁶⁵⁵ Though the rail industry escaped the 2019-20 fires largely unscathed, with only 20 built assets on the rail corridor affected,⁶⁵⁶ there were frequent passenger and freight service disruptions particularly in Sydney's outer urban fringes.⁶⁵⁷

The Inquiry notes that in the South Coast, where both road and rail networks were unavailable for evacuations, community members initiated water transport routes along rivers and coastline to provide supplies and communications to isolated communities, until assistance was able to reach them by road.⁶⁵⁸

These examples highlight the criticality of effective intermodal transport routes, not just for commercial purposes, but also as a lifeline to communities and as strategic logistical importance for the movement of goods and people. These alternatives need to be included in planning for access to and egress from communities at risk of bush fire.

4.5.1.1.4 No single source of road closure information

No road network can be completely fire proofed. Timely and effective public communications are required to ensure communities have enough time and information to relocate safely prior to an emergency and evacuate during it.

Statements to the Inquiry showed that early communications about potential road closures were effective as they allowed residents time to respond and prepare.⁶⁵⁹ However, some submissions emphasised the need for a centralised platform to communicate road closure

⁶⁵⁴ Ibid.

⁶⁵⁵ Ibid.

⁶⁵⁶ Ibid.

⁶⁵⁷ Carter, Mark. (2020, 6 January). Bushfires impact rail in New South Wales, *International Railway Journal*. Retrieved from <https://www.railjournal.com/regions/australia-nz/bushfires-impact-rail-nsw/>.

⁶⁵⁸ TfNSW (Transport for NSW). (2020). *Advice to the Inquiry provided 14 May 2020*.

⁶⁵⁹ Meeting with TMC (Transport Management Centre) 1 June 2020; Vanessa Keenan, Submission to the Inquiry.

notices.⁶⁶⁰ Currently, notices for State-managed road closures can be found online using the *Live Traffic NSW* app, but it does not cover the closure of council-managed roads. This means that residents preparing to evacuate using local roads may need to access both the app and multiple council websites. The section on Public Warning Systems in Chapter 5 of this report further explores effective communication of public information and warnings as a critical element of emergency management.

4.5.1.1.5 Only one road in and one road out

The Inquiry noted the concerns expressed by many communities, particularly on the South Coast, about the risks presented when access to a town from an arterial road is via a single road. For example, residents who attended the Lake Conjola/Conjola Park community meeting held by the Inquiry called for an examination of this issue for towns and villages which are surrounded by bushland.

The discussion above canvasses some options for increasing the resilience of roads. But the Inquiry recognises that issues such as cost, topography, land ownership, and environmental considerations mean that the practicality of building additional access roads or upgrading existing access roads is low. The Inquiry makes no recommendations on this issue, except to reinforce recommendations in previous parts of this report that leaving early is the most practical option in these cases and this needs to be communicated well to the relevant communities.

4.5.1.1.6 Building NSW's road network capacity and resilience

The NSW road network is a lifeline to communities and of logistical importance for the movement of goods and people. The 2019-20 bush fires highlighted the vulnerability of regional communities when key road corridors are closed and planned alternate routes are unavailable.

Road upgrades

A number of statements were made to the Inquiry noting that, although a road network cannot be completely fire-proofed, it can be made more fire resilient by being constructed with dual carriage-way configuration, wide shoulders, clear verges and fire-resistant materials. Roads built or upgraded to this standard can foster confidence in the community that they will have access in a bush fire situation to a road which is protected, safe, useable and maintained, even if affected directly by fire or smoke. These measures also bring road safety advantages for everyday use and in other natural disaster situations.

The Inquiry commends the \$960 million investment committed to improve the Princes Highway between Jervis Bay Road and Moruya. A strategic business case is underway for upgrade projects from south of Nowra to the Victorian border and is expected to be complete by the end of this year. A further \$2.5 billion has been committed to upgrade the Great Western Highway between Katoomba and Lithgow.⁶⁶¹

The Inquiry also acknowledges that the NSW Government's *Future Transport Strategy 2056* identifies East-West corridors across bush fire affected areas in NSW that would benefit from improved freight and community connection. These corridors include.⁶⁶²

⁶⁶⁰ Robert Leahy, Submission to the Inquiry; Dr Stephen Ranck, Submission to the Inquiry.

⁶⁶¹ TfNSW (Transport for NSW). (2020). *Advice to the Inquiry provided 7 July 2020*.

⁶⁶² TfNSW (Transport for NSW). (2020). *Advice to the Inquiry provided 14 May 2020*.

- linking the Hunter Expressway with the Golden Highway and New England Highways, and developing the Golden Highway to provide an alternative route from Central West and Orana around Greater Sydney
- investigation of improvements to the Bells Line of Road and Great Western Highway to continue to deliver benefits for local communities and the Central West and Orana
- investment in the Illawarra escarpment to improve the connections from Wollongong to Sydney and the South East and Tablelands and to maximise access to Port Kembla
- improvements between the city and the coast via the Kings Highway for both access to services and to support the visitor economy improvements to the Gwydir Highway between Grafton and Glen Innes, improving safety and freight access between the New England tablelands and western plains with the North Coast.

Many community stakeholders called for the upgrade of secondary roads (describing them sometimes as ‘goat tracks’) to mitigate the risk of being isolated in a fire event. Often, upgrades of these regional and local roads are a local council responsibility.⁶⁶³ However, the scale of the recent fires demonstrated that even upgraded secondary roads can be similarly affected by fires, so upgrades may not necessarily result in optimal outcomes for the relevant community in a bush fire event nor be the most appropriate or cost-effective means of improving fire protection.

Improved bush fire planning and protection of road infrastructure

For roads which do not meet the criteria for fire-resilience set out above, formal standardised bush fire risk assessment guidelines and supporting processes could operate. These guidelines could be based on the *Road Bushfire Risk Assessment Guideline and Risk Mapping Methodology* led by VicRoads and involving other government stakeholders and Councils following the Victorian Bushfires Royal Commission (2009).⁶⁶⁴ This would complement the acceptable solutions presented for new developments outlined in the PBP. Such guidelines would ensure that high-risk communities with a single linking road are identified, and that planning and preparation to communicate early community evacuations are implemented.

Noting that no two fires burn the same way, further route options analysis in planning for the prioritisation of evacuation, critical goods delivery and services is always required during and just after a bush fire emergency for rapid identification of necessary road closures – it can’t all be done in advance of the fire season. The Inquiry suggests the route options analysis included in the proposed guidelines should be developed in consultation with NSW RFS and cover potential closures or damage to road infrastructure assets in high risk areas, to improve access and the ability to deliver critical goods and services to local communities and emergency services.

Recommendation 31: That, in order to improve bush fire planning and protection of road infrastructure and to ensure communities, freight movers and fire fighting agencies have appropriate access and egress in a bush fire event, Government, working with local government as needed:

- develop a formal bush fire risk assessment process for all State roads and bridges, to identify:

⁶⁶³ TfNSW (Transport for NSW). (2020). *Advice to the Inquiry provided 7 July 2020*.

⁶⁶⁴ VicRoads. (2013). *Road Bushfire Risk Assessment Guideline and Risk Mapping Methodology Guideline*. Retrieved from <https://www.vicroads.vic.gov.au/business-and-industry/design-and-management/bushfire-risk-assessment-guidelines>.

- 'high-risk' communities where access and egress in the event of a fire will be affected, for example rural communities connected by a single road surrounded by bushland, and ensure community bush fire planning processes (i.e. Bush Fire Risk Management Plans (BFRMPs) or Community Protection Plans) include plans to 'leave early' or enforce mandatory evacuation orders
 - how waterways can be integrated better into the transport network as evacuation routes or places of shelter when road and rail transport is unavailable – waterways should be included in regional emergency management plans
 - route options for rapid identification of needed road closures in the event of fire
 - key sections of the State's road network for future upgrade to ensure whole corridors are resilient to fire impacts, regardless of who manages the asset
 - audit, through the NSW RFS Audit Unit (to be established) the inclusion of critical road infrastructure in BFRMPs prepared by Bush Fire Management Committees (ensuring that appropriate transport representation is provided to BFMCs) and Local Emergency Management Committees across the State.
- In support of these measures, it will be critical that the community is given early warning of bush fire events and has ample time to evacuate prior to or during an emergency.

4.5.1.2 Roadside vegetation

The Inquiry was provided with evidence that the primary factors affecting the duration of a road closure were damage to utilities and road infrastructure and clearing of damaged trees at risk of falling on the road.⁶⁶⁵

Community input to the Inquiry often reflected stories of impeded road access due to fallen trees or power poles. In reflecting on the Tianjara and Currowan fires, one person stated:

*The main access road was completely blocked by several large trees which had fallen across the road, this meant there was no ability for any assistance to get through this way.*⁶⁶⁶

Many local people and tourists were prevented from evacuating dangerous areas in the South Coast fires due to prolonged closure of the Princes and Kings Highways because of burning trees or destabilised trees at risk of falling post fire. As previously mentioned, these closures also left people isolated and unable to access essential goods and services, with flow-on effects for local businesses.

The Inquiry was advised that road clearing extended beyond NSW. For example, when the Princes Highway was cleared to the Victorian border, local Transport for NSW (TfNSW) teams went above the call of duty to continue clearing to Mallacoota (with permission from their Victorian counterparts) to give the town connection to NSW for supplies and evacuation if required. TfNSW advised that Victorian response crews were very appreciative as the Victorian access took an extended period to clear.⁶⁶⁷

⁶⁶⁵ TfNSW (Transport for NSW). (2020). *Advice to the Inquiry provided 7 July 2020*.

⁶⁶⁶ Greg Mitchell, Submission to the Inquiry.

⁶⁶⁷ TfNSW (Transport for NSW). (2020). *Advice to the Inquiry provided 14 May 2020*.

TfNSW provided the Inquiry with an additional example highlighting the advantages of the design of the Pacific Highway:⁶⁶⁸

The upgraded Pacific Highway can again be used as an exemplar key road corridor ... It was quickly returned to normal operations because, in addition to the road design and asset configurations described above, wider road reserves and less mature vegetation meant it was little affected by burning trees. Sections of the highway could be reopened within several hours, once the immediate fire and smoke threat had passed. Older sections with narrower road reserves or more mature vegetation took much longer to reopen.

Roadside vegetation was also identified as creating a number of further risks. Where roads are immediately flanked by scrub, and particularly by trees higher than the road is wide, nearby powerlines can be threatened. Each connection point between a tree and a powerline becomes a potential ignition site and can also disrupt power supply. Power outages then affect people's ability to respond to a fire event and subsequent recovery efforts. This potential outcome is not bush fire specific – strong wind, car accidents or human actions can have the same result. Significant roadside grass fuel loads also create a fire risk and need to be managed to prevent ignitions.

Community members often criticised State and local authorities for failing to clear roadside vegetation appropriately, with some describing vegetation management as biased in favour of environmental principles noting that the preference seemed to be to keep trees – regardless of their condition or associated risks.

4.5.1.2.1 Management of roadside vegetation for bush fire preparation

The *Rural Fires Act 1997* contains some bush fire vegetation clearing requirements,⁶⁶⁹ but so does other legislation, including the *Roads Act 1993*, the *Environmental Planning and Assessment Act 1979* and related planning instruments, the *State Emergency and Rescue Management Act 1989* and the *Local Land Services Act 2013*.

In addition, legislative requirements about specific environmental aspects of roadside reserve management are contained in NSW's *Biodiversity Conservation Act 2016* and *Weeds Management Act 2001*, and in the Commonwealth's *Environmental Protection and Biodiversity Conservation Act 1999*.

This range of legislation adds complexity to the overall control and coordination of roadside vegetation.

Biannual multi-agency collaboration sessions are held at the change of major natural disaster seasons – following fires and flooding during summer and snow and ice during winter – to review the outcomes of each agency's response and plan for the season ahead.⁶⁷⁰

In addition, the NSW Roadside Environment Committee (REC) meets four times a year for the purpose of promoting and coordinating leading practice in environmental management of

⁶⁶⁸ Ibid.

⁶⁶⁹ *Rural Fires Act 1997* Part 4.

⁶⁷⁰ TfNSW (Transport for NSW). (2020). *Advice to the Inquiry provided 14 May 2020*.

linear reserves, including roadside reserves, across the State.⁶⁷¹ The REC is an umbrella body of linear infrastructure managers and environment organisations, with 13 member organisations currently including TfNSW, NSW RFS, Local Land Services and Local Government NSW. Bush fire management and fire regimes are identified as a key environmental management issue by the REC.⁶⁷²

Responsibility for the management of road reserves along main roads and highways lies with TfNSW and various other State government agencies, while responsibility for managing local roads and their reserves lies with local councils.

TfNSW Asset Management Plans incorporate general road maintenance programs, including hazard reduction, which contribute to bush fire readiness. TfNSW does not undertake back burning as a method of hazard reduction but uses mechanical thinning or pesticides to reduce fuel loads.⁶⁷³ However, in some rural areas, NSW RFS may request access to TfNSW property to conduct back burning in accordance with community hazard reduction plans.⁶⁷⁴

Council works on existing roadsides are covered under the relevant Local Environment Plan and do not require a permit. However, local councils do have a responsibility to undertake a Review of Environmental Factors to ensure appropriate management of environmental values. Further, local councils are encouraged to implement Roadside Vegetation Management Plans or similar.

Bush Fire Risk Management Plans, as developed by the relevant Bush Fire Management Committee under the *Rural Fires Act*, need to cover linear reserves.

4.5.1.2.2 Competing priorities

Despite these responsibilities and coordinating efforts, the complex statutory framework means that different agencies give different priorities to different factors in decisions about clearing roadside vegetation, and the 2019-20 fires exposed the tensions around balancing these factors.

Bush fire risk and safety considerations must be balanced against not only conservation needs but also geotechnical requirements, legal requirements, infrastructure corridors (water, power, telecommunications), cultural values, grazing, recreational uses like mountain biking, horse riding and hiking, and development.

Feedback from councils to the Inquiry reflected local frustrations with the legislative framework. In its submission, Snowy Valley Council used an example of tensions between permissible roadside grazing and increased requests for such as a result of drought, ultimately calling for State and Commonwealth governments to:

- ... identify legislative complexities relating to roadside management, review and amend to facilitate a range of works on roadsides to reduce bush fire risk
- provide[s] consistent guidance to Councils and other road managers to help resolve competing environmental and fuel load objectives for roadside managers ...

⁶⁷¹ NSW Roadside Environment Committee. (2018). Annual Report 2017-18. Retrieved from <https://www.rms.nsw.gov.au/documents/about/environment/2017-18-annual-report.pdf>.

⁶⁷² Ibid.

⁶⁷³ TfNSW (Transport for NSW). (2020). *Advice to the Inquiry provided 14 May 2020*.

⁶⁷⁴ Ibid.

Several state and national transport organisations and stakeholders reported to the Inquiry that the limiting factor to clearing road verges was a shift towards prioritising environmental values and protecting trees as animal habitat.⁶⁷⁵

These stakeholders advocated the removal of trees from within boundary to boundary zones, highlighting that forgiving road environments do not include hazards like trees and that this is true for everyday use as well as in any natural disaster event.

The Inquiry noted that roadside verges can be widened in an environmentally supportive and conservation friendly way through the use of biodiversity offsets.

4.5.1.2.3 Outcomes-based roadside vegetation management for the broader road network

In addition to prioritising strategic investment and verge clearing on key trunk roads (most of which are a State responsibility), the Inquiry suggests placing a greater focus on outcomes-based vegetation management for the broader road network. It is essential that the councils responsible for Local and Regional roads have clear and consistent frameworks to guide decision making about roadside vegetation management.

Outcomes-based vegetation management involves assessing the protection of roads on a case-by-case basis, following an analysis of:

- priority (is the road an arterial road or alternate route?)
- utility (is it an evacuation route, or does it provide access for emergency services?)
- amenity (is the road and associated infrastructure serviceable?)
- risk level (is the road frequently affected by fire?)
- strategic value (is the road able to be used as a fire break, or in other strategic fire fighting operations?).

In providing guidance for calculating the details of Asset Protection Zones, the NSW RFS *Planning for Bush Fire Protection* document (PBP) specifies landscape characteristics for consideration including fuel loads, vegetation composition and maturity and landscape configuration – including distance, slope and setbacks.

An outcomes-based framework should similarly account for these landscape characteristics when assessing roadside vegetation management outcomes for a road. Following assessment, it may be that, in some areas, risk can be adequately addressed by the provision of strategically placed road pull-out zones available for use in case of an emergency, or for evacuation, fire fighting, supply delivery and other necessary activities.⁶⁷⁶

Recommendation 32: That, in order to ensure outcomes-based roadside vegetation management to reduce roadside tree fall and grass ignitions in planning and preparing for bush fire, Transport for NSW, working with local government and NSW RFS, establish a consistent framework for roadside vegetation management that analyses road priority, utility, amenity, strategic value and risk. The framework should:

- take into consideration landscape characteristics like distance, slope, set back, vegetation maturity and type. Acceptable outcomes under this framework could include clear verges, or alternatives such as safe zones/pull-outs.
- tie in formally with other strategic land use and biodiversity processes.

⁶⁷⁵ Meeting with the Australian Roads Research Board on 8 May 2020.

⁶⁷⁶ TfNSW (Transport for NSW). (2020). *Advice to the Inquiry provided 14 May 2020*.

A framework such as this should assist in balancing the objectives of existing roadside management, including road safety, bush fire risk mitigation, preservation of roadside amenity, and protection of environmental values.

4.5.2 Fire trails

Key points

- The fire trails required for the 2019-20 season were inadequate.
- Although the 2017 amendments to the *Rural Fires Act 1997* provide a sound basis for managing a strategic and integrated network of fire trails across NSW, insufficient implementation has occurred.
- Implementation needs to be accelerated through deadlines for completion of Fire Access and Fire Trail plans, and better monitoring and review processes.
- There is no whole-of-government asset management system for fire trails at present, inhibiting the prioritisation of fire trail creation and maintenance.
- The process for negotiating fire trails through land with multiple owners is complex, challenging and not guaranteed of success.

The State-wide network of fire trails is a key component of NSW's ability to prevent, fight, manage or contain fires in order to protect life and assets. It is estimated that NSW has some 75,000 kms of fire trails⁶⁷⁷ – the actual total will be confirmed once the Fire Access and Fire Trail plan process (described below) being undertaken by NSW RFS is complete. Fire trails cover private and public land and, like NSW roads, are managed by various public and private landholders and occupiers.

The Inquiry heard at community meetings, consultations and through submissions that the fire trails were not good enough to deal with a very bad fire season such as 2019-20. Many community members told the Inquiry that inadequate maintenance of existing fire trails and failure to construct new strategic fire trails caused significant delays accessing fires, and that this allowed the momentum and intensity of fires to build – subsequently increasing risks to fire fighter safety. It also meant people and heavy plant were inefficiently deployed at the last minute to cut tracks into fires, causing unplanned and potentially avoidable damage to biodiversity and cultural assets.

The scale and severity of the 2019-20 fire season has highlighted the fact that, even though amendments to the *Rural Fires Act 1997* in 2017 provided a legislative framework for the management of fire trails and improved whole-of-government focus and associated funding for them, progress in planning, preparing, implementation and delivery has been slow. More work still needs to be done to build NSW's fire trail network.

4.5.2.1 Fire trail management in NSW before 2017

Historically, decisions about the establishment and maintenance of fire trails in NSW sat with the various "land managers guided by a cooperative framework established by the NSW Bush Fire Coordinating Committee (BFCC)".⁶⁷⁸ There was not a whole-of-government strategy or consistency about fire trail building and maintenance standards.

⁶⁷⁷ RFS (NSW Rural Fire Service). Fire Trail Register. Retrieved from <https://www.rfs.nsw.gov.au/plan-and-prepare/fire-trails/fire-trail-register>.

⁶⁷⁸ NSW RFS (NSW Rural Fire Service). (2016). Fire Trail Standards. Retrieved from http://www.rfs.nsw.gov.au/_data/assets/pdf_file/0009/69552/Fire-Trail-Standards-V1.1.pdf.

Public land management agencies in NSW all approached and managed fire trails somewhat differently as assets within their various portfolios. And fire trails often served multiple purposes. For example, Forestry Corporation NSW built and managed a strong network of combined trails and access roads for fire mitigation works, which are primarily used for commercial purposes such as hauling timber.⁶⁷⁹ NPWS manages over 31,000 km of fire trails,⁶⁸⁰ some of which are used for visitor access, for recreation purposes or for land conservation management programs.⁶⁸¹

From a fire fighting perspective this situation was problematic and was the subject of discussion for some years until the Wambelong bush fire became a catalyst for change.

In mid-January 2013, the Wambelong bush fire burnt over 55,000 hectares, including 53 homes and 95% of the Warrumbungles National Park.⁶⁸² Following this fire, the worst NSW had seen in over a decade at that point, a need for a different approach to fire trail management was identified. Both a Parliamentary Committee Inquiry and a Coronial Inquiry were held into the Wambelong fire. The Parliamentary Committee heard evidence that the NPWS did not maintain fire trails to be effective fire breaks (though the NPWS disagreed), and that there were not enough fire trails in the park or in the general area.⁶⁸³ It concluded, among other things, that more fire trails were needed, and recommended that “NPWS, at the direction of NSW RFS, enhance the network of trails within national parks across NSW,” including by reopening trails that had been closed within the previous 10 years.⁶⁸⁴ The Coronial Inquiry also recommended that the NPWS consider developing additional fire trails in the park.⁶⁸⁵

4.5.2.2 Fire trail management since 2017

In February 2015, the NSW Government announced its commitment to introduce legislation giving the NSW RFS the powers it needed to create an improved, standardised and integrated fire trail network across the State.⁶⁸⁶ Amendments to the *Rural Fires Act 1997* came into effect on 1 July 2017.

The Act now allocates to the NSW RFS Commissioner specific powers to:

- issue Fire Trail Standards – these Standards set out prescribed performance criteria for all fire trails on land throughout the State
- designate, certify and register trails

⁶⁷⁹ FCNSW (Forestry Corporation of NSW). (2020). *Advice to the Inquiry provided 27 March 2020*.

⁶⁸⁰ NPWS (National Parks and Wildlife Service). (2020). *Advice to Inquiry provided 25 March 2020*.

⁶⁸¹ NPWS (National Parks and Wildlife Service). (2020). *Advice to Inquiry provided 5 July 2020*.

⁶⁸² RFS (NSW Rural Fire Service). (2013, 22 May). Ferocious – The Wambelong Fire. Retrieved from <https://www.rfs.nsw.gov.au/news-and-media/general-news/ferocious-the-wambelong-fire>.

⁶⁸³ NSW Legislative Council, General Purpose Standing Committee No. 5. (2015). Wambelong fire. Retrieved from

[https://www.parliament.nsw.gov.au/lcdocs/inquiries/1951/150220%20GPSC5%20Report%2041%20\(Final\).pdf](https://www.parliament.nsw.gov.au/lcdocs/inquiries/1951/150220%20GPSC5%20Report%2041%20(Final).pdf).

⁶⁸⁴ Ibid.

⁶⁸⁵ Coroners Court New South Wales. (2015, 28 September). Inquiry into fire at Wambelong Camp Ground, Warrumbungles National Park, New South Wales January 2013. Retrieved from <http://www.coroners.justice.nsw.gov.au/Documents/Warrumbungles%20findings%20Final%2028%2008%2015.pdf>.

⁶⁸⁶ NSW Government. (2016). Response to recommendations of the Parliamentary and Coronial Inquiries into the Wambelong fire. Retrieved from <https://www.parliament.nsw.gov.au/lcdocs/inquiries/1951/Government%20Response.pdf>.

- direct an owner or occupier of public land to construct and maintain a fire trail and enter into an agreement with private landowners where the BFMC identifies a need for the construction of a fire trail on private land.

Further provisions relate to fire trail:

- identification as strategic or tactical
- construction and maintenance
- signage
- complaints and compliance
- reporting.

The Act also requires the State's 56 Bush Fire Management Committees (BFMC) to prepare Fire Access and Fire Trail (FAFT) plans for their relevant areas and to ensure there is a strategic network of fire trails for their area and that the pre-season condition of this network is satisfactory. The FAFT plans supplement existing fire planning activities undertaken at the local level, such as bush fire risk management planning, and identify the appropriate means of accessing land to prevent, fight, manage or contain bush fires. FAFT plans are to comprise a map showing a base layer of all existing vehicular tracks, trails and roads and the identified fire trail network for that area. They should also include a register of the identified fire trails within the network, and include information such as name, status, vehicle carrying capacity, current conditions and responsible agency, among other matters.⁶⁸⁷ BFMCs must submit FAFT plans for approval by the Bush Fire Coordinating Committee (BFCC) every five years,⁶⁸⁸ for the NSW RFS Commissioner to certify and register on the NSW RFS website.

It is clear to the Inquiry that good work has been undertaken to develop and build a robust framework underpinning fire trail management. The Standards were gazetted on 8 September 2017,⁶⁸⁹ and on-ground works have commenced in the Lower Hunter BFMC area which has hosted pilot processes for FAFT planning and associated outcomes.⁶⁹⁰

The Inquiry considers that this legislation and supporting programs provide a sound basis (with some additions covered in the recommendation below) for managing a strategic and integrated network of fire trails across the entire State.

4.5.2.3 Examples of good fire trail management and good technology to deal with fire trails issues

The Inquiry heard some examples of good practice with regard to fire trails.

The Forestry Corporation builds and maintains 60,000 kms of fire trails and access roads to provide close and rapid access to fires for mitigation works, suppression and containment on its land and neighbouring properties. It reported to the Inquiry that its preparation programs and activities were brought forward in anticipation of early fire season onset, and a potentially high-tempo fire season. This included significant investments and additional

⁶⁸⁷ RFS (NSW Rural Fire Service). (2016). Fire Trail Standards. Retrieved from http://www.rfs.nsw.gov.au/_data/assets/pdf_file/0009/69552/Fire-Trail-Standards-V1.1.pdf.

⁶⁸⁸ RFS (NSW Rural Fire Service). (2017). Policy 1/2017 Fire Trails, Bush Fire Coordinating Committee. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0011/9596/BFCC-Policy-1-2017-Fire-Access-And-Fire-Trails-FAFT.PDF.

⁶⁸⁹ NSW RFS (NSW Rural Fire Service). (2020). Fire Trails. Retrieved from <https://www.rfs.nsw.gov.au/plan-and-prepare/fire-trails>.

⁶⁹⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 16 July 2020*.

resourcing ahead of the 2019-20 season.⁶⁹¹ More details are given in Chapter 5, section 5.5.3.2.

Additionally, Forestry Corporation's in-house-developed MapApp mapping application, allows it to collect, display and share spatial information in real time for field-based activities including land and fire planning and management such as access and fire trails.⁶⁹²

The NPWS informed the Inquiry of its innovative process for assessing fire trail condition, using the Road Asset Condition Assessment System (RACAS)⁶⁹³ also operated by NSW RFS. The system was used during the NPWS' Fire Trail Assessment Program, from October 2018 through 2019, and assessed 78% of the NPWS fire trail network. RACAS involves a spatially enabled, camera-based system fitted to the roof of NPWS vehicles and linked by cable to an in-car display tablet for data recording. The information captured can be analysed remotely to assess spatial reference, surface condition, surface type, width and slope, roughness, adjacent vegetation growth and defects, with the possibility of point-in-time annotation by staff.⁶⁹⁴

The Inquiry acknowledges the potential for both MapApp and RACAS to be used more widely to inform a range of decision making about fire trails.

4.5.2.4 Yet fire trails in NSW were inadequate in 2019-20

Nonetheless, the Inquiry heard a repeated message from many stakeholders – that the poor condition of the fire trail network significantly slowed up and hindered fire suppression activities during the 2019-20 season. The issues identified by various stakeholders included:

- poor maintenance of fire trails preventing them from being used due to the unacceptable threat posed to the safety of firefighters
- the lack of fire trails into hard-to-access bush land, for example landscapes with terrain constraints including steep slopes, cliffs, deep creek lines and gullies and rock ledges
- fire trails being maintained for alternate uses but not up to a standard needed for fire mitigation or suppression
- land management agencies, particularly NPWS, were perceived as deliberately blocking or closing trails, and deliberately allowing trails to fall into disrepair, with reasons for such including legal impediments, prevention of arson or rubbish dumping, and restricting recreational vehicle damage to sensitive environmental areas.

For example, in its meeting with the Inquiry, the Cooma Incident Management Team raised the issue that the extent of work required during the season on existing fire trails to enable safe use and passage was an ongoing challenge. They went on to explain that, due to the fire activity and inadequacy of the existing trails in that region, they also had to develop containment lines separately from any identified fire trails.⁶⁹⁵

The Inquiry heard particularly stringent criticism from both community and government stakeholders of fire trails owned or managed by NPWS. Its various statutory obligations were described as being in tension, resulting in perceptions that the wrong obligation was prioritised over another, e.g. conservation imperatives over protection of lives and property.

⁶⁹¹ FCNSW (Forestry Corporation of NSW). (2020). *Advice to the Inquiry provided 27 March 2020*.

⁶⁹² Ibid.

⁶⁹³ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 25 March 2020*.

⁶⁹⁴ Ibid.

⁶⁹⁵ Meeting with Cooma Incident Management Team on 27 April 2020.

This tension is acknowledged by NPWS in its State-wide strategy for fire planning and management practices, which states "... native plants, animals and ecosystems are under increased pressure from a range of threatening processes, including habitat fragmentation, climate change, invasive species, land-use changes and altered fire regimes. A major challenge is finding the right balance in our approach to bush fire management which addresses each of these concerns."⁶⁹⁶ Though it was written in the context of fire regimes more broadly, the Inquiry considers this excerpt demonstrates the challenging balancing act required of NPWS to meet its often competing obligations appropriately.

In fact, the Inquiry was provided evidence by NPWS that, of the 78% of its fire trail network assessed using the new RACAS system described above, 20% has been further analysed for surface condition. Of this portion assessed for surface condition, 83% was assessed as being Fair to Poor; 7% Very Poor and only 10% being Good or Very Good.⁶⁹⁷ The Inquiry understands that this surface condition assessment has been made against internal standards to enable assessment against the NSW RFS Fire Trail Standards, and that NPWS has provided this information to several BFMCS.⁶⁹⁸

4.5.2.5 Reasons for fire trail inadequacy

Given the volume of this feedback, and the evident passion with which it was given, the Inquiry sought to understand why fire trails were inadequate, given the quality of the legislative framework and supporting programs for fire trail management established in 2017.

The Inquiry acknowledges the dry conditions characterising the period prior to the 2019-20 bush fires hampered fire trail preparations before the season, and performance during it. These conditions, as outlined in detail in Chapter 2, meant trails used by fire vehicles deteriorated significantly with destabilised trail surface, bull dust patches and failed drainage.⁶⁹⁹

However, looking at progress in implementing and delivering against the amendments and supporting programs so far, the Inquiry concludes that:

- though the amendments set out a good framework and basis for integrated and consistent fire trail management, implementation of the FAFT planning process has been slow. Though the BFCC through the Chair can provide direction on FAFT Planning, there seems to be no mechanism at the BFCC level to ensure fire trail build and maintenance is prioritised on a strategic, tenure-blind basis across the State
- land management agencies have been more focused on working to their agency's internal standards and imperatives and have not embraced working effectively cross tenure to deliver collectively on a high quality, State-wide fire trail network
- there is no formal requirement in NSW legislation, BFCC Policy or the NSW RFS Fire Trail Standards for a FAFT plan to be reviewed and revised following a significant bush fire event and for any revisions to be implemented rapidly
- despite NPWS success in securing funding for a New Policy Proposal to invest in the renewal, upgrade and maintenance of its fire trail network, delivery by NPWS against

⁶⁹⁶ NPWS (National Parks and Wildlife Service). (2013). *Living with Fire in NSW National Parks: A strategy for managing bushfires in national parks and reserves 2012–2021*, p vii. Retrieved from <https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Parks-reserves-and-protected-areas/Fire/living-with-fire-in-nsw-national-parks-strategy-2012-2021-120690.pdf>.

⁶⁹⁷ NPWS (National Parks and Wildlife Service). *Advice to the Inquiry provided 25 March 2020*.

⁶⁹⁸ NPWS (National Parks and Wildlife Services). (2020). *Advice to the Inquiry provided 19 July 2020*.

⁶⁹⁹ Ibid.

this funding (allocated in July 2019) is in its infancy; and some other land management agencies do not have enough resources to get their trails up to standard

- most agencies did not ramp up fire trail construction or maintenance in preparation for the predicted, catastrophic season despite them all acknowledging that a very bad season was likely
- the size and varied, multi-tenure nature of the fire trail network is not captured in a single asset management system
- there is significant difficulty negotiating the construction and maintenance of fire trails across multiple tenures, both between the different agencies (which have different approaches to/concerns about fire trails) and with regard to ongoing negotiations with private land holders, especially as compulsory land acquisition is not an option at present for some agencies.

4.5.2.5.1 Less than 20% of BFMCS have approved FAFT Plans

FAFT planning under the new legislative framework is not yet working effectively. As at 1 July 2020, only 11 of the 56 BFMCS have a BFCC approved FAFT Plan including the Lower Hunter, North West Zone, Bland Temora, Riverina, Barwon, Canobolas, Cobar, Cudgegong, Mid Lachlan Valley, Orana and South West Slopes. The remaining 45 FAFT Plans are yet to be approved by the BFCC. This includes 19 awaiting BFCC review and 26 still being finalised by relevant BFMCS.⁷⁰⁰ In other words, 45 BFMCS (over 80%) still do not have approved FAFT plans.

Once a FAFT plan is approved, an assessment statement must be submitted to the NSW RFS by land managers and landowners. In the case of public land, the land manager must provide an annual statement on the condition of each designated and registered fire trail on the land, and whether it meets the Standards. For fire trails on private land, assessment arrangements are as specified in the agreement between the NSW RFS and the landowner.⁷⁰¹ The Inquiry was told that, in respect of the 11 approved FAFT plans, no relevant fire trail managers and landowners had yet provided an annual assessment. When taken with the 45 unapproved FAFT plans, it is clear that a regular reporting process on the condition of existing fire trails across various tenures to the NSW RFS is not yet bedded down.

Without established FAFT Plans and accurate information about trail condition, the Commissioner's compliance and enforcement powers under the Act are of little use. Currently, there appears to be limited, if any, compliance or enforcement activity undertaken by NSW RFS with regard to approved fire trails.

4.5.2.5.2 Support for fire trail works is available but work needs to accelerate

The implementation of an improved, standardised and integrated fire trail network in NSW under the legislative amendments is facilitated by \$1 million per year dedicated NSW RFS funding for on-ground fire trail works.⁷⁰² In addition, the Bush Fire Risk Mitigation and Resilience Program, administered by NSW RFS, has a total of \$6 million available annually to assist public land managers and owners to undertake bush fire mitigation works, including

⁷⁰⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 16 July 2020*.

⁷⁰¹ RFS (NSW Rural Fire Service). (2016). Fire Trail Standards. Retrieved from http://www.rfs.nsw.gov.au/data/assets/pdf_file/0009/69552/Fire-Trail-Standards-V1.1.pdf.

⁷⁰² RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 15 April 2020*.

fire trail and hazard reduction activities. On average over the past three years, approximately 40%, or about \$2.4 million, of the program budget has been allocated to fire trail works.⁷⁰³

Over the three financial years prior to 2019-20, NPWS reports spending \$20.4 million on construction, maintenance, inspection and vegetation management on its road and fire trail network.⁷⁰⁴ Most of the current dedicated capital works funding for building and maintaining fire trails now comes from the New Policy Proposal NPWS successfully bid for and secured in 2019. This provides \$125 million over a four-year period to upgrade fire trails on its land (31,148 km of trails (pre-FAFT) as at 20 March 2020) to the gazetted standard.⁷⁰⁵

The remaining portion of the State fire trail network is reliant on various funding mechanisms. Fire trails on Crown Land must secure funding via open and competitive assessment with public application under the Crown Reserves Improvement Fund (CRIF). Annual reporting shows that this fund was worth over \$16 million in 2019-20, with \$1 million allocated to bush fire projects and \$1.27 million to tracks and trails.⁷⁰⁶ Forestry Corporation NSW is a State-owned corporation and runs commercially. In the 2018-19 financial year it reported receiving an \$18 million Community Service Obligation fee for service to manage fire, pests, weeds, tourism and public roads across NSW.⁷⁰⁷

Given the resources available and the 2019-20 fire season being forecast as exceptionally bad, the Inquiry found no evidence that any extra activity was undertaken by NPWS or any other public land management agencies – with the exception of Forestry Corporation – to ramp-up fire trail construction or maintenance to mitigate the risks of that pending, catastrophic season.

4.5.2.5.3 No single asset management system

Unlike the roads network, there is no single whole-of-government asset management system for fire trails. Each land manager or landowner is responsible for registered fire trails as an asset within their land. They are required to report on the condition of these, as stated above. The Inquiry notes that the ongoing FAFT planning process includes a spatial layer of trails and treatment register for trail building and maintenance. However, the fact that no reports from land holders of FAFT-approved fire trails have yet been received (as noted above), restricts the NSW RFS' ability to monitor and enforce compliance with the Standards. It also prevents NSW RFS from prioritising maintenance and capital works on a State-wide basis – though, at present, it is under no legal obligation to do so.

The Australian Road Research Board suggested to the Inquiry that a fit-for-purpose solution to collaborative fire trail management could be modelled on roads management, in which the outcomes of annual auditing would be captured in an asset management system to generate a prioritised worklist which, in turn, would drive a maintenance and capital works program.

⁷⁰³ Ibid.

⁷⁰⁴ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 25 March 2020*.

⁷⁰⁵ Ibid.

⁷⁰⁶ DPIE (Department of Planning, Industry and Environment). (2020). Crown Reserves Improvement Fund. Retrieved from <https://reservemanager.crownland.nsw.gov.au/funding/crif#heading-1>.

⁷⁰⁷ FCNSW (Forestry Corporation of NSW). (2019). Annual Report 2018-29. Retrieved from https://www.forestrycorporation.com.au/_data/assets/pdf_file/0019/1190026/annual-report-201819.pdf.

4.5.2.5.4 Achieving landowner consensus on fire trail networks can be difficult

Many fire trails are multi-tenure, i.e. owned and managed by several government agencies and/or private landholders. The Inquiry heard of one instance where a single area had over 2,000 km of fire trails, one third of which were on private land requiring negotiation with 600 different landowners – one fire trail alone had 12 private landowners.⁷⁰⁸

BFMC Policy 1/2017 *Fire Access & Fire Trails* requires that the fire trail network be decided by consensus as far as possible.⁷⁰⁹ NSW RFS and government land management agencies provided information to the Inquiry that identified several issues in fire trails management, suggesting that the most significant of these was the inability to enable an effective and streamlined tenure-blind approach.⁷¹⁰

The Inquiry heard that there appears to be reluctance on the part of some government agencies, particularly NPWS, to undertake works on other land tenures. This seems to be due, at least in part, to perceived legal impediments, despite the *Rural Fires Act 1997* containing specific provisions that enable the delivery of the fire trail network on a tenure-blind basis.⁷¹¹

Multi-tenure trails were identified by many stakeholders as presenting challenges to collaborative trail management due to the competing statutory objectives of each responsible authority. The Inquiry was provided with the example of a multi-tenure fire trail in Medowie, where nine months of planning was required to achieve multiple landowner consent for a mere nine days' work.⁷¹² In this case, planning delays were due to environmental approvals and negotiations with landholders over contractor engagement. In comparison, where multi-tenure management works well, fire trails can be efficiently constructed and certified.

Several stakeholders cited negotiations with private landholders as particularly complex.⁷¹³ This is said to be due to the need to undertake ongoing engagement with owners during the planning, construction and maintenance phases. NSW RFS reported to the Inquiry that, due to the scale of the network and the extent to which fire trails need to be located on private land, finding appropriate resources for the negotiation, execution and administration of private land agreements is challenging.

The Inquiry notes that it is impossible for NSW RFS, in the absence of powers to acquire an easement interest, to compel landowners to agree to a fire trail on their land. The Inquiry also notes that, in the first instance, NSW RFS fire trail planners and BFMCs attempt to plan and construct new trails on publicly owned land before resorting to private land.

Ideally when a trail is identified as necessary on private land, the process of negotiating access and then designing and building it should be undertaken cooperatively between the

⁷⁰⁸ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 27 April 2020*.

⁷⁰⁹ RFS (NSW Rural Fire Service). (2017). Policy 1/2017 Fire Trails, Bush Fire Coordinating Committee. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0011/9596/BFCC-Policy-1-2017-Fire-Access-And-Fire-Trails-FAFT.PDF.

⁷¹⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 16 July 2020*; Meetings with NSW Rural Fire Service 29 June 2020; National Parks and Wildlife Service 29 May 2020; Soil Conservation Service 19 May 2020.

⁷¹¹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 15 April 2020*.

⁷¹² Meeting with Cooma Incident Management Team on 27 April 2020; Meeting with Soil Conservation Service 19 May 2020.

⁷¹³ Meetings with NSW Rural Fire Service 29 June 2020; National Parks and Wildlife Service 29 May 2020; Soil Conservation Service 19 May 2020.

landowner and NSW RFS in such a way that it is mutually beneficial to the landowner and the State. NSW RFS needs to ensure it has officers who are skilled at building strong relationships with the relevant landowners and that all negotiations are conducted swiftly.

For those times when a landowner is not satisfied with the details of the arrangements to establish a fire trail across their land and no alternative fire trail option is available, then, as a last resort, the Government should consider negotiating acquisition of an easement interest, with appropriate compensation over private land.

4.5.2.6 Accelerating delivery of a strategic fire trail network in NSW

The scale and severity of the 2019-20 season affords an opportunity to review the intent of, and build on the ground laid by, the 2017 amendments.

First, the Inquiry recommends that the FAFT Planning process be accelerated and enhanced. With 19 current BFMC-endorsed FAFT Plans waiting for BFCC approval, and 26 BFMCs still to endorse a FAFT Plan before submitting it for approval, it is time for faster action by all involved.

While it is evident that the BFCC approval of each FAFT Plan will ultimately provide it with a complete picture of the State-wide fire trail network, the legislation does not oblige the BFCC to take a State-wide approach to priorities for construction and maintenance across those plans. Though the BFCC has authority to provide direction to BFMCs, it appears that current approvals are based on specific, regional BFMC priorities, and nothing more.⁷¹⁴ The Inquiry considers that the BFCC should actively review FAFT Plans for State-wide priorities. This would enhance the strategic operation of the fire trail network across NSW (see governance section in Chapter 3).

The Inquiry also notes there is no formal requirement in NSW legislation, BFCC policy or the NSW RFS Fire Trail Standards for a FAFT Plan to be reviewed following a significant bush fire event – review is only required on a five-year cycle. The Inquiry notes that the Hawkesbury BFMC has commenced a review of the current classification of fire trails in its (BFCC-approved) FAFT Plan in the context of operational experiences during the 2019-20 fire season, to determine if any changes are needed. It is particularly looking at whether containment lines⁷¹⁵ constructed during that season should be included as part of the permanent fire trail network. The Inquiry commends the Hawkesbury BFMC for this action and recommends that this be standard practice after a significant bush fire event, particularly given the high number of containment lines that were built during the past season.

Recommendation 33: That as a matter of urgency, in order to accelerate and finalise a State-wide strategic fire trail network, the NSW RFS Commissioner and Bush Fire Coordinating Committee (BFCC):

- set a deadline for Bush Fire Management Committees to complete all outstanding Fire Access and Fire Trail (FAFT) Plans for submission to BFCC for approval, and a related deadline for BFCC consideration of these
- assess the completed suite of FAFT Plans to identify high-priority trails of relative strategic importance across the State for urgent construction or upgrades with particular reference to the needs of upcoming fire seasons

⁷¹⁴ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 16 July 2020*.

⁷¹⁵ RFS (NSW Rural Fire Service). (2016). Control Lines. Retrieved from <https://nswrfs.atlassian.net/wiki/spaces/FOUNDATION/pages/29229284/Control+Lines>.

- enforce completion of annual fire trail condition assessment reporting by relevant landholders. Following this, the BFCC should, as part of its standard business, undertake an audit of all FAFT Plans and annual fire trail condition assessment reports
- develop a single asset management system to capture the outcomes of annual fire trail condition assessment reporting on a tenure-blind basis to support BFCC strategic and budgetary prioritisation and inform funding allocation to agencies for capital works programs
- commission a review of FAFT Plans, with particular assessment of containment line potential, following a significant bush fire event in their area, as part of the planned review of BFCC Policy and NSW RFS Standards in 2020-21.

Where it is not feasible to construct a fire trail completely on public land, and private landowners are not satisfied with proposed negotiated arrangements to construct the trail across their land, Government should negotiate acquisition of an easement interest, with appropriate compensation, over private land.

The Inquiry considers that, as part of the NSW RFS/BFCC annual statement, the Commissioner should provide an assessment of the overall state of the fire trail network against the Standards. This assessment should be informed by information collected in the annual audit and supported using remote sensing technology (satellite imagery, drones, LiDAR, automated fire towers, car-mounted cameras, etc.).

4.6 BUSH FIRE SMOKE

Key points

- Fine particulate (PM2.5) exposure during the 2019-20 bush fire season was unprecedented. Increased exposure to PM2.5 has been associated with multiple health impacts, which are greater for vulnerable people. Evidence shows that sustained exposure (weeks and months) to poor air quality compared to acute exposure (days) produces greater impact. However, the long-term impacts of prolonged exposure to severe bush fire smoke as seen in the 2019-20 season is unknown.
- Given the expected increases in frequency and severity of major bush fires, smoke is one of many effects of fire that could intensify in future seasons. The associated health risks and financial implications as a result of exposure to bush fire smoke must be better balanced, and become essential components of, future fire management.⁷¹⁶ This includes investment in public health research and smoke forecasting/modelling, and improved evidence-based public health messaging.

The 2019-20 fire season was exceptional in scale, severity and impact – and one of the most identifiable impacts was smoke. Smoke from the 2019-20 fire season engulfed not only fire affected communities, but extended across towns, cities, states and even international borders, with New Zealand reporting orange skies and discolouration of its iconic glaciers.⁷¹⁷

⁷¹⁶ NSW Bushfire Risk Management Research Hub (2020) 'Smoke and human health'.

⁷¹⁷ Salinger, Jim. (2020, 8 January). Australia's bushfires mean New Zealand has become the land of the long pink cloud, *The Guardian*. Retrieved from <https://www.theguardian.com/world/2020/jan/08/australia-bush-fires-aotearoa-new-zealand-has-become-kikorangi-mawhero-land-of-the-long-pink-cloud>.

The extent of the smoke led to a significant reduction in recorded air quality. As well, it impeded visibility and forecasting for fire fighting operations. This section examines the community's exposure to poor and hazardous air quality levels as a result of bush fire smoke during the 2019-20 fires and the associated health risks and financial implications.

The Inquiry acknowledges the ongoing NSW Parliamentary Inquiry, self-referred on 5 February 2020, which is to inquire and report on the health impacts of exposure to poor levels of air quality resulting from bush fires and drought and any related matters, and the effectiveness of the NSW Government to plan for and improve air quality

Ambient air quality in Australia is regulated by the National Environment Protection Measure (NEPM). The NEPM sets a maximum 24-hour mean concentration of 50 micrograms per cubic metre for particles with a diameter of 10 micrometres or less (PM10) and 25 micrograms per cubic metre for particles with a diameter of 2.5 micrometres or less (PM2.5).⁷¹⁸

PM10 particles are small enough to pass through the throat and enter the nose and lungs. PM2.5 can penetrate deep into the lungs and enter the bloodstream.⁷¹⁹ PM2.5 particles are one of the most studied air pollutants – and there is abundant evidence demonstrating the risks at different levels of pollution.⁷²⁰ Increased exposure to PM2.5 has been associated with multiple health impacts, including premature deaths, cardiorespiratory hospital admissions and asthma-related emergency department presentations.⁷²¹

The NSW Government air quality monitoring network is operated by the Department of Planning, Industry and Environment. With 92 monitoring stations currently, it is one of the largest and the longest running in Australia.⁷²² Recent commitments to air quality observations include the:⁷²³

- establishment of new monitoring stations in Sydney, Parramatta and Penrith
- expansion of regional monitoring to Armidale, Coffs Harbour, Goulburn, Gunnedah, Narrabri and Orange
- upgrade of the Rural Air Quality Monitoring Network and the launch of baseline air quality monitoring in rural NSW.

International research has found that air pollution is one of the leading causes of death globally.⁷²⁴ Generally, Australia has great air quality by world standards. However, during

⁷¹⁸ NSW Bushfire Risk Management Research Hub (2020) 'Smoke and human health'.

⁷¹⁹ NSW Health. (2013). Particulate matter (PM10 and PM2.5). Retrieved from <https://www.health.nsw.gov.au/environment/air/Pages/particulate-matter.aspx>.

⁷²⁰ Meeting with NSW Health 6 March 2020; NSW Bushfire Risk Management Research Hub (2020) 'Smoke and human health'.

⁷²¹ NSW Bushfire Risk Management Research Hub (2020) 'Smoke and human health'; Borchers Arriagada, N, Horsley, J, Palmer, A, Morgan, G, Tham, R & Johnston, F. (2019) Association between fire smoke fine particulate matter and asthma-related outcomes: Systematic review and meta-analysis. *Environmental Research*, 179. doi: 10.1016/j.envres.2019.108777 ; Cascio, W. (2018) Wildland fire smoke and human health. *Science of the Total Environment* 624, 586–595. doi: 10.1016/j.scitotenv.2017.12.086.

⁷²² Meeting with Department of Planning, Industry and Environment 20 July 2020.

⁷²³ DPIE (Department of Planning, Industry and Environment). (2020). *Advice to the Inquiry provided 21 July 2020*; NSW Government. (2020). Submission to the NSW Parliamentary Inquiry into the health impacts of exposure to poor levels of air quality resulting from bushfires and drought.

⁷²⁴ Lelieveld, J, Pozzer, A, Pöschl, U, Fnais, M, Haines, A, Münzel, T. (2020) Loss of life expectancy from air pollution compared to other risk factors: a worldwide perspective. *Cardiovascular Research* 116(7), 1334. doi:10.1093/cvr/cvaa073.

bush fires, particle pollution can reach extremely high concentrations and have significant consequences on the health of the community exposed.⁷²⁵

4.6.1 What was the extent and impact of community exposure to smoke during the 2019-20 fire season?

Since the 2000-01 bush fire season, the historical average annual number of days the population-weighted average PM_{2.5} exceeded the National Air Quality Standard was 1.6%.⁷²⁶ Between 1 October 2019 and 31 March 2020, it was exceeded on 34 out of 183 days – or 18.6% of days.⁷²⁷ On average, more than 7.8 million people (99.8%) of the NSW population were exposed to a higher PM_{2.5} level than the historical mean.⁷²⁸

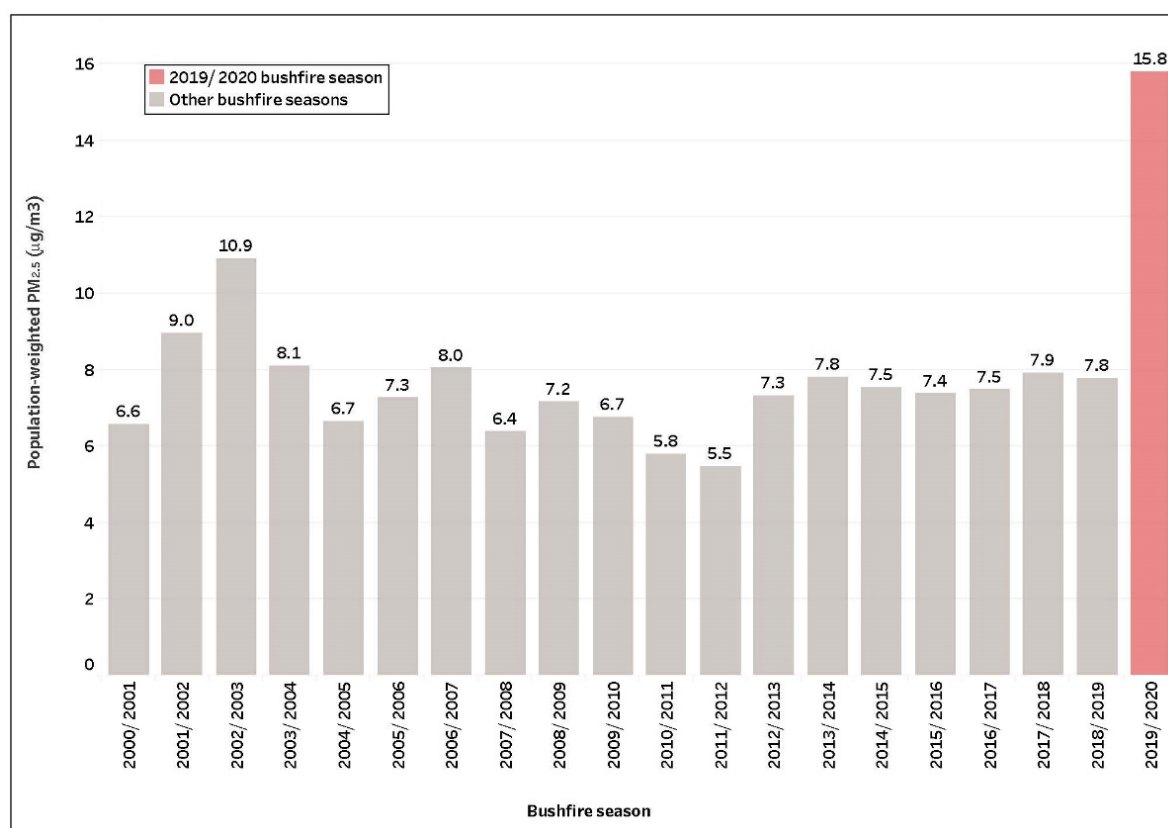


Figure 4-3: Estimated population-weighted PM_{2.5} (µg/m³) by fire season for last 20 fire seasons in NSW (prepared by NSW Bushfire Risk Management Research Hub).⁷²⁹

The highest population-weighted PM_{2.5} daily mean of 80.4 micrograms per cubic metre was observed on 10 December 2019.

⁷²⁵ Meeting with Associate Professor Fay Johnston on 27 February 2020.

⁷²⁶ NSW Bushfire Risk Management Research Hub (2020) 'Smoke and human health'

⁷²⁷ Ibid.

⁷²⁸ Ibid.

⁷²⁹ NSW Bushfire Risk Management Research Hub (2020) 'Smoke and human health'.

Though the level of daily exposure and extent of the population exposed has been observed previously in NSW, particularly around Sydney, the overall impact given the accumulated exposure that lasted for months is unprecedented at a regional and rural scale.⁷³⁰

During the 2019-20 bush fires, nine temporary monitoring stations were deployed at Batemans Bay, Coffs Harbour, Cooma, Grafton, Lismore, Merimbula, Port Macquarie, Taree, and Ulladulla.⁷³¹ The Inquiry notes that several of these monitors were only available to be deployed as emergency monitors due to ongoing upgrades to the fixed rural network being undertaken, and that in future seasons the network may not have this resourcing flexibility.⁷³²

4.6.1.1 Public health impacts and the implied cost of smoke

It is estimated that between 1 October 2019 and 10 February 2020, bush fire smoke in eastern Australia caused 417 premature deaths.⁷³³ There are also estimates of 3,151 admissions to hospital for cardiorespiratory problems and 1,305 additional presentations to emergency departments for asthma aggravated by the smoke.⁷³⁴ More than 50% of these impacts were in NSW.⁷³⁵

The health costs for Australia attributable to fire smoke over the same period were significantly higher than for any of the previous 20 fire seasons, estimated to be \$1,948.5 million. This was considerably higher (> 9X) than the median of the last 19 fire seasons.⁷³⁶ Estimated health costs attributable to fire smoke for NSW were \$1,070 million for the 2019-20 fire season.⁷³⁷

⁷³⁰ Ibid; Borchers Arriagada, N, Palmer, A, Bowman, D, Morgan, G, Jalaludin, B & Johnston, F. (2020) Unprecedented smoke-related health burden associated with the 2019–20 bushfires in eastern Australia. *Medical Journal of Australia* (research letter). doi: 10.5694/mja2.50545.

⁷³¹ NSW Government. (2020). Submission to the NSW Parliamentary Inquiry into the health impacts of exposure to poor levels of air quality resulting from bushfires and drought.

⁷³² Meeting with Department of Planning, Industry and Environment 20 July 2020.

⁷³³ NSW Bushfire Risk Management Research Hub (2020) 'Smoke and human health'; Borchers Arriagada et al (2020) Unprecedented smoke-related health burden associated with the 2019–20 bushfires in eastern Australia. *Medical Journal of Australia* (research letter). doi: 10.5694/mja2.50545.

⁷³⁴ NSW Bushfire Risk Management Research Hub (2020) 'Smoke and human health'.

⁷³⁵ Ibid; Borchers et al (2020).

⁷³⁶ NSW Bushfire Risk Management Research Hub (2020) 'Smoke and human health'; Johnston, F, Borchers Arriagada, N, Morgan, G, Jalaludin, B, Palmer, A, Williamson, G & Bowman, D. (2020). Unprecedented health costs of bushfire-related air pollution PM2.5 from the 2019-20 Australian megafires. Manuscript Submitted for Publication.

⁷³⁷ Ibid.

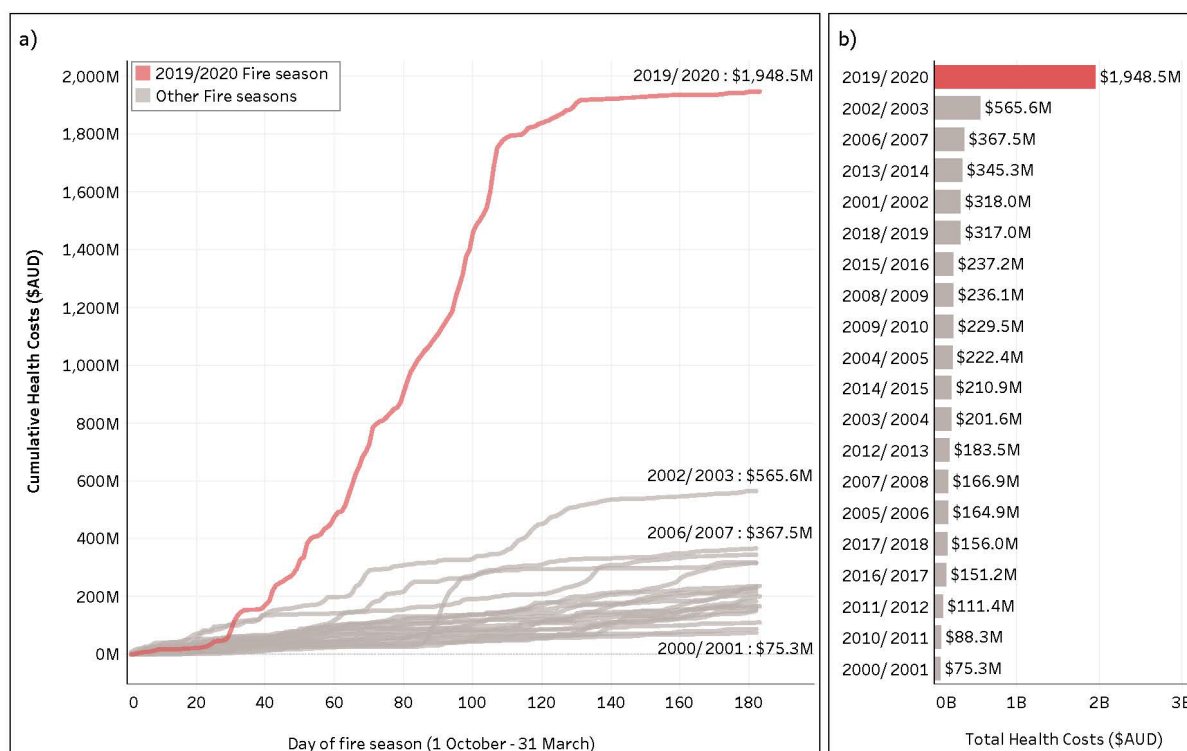


Figure 4-4: Cumulative smoke-related health costs for the 20 consecutive fire seasons (1 Oct–31 March) in Australia (excluding Northern Territory) (prepared by NSW Bushfire Risk Management Research Hub).⁷³⁸

4.6.1.2 Smoke is a greater health risk for vulnerable or disadvantaged members of an exposed community

For most individuals, periodic exposure to smoke is not overly problematic. However, vulnerable segments of the community, for example pregnant women, outdoor workers, lower socio-economic groups, Aboriginal and Torres Strait Islander communities, children, the elderly or individuals with pre-existing comorbidities such as diabetes or heart and lung issues, are at greater risk of health complications from exposure to poor air quality due to bush fire smoke.⁷³⁹

There is evidence that suggests exposure to bush fire smoke during pregnancy is associated with reduced infant birthweight and increased risk of gestational diabetes in pregnant women,⁷⁴⁰ and that children born to mothers exposed to smoke during pregnancy have a higher risk of acute respiratory infections between the ages of two and four.⁷⁴¹

Age is shown to be a determining factor in increased health risks associated with poor air quality. There is evidence that the elderly are at greater risk from exposure due to increased

⁷³⁸ Ibid.

⁷³⁹ Horsley, J, Broome, R, Johnston, F, Cope, M & Morgan, G. (2018). Health burden associated with fire smoke in Sydney, 2001–2013, *The Medical Journal of Australia* 208(7), 309-310. doi: 10.5694/mja18.00032.

⁷⁴⁰ Johnston, F, Melody, S, Venn, A, Wills, K & Ford, J. (2019, 20 May). Gestational diabetes increased in women exposed to mine fire smoke, *Hazelwood Health Study*. Retrieved from <https://hazelwoodhealthstudy.org.au/articles/gestational-diabetes-increased-in-women-exposed-to-mine-fire-smoke>.

⁷⁴¹ Ibid.

likelihood of a pre-existing chronic health condition, and young children due to their lungs being in development.

Research into the health effects of poor air quality on disadvantaged communities, including lower socio-economic groups, is limited. Potentially at risk, due to increased rates of homelessness or poor housing, are people from lower socio-economic groups who generally possess higher rates of chronic disease, lower health literacy and less subsequent capacity to take preventive action. They are also more likely to live in areas with poorer everyday air quality, for example near industrial premises or major roads.⁷⁴²

Aboriginal and Torres Strait Islander communities generally have higher rates of chronic health conditions and are more susceptible to the health effects of poor air quality caused by bush fire smoke.⁷⁴³

Members of the community who spend more time outdoors working or exercising are also at risk. A number of submissions to the Inquiry identified bush fire smoke exposure as a particular threat to the safety and health of fire fighting personnel, such as NSW RFS members, and Forestry Corporation and National Parks and Wildlife Service staff. Stakeholders identified insufficient training, differences in protective equipment provided to rural and metro personnel, and failure to screen individuals for pre-existing medical conditions or smoke-related illnesses as exacerbating the extreme exposure faced by firefighters in active duty. Chapter 5 of this report explores the safety and well-being of first responders in greater detail.

In addition to affecting fire fighting personnel, the extent of the smoke also complicated operational fire fighting. It impeded fire spread prediction processes, but also interfered with remote sensing technologies including linescanning services, and the ability to launch weather balloons and air transport arrangements. Chapter 2 of this report describes the impact of smoke as limiting the use of certain sensing technologies and Chapter 5 explores the impact of smoke on broader operational fire fighting in responding to the 2019-20 bush fires.

4.6.1.3 Long-term impacts of smoke from the 2019-20 bush fire season are unknown

Evidence shows that the longer-term health impacts of sustained poor air quality include respiratory illnesses, some cancers and heart disease.⁷⁴⁴ However, the long-term health impacts of severe exposure to bush fire smoke sustained over a period of weeks and months, such as during the 2019-20 season, are not known as there is limited research in this area.⁷⁴⁵

The Hazelwood Health Study is an ongoing investigation into the long-term health outcomes of community exposure to six weeks of smoke from the 2014 Hazelwood coal mines in Victoria. The duration and level of PM2.5 exposure of that event is comparable to the recent 2019-20 bush fire season, despite the source of smoke being coal rather than vegetation

⁷⁴² AMA (Australian Medical Association). (2020). Submission to the NSW Parliamentary Inquiry into the health impacts of exposure to poor levels of air quality resulting from bushfires and drought.

⁷⁴³ Ibid.

⁷⁴⁴ Meeting with Associate Professor Fay Johnston on 27 February 2020; Associate Professor Fay Johnston. (2020). Submission to the NSW Parliamentary Inquiry into the health impacts of exposure to poor levels of air quality resulting from bushfires and drought.

⁷⁴⁵ Ibid.

from bush fires.⁷⁴⁶ Results from the study have found evidence of longer-term health impacts due to smoke exposure.⁷⁴⁷

Based on this evidence it is therefore likely that the health effects of the recent fire season will extend to several years. Further investigation and improved data collection are needed to understand better the long-term health impacts of bush fire smoke exposure, particularly for vulnerable segments of the community including pregnant women and children.

NSW Health is conducting research into the health effects of bush fire smoke in collaboration with the Centre for Air pollution, energy and health Research (CAR). The research is supported by the Human Health and Social Impacts Node of the NSW Government's Adaptation Research Hub.⁷⁴⁸

The Environmental Health Standing Committee (enHealth) of the Australian Health Protection Principal Committee is leading the development of a nationally consistent approach to communication of air quality information.⁷⁴⁹ The Inquiry also notes the Commonwealth Government funding commitment of \$5 million to improve understanding of the impacts of the 2019-20 bush fire event, including \$3 million for research into the physiological impacts of prolonged bush fire smoke exposure.⁷⁵⁰

The Inquiry supports further investment to build on existing knowledge of smoke effects on air quality and the long-term impact of the 2019-20 bush fires, with a view to informing clinical and public health practices and messaging ahead of future bush fire seasons.

4.6.2 Considering smoke in NSW fire management – now and in the future

The evidence detailed in Chapter 2 of this report suggests that the frequency and intensity of extreme bush fires is likely to increase. As such, the 2019-20 fire season provides an indication of the likely impacts that the community may face in future seasons.

Smoke management can be difficult for many reasons, including:

- the geography of many of our major population centres does not facilitate smoke dispersion. For example, Sydney is surrounded by perimeter ranges that effectively create a bowl and, when combined with low level inversions and stable weather, trap smoke from bush fire and hazard reduction burns
- the unpredictability of fire makes characterising smoke difficult. Smoke levels and intensity are dependent upon undefined variables, like how much area will burn to generate smoke, how long it will burn for and what exactly is burning

⁷⁴⁶ Meeting with Associate Professor Fay Johnston on 27 February 2020.

⁷⁴⁷ Johnson, A, Gao, C, Dennekamp, M, Williamson, G, Brown, D, Carroll, M, Monaco, A, Ikin, J, Abramson, M & Guo, Y. (2019). Associations between Respiratory Health Outcomes and Coal Mine Fire PM_{2.5} Smoke Exposure: A Cross-Sectional Study. *International Journal of Environmental Research and Public Health* 16(21). doi: 10.3390/ijerph16214262; Willis, G, Chappel, K, Williams, S, Melody, S, Wheeler, A, Dalton, M, Dharmage, S, Zosky, G & Johnston, F. (2019) The impact of exposure to coal mine fire smoke in utero and in early childhood on parent-reported indicators of childhood atopic and respiratory illness. *Environmental Epidemiology* 3: 441. doi: 10.1097/01.EE9.0000610972.18990.08.

⁷⁴⁸ NSW Health (2020). *Advice to the Inquiry provided 27 July 2020*.

⁷⁴⁹ Ibid.

⁷⁵⁰ Minister for Health. (2020). \$5 million for research into bushfire impact on Australian communities. Retrieved from <https://www.health.gov.au/ministers/the-hon-greg-hunt-mp/media/5-million-for-bush-fire-related-health-research>.

- the prevailing weather conditions can see smoke potentially travelling large distances. Smoke from the 2019-20 bush fires crossed international borders and reached the stratosphere.⁷⁵¹

Given the widespread and potentially severe health and economic impacts of smoke exposure, smoke and health should be essential considerations in responsible fire management.⁷⁵²

4.6.2.1 Balancing the cost of community health against appropriate fire management practices

So far, this section has explored the health and financial impacts caused by smoke from periodic and severe bush fires like those experienced in the 2019-20 season. Hazard reduction burning is a much used bush fire mitigation tool, yet hazard reduction burns similarly generate smoke that reduces air quality and can have associated health risks – the difference being that these fires are scheduled and controlled.

As hazard reduction burning is a key method for reducing the incidence, severity and impact of bush fires, landowners, managers and fire agencies need to be able to factor in the health risk of smoke exposure from each type of fire when implementing a hazard reduction burn program.

Research from Western Australia has shown that, in a comparison of hazard reduction burning and bush fire over the period 2002-2017, the estimated health-related costs of hazard reduction burning were in many years higher than those attributable to bush fire.⁷⁵³ Although the mean estimated health costs were lower on days affected by smoke from hazard reduction burns than on days affected by bush fire smoke, the total number of days affected by smoke from hazard reduction burns was far greater than the number of days affected by bush fire smoke.⁷⁵⁴

This study demonstrates that, though hazard reduction burning may reduce the risk and consequences of bush fire, a better understanding of the full health impacts of this type of fire is required so that it can be incorporated into control strategies for sustainable fire management.⁷⁵⁵

More can be done to improve the risk-to-benefit ratio of hazard reduction burning through smoke modelling. Effective smoke modelling and forecasting can enable consideration of, and proactive planning for, the impacts of smoke from hazard reduction burns.

4.6.2.2 Smoke modelling is complex and could be improved

Currently, smoke modelling is used in conjunction with the NSW Air Quality Forecasting Framework (AQFF). DPIE delivers air quality forecasts through the AQFF, which uses a number of modelling systems to forecast air pollution in Sydney and the Greater Metropolitan Region up to 72 hours ahead, and can support hazard reduction burn management, dust storm and bush fire forecasting and plume modelling for industrial

⁷⁵¹ NSW Government. (2020). Submission to the NSW Parliamentary Inquiry into the health impacts of exposure to poor levels of air quality resulting from bushfires and drought.

⁷⁵² NSW Bushfire Risk Management Research Hub (2020) 'Smoke and human health'

⁷⁵³ Borchers Arriagada, N, Palmer, A, Bowman, D & Johnston, F. (2020, 20 April) Exceedances of national air quality standards for particulate matter in Western Australia: sources and health-related impacts, The Medical Journal of Australia (research letter). doi: 10.5694/mja2.50547.

⁷⁵⁴ Ibid.

⁷⁵⁵ Ibid.

incidents.⁷⁵⁶ All models are coupled with the Bureau of Meteorology's meteorological forecast – used as the primary meteorological input to the Framework.⁷⁵⁷

NSW RFS has other smoke modelling capability as well, that combines a weather forecast model with smoke/pollution modelling software and mapping. The system generates an animated model that can provide an indication of the trajectory of smoke dispersion as well as, potentially, an indication of its concentration. This type of modelling capability, and that provided by DPIE using the AQFF, is routinely used to inform NSW RFS risk assessments or decisions relating to fire fighting operations, including hazard reduction burns or burn sizes.⁷⁵⁸ However, NSW RFS advises that the system was designed for hazard reduction burning and has not been configured for the purpose of modelling smoke from bush fires which emit a greater amount of smoke higher into the atmosphere.

Working with the Bureau of Meteorology and the Australasian Fire and Emergency Service Authorities Council, NSW RFS is exploring the national Air Quality Forecast System (AQFx) as an alternative solution to meet its needs better.⁷⁵⁹ The AQFx uses a fire spread model to calculate smoke emissions from bush fires and includes wind-blown dust and urban sources of pollution.⁷⁶⁰ The AQFx was trialled by NSW RFS over the 2019-20 season. NSW RFS reported to the Inquiry that the trial identified the AQFx as having the potential, with some adaptation to address current limitations and meet certain operational requirements, to provide a significantly improved air quality forecast of smoke and dust.⁷⁶¹

However, the Inquiry has been advised by DPIE that further investments in modelling and forecasting systems should take a broader view of air quality in order to deliver on multiple fronts, rather than having a singular focus on smoke, and that a critical evaluation of all of the air quality modelling and forecasting needs of jurisdictions is required before a particular solution is pursued. DPIE has considerable expertise in air quality monitoring, including smoke modelling capabilities under the AQFF, and should be actively engaged in determining the most effective model for further investment in air quality modelling and forecasting.

As DPIE explained to the Inquiry,⁷⁶² it is important that investments in this area consider all pollutants of concern, including smoke but also ozone and dust that are present during bush fires.

4.6.2.3 Preparing and providing better air quality information

The NSW Government air quality website, managed by DPIE, provides daily forecasts for Sydney and near real-time information for other regions where air quality is monitored.

⁷⁵⁶ DPIE (Department of Planning, Industry and Environment). (2020). *Advice to the Inquiry provided 21 July 2020*.

⁷⁵⁷ NSW Government. (2020). Submission to the NSW Parliamentary Inquiry into the health impacts of exposure to poor levels of air quality resulting from bushfires and drought.

⁷⁵⁸ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*; DPIE (Department of Planning, Industry and Environment). (2020). *Advice to the Inquiry provided 21 July 2020*.

⁷⁵⁹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

⁷⁶⁰ CSIRO. (2020). Smoke forecasting for bushfires and prescribed burns. Retrieved from <https://www.csiro.au/en/Research/OandA/Areas/Assessing-our-climate/Smoke-forecasting>.

⁷⁶¹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

⁷⁶² DPIE (Department of Planning, Industry and Environment). (2020). *Advice to the Inquiry provided 23 July 2020*.

Members of the public can opt in to receive a daily SMS or email, with air quality ratings and forecasts. A colour-coded Air Quality Index (AQI) displays levels of observed air pollution against national standards. Air pollution that exceeds the national standards is classified as 'poor' with an AQI of 100 or more. When values exceed 200, air quality is reported as 'hazardous'.⁷⁶³



Figure 4-5: Air quality categories in NSW.⁷⁶⁴

During the 2019-20 bush fires, health information was added to the air quality website and hourly-average PM2.5 concentrations were reported.⁷⁶⁵ In addition to DPIE air quality alerts, air quality information provided in the BoM weather forecasts provides further information and context in a public forum.⁷⁶⁶

The NSW RFS is the lead agency for providing information relating to fire activities and is supported by DPIE and NSW Health in communicating information about smoke. Currently, NSW RFS coordinates issuing of alerts and warnings related to fire under its Hazard Reduction Burn Smoke Management Protocol⁷⁶⁷ and is generally the agency that responds to enquiries about smoke during hazard reduction burning. Often this is irrespective of the tenure or lead agency undertaking the response or hazard reduction activity. NSW RFS may issue messages via the media, social media and on the NSW RFS website.⁷⁶⁸

In the event of a bush fire, information on smoke is provided by the relevant NSW RFS Incident Management Team and public liaison roles. These roles disseminate information via various communication media including traditional and social media, the NSW RFS website, the Fires Near Me NSW app and other channels.⁷⁶⁹

However, evidence available to the Inquiry indicated that current public health messaging and channels were lacking. Key issues that stakeholders identified with current access to air quality information and messaging include:

- upgrades to the current air quality monitoring network in rural NSW being partway implemented resulted in public perception that the network has inadequate reach, and is failing many regional and remote communities which need access to relevant air quality information to protect their health
- significant public confusion due to nationally inconsistent air quality reporting and advice. For example, the same advice is given to the public on days where air quality is classified as 'hazardous' even though they may have vastly different levels of PM2.5 – as was seen during the start of summer and at the peak of the bushfires

⁷⁶³ NSW Government. (2020). Submission to the NSW Parliamentary Inquiry into the health impacts of exposure to poor levels of air quality resulting from bushfires and drought.

⁷⁶⁴ DPIE (Department of Planning, Industry and Environment). (2020). Daily Air Quality Index (AQI). Retrieved from <https://www.dpie.nsw.gov.au/air-quality/current-air-quality/daily>.

⁷⁶⁵ NSW Government. (2020). Submission to the NSW Parliamentary Inquiry into the health impacts of exposure to poor levels of air quality resulting from bushfires and drought.

⁷⁶⁶ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

⁷⁶⁷ Ibid.

⁷⁶⁸ Ibid.

⁷⁶⁹ Ibid.

- generic advice is provided on an opt-in basis for individuals regardless of vulnerability, and the provision of a 24-hour rolling AQI was inadequate to support vulnerable individuals to make key health protection decisions
- smoke warnings and risks currently provided relate mainly to the immediate health impacts of short-term (i.e. daily) changes in air quality rather than to potential health risks, or action to take, when there is more sustained exposure to air pollution
- frequent warnings to communities during extended periods about fire and smoke impact across various platforms (i.e. Fires Near Me) lessened the impact of smoke warnings at critical times
- organisations, including schools, employers with outdoor workers and sporting organisations, need more targeted advice and better guidance to support operational decisions during extended periods of exposure to bush fire smoke. For example, it is impractical to advise these groups to stay indoors for prolonged periods of time.

4.6.3 Improving public information and community engagement on air quality

Effective public health messaging in bush fire events is critical to reduce the associated health and economic costs. In the 2019-20 bush fire season, communities did not have adequate access to information and/or received messaging which was inconsistent and not sufficiently detailed or nuanced for different community groups. NSW requires clearer, more detailed information to be made easily available to the public.

The Inquiry suggests that the most effective intervention is giving people information to make choices about their own exposure rather than other public health intervention, for example, handing out masks.

In order to avoid anxiety during a major bush fire event as was seen during 2019-20, a comprehensive public education campaign like that for sun sense should be implemented and include advice on:

- how to reduce air pollution in the home during short and sustained exposure periods
- clear advice on the effectiveness of personal (masks) and home (portable domestic air cleaners) equipment – for example, what type of facemasks to use, and when they should be used (P2 masks can cause problems for people with lung conditions)
- how to minimise exposure to air pollution caused by smoke if staying at home is not possible
- targeted advice for organisations and disadvantaged or vulnerable segments of the community about the health risks posed by exposure to smoke and how best to manage or minimise exposure to smoke – for example, having an up to date health action plan, knowing when to start preventative medication for asthma.

Also, prior to fire seasons, there should be clear public communication before planned hazard reduction burns and other fire management activities that may generate smoke and affect air quality.⁷⁷⁰

During a fire event, people need better access to real time accurate PM2.5 data, and evidence-based health messaging to help manage their exposure. Information on appropriate risk mitigation should be provided with advice on air quality levels. Evidence to the Inquiry shows that on 10 December 2019, DPIE air quality webpages recorded 208,000 unique visitors, and that over the bush fire period the DPIE alert system added 8,000

⁷⁷⁰ Grattan Institute. (2020). Submission to the NSW Parliamentary Inquiry into the health impacts of exposure to poor levels of air quality resulting from bushfires and drought.

subscribers.⁷⁷¹ Though the current alert system and direct messaging offered by government is commendable, it requires people to opt in.

Changes to increase effective public engagement on smoke exposure could include the use of tools such as the AirRater app which allows users to access information in a form they relate to. Developed in 2015 through collaboration between several public research and health agencies⁷⁷² to support vulnerable segments of community to reduce their exposure to environmental health hazards, AirRater provides local information in near-real time. This includes the provision of location specific hourly PM10 and PM2.5 pollution information from government monitoring networks.⁷⁷³ The Inquiry understands that DPIE currently supports AirRater through data access and provision arrangements.⁷⁷⁴

The app allows users to input their symptoms and is useful for individuals with pre-existing respiratory conditions such as asthma, hay fever or other lung conditions. The Inquiry received evidence that, during the 2019-20 bush fire season, over 30,000 people in NSW downloaded AirRater, which suggests community members were seeking information not readily available or sufficiently user-friendly from government agencies. AirRater is currently funded to operate in Tasmania, the ACT and the Northern Territory.⁷⁷⁵

Importantly, to mitigate the risks of bush fire smoke exposure to the community, more support for vulnerable or disadvantaged parts of the community is required. Messages should be targeted and tailored for at-risk groups. Advice to people with asthma should provide different relevant information than that provided to pregnant women. Additionally, targeted advice for employers, schools and other organisations about minimising exposure to smoke, including whether outdoor activity should be prohibited, is required.

Recommendation 34: That, in order to capture and understand the impacts of bush fire smoke better, Government invest in operational air quality forecasting and alert systems, and public health research and policy development. This would involve investment to:

- develop a comprehensive system of forecasting and alerts for air quality incidents and all pollutants of concern, including but not limited to bush fire smoke, ozone and dust, and which is ideally nationally consistent
- investigate further the health impacts of bush fire smoke, based on improved data collection and including research on the long-term health impacts of poor air quality as a result of sustained exposure to severe bush fire smoke, particularly for vulnerable and at-risk segments of the community (children, elderly, firefighters, etc).

⁷⁷¹ DPIE (Department of Planning, Industry and Environment). (2020). *Advice to the Inquiry provided 21 July 2020*.

⁷⁷² The Menzies Institute for Medical Research, University of Tasmania School of Biological Sciences, the Environment Protection Authority Tasmania, CSIRO and the Australian National University. Current funding is provided by the Menzies Institute for Medical Research, the Department of Health Tasmania, ACT Health, & the NT EPA. AirRater. Retrieved from www.airrater.org.

⁷⁷³ Centre for Air pollution, energy and health Research (CAR). (2020). Submission to NSW Parliamentary Inquiry into the health impacts of exposure to poor levels of air quality resulting from bushfires and drought.

⁷⁷⁴ DPIE (Department of Planning, Industry and Environment). (2020). *Advice to the inquiry provided 21 July 2020*.

⁷⁷⁵ Centre for Air pollution, energy and health Research (CAR). (2020). Submission to NSW Parliamentary Inquiry into the health impacts of exposure to poor levels of air quality resulting from bushfires and drought.

Recommendation 35: That, in order to improve the provision of evidence-based public health messaging about air quality during bush fire events, Government develop a public education campaign and supporting systems before the next bush fire season. This should include:

- a public education campaign (like sun exposure), to help people make their own decisions about exposure to bush fire smoke
- tailored messaging to target:
 - smoke-vulnerable cohorts of the community
 - general practitioners, particularly in rural and regional areas, so they can advise patients with relevant, susceptible comorbidities
 - employers, to support development of appropriate workplace health and safety guidance for outdoor workers
- an improved air quality alert system such as an enhanced Air Rater app.

4.6.4 Snapshot of ecosystem impacts of the 2019-20 fire season

Researchers from the Research Hub explained to the Inquiry that ecological consequences of the 2019-20 fire season will take time to play out and be fully understood.⁷⁷⁶ In particular, it is difficult to tease out what might be a cyclical variation in an ecosystem, compared with a different or more permanent kind of change. The lag in understanding the effects of the fires is also complicated by multiple other interactions that are independent of the bush fires, for example, landscape fragmentation.

In particular, the Research Hub researchers made the point that we are in unknown territory in understanding the interaction of the bush fires and the severe drought that is ongoing in several of the fire affected regions, and how this will influence the recovery or otherwise of certain ecosystems.

Chapter 2 included analysis completed by the Research Hub on vegetation fire frequency thresholds, indicating that large areas are now in a 'vulnerable' category, meaning that more fire in the near term could result in adverse changes to the vegetation communities, such as the decline and loss of species and changes to structure.

The Research Hub completed a series of further projects looking at the following questions:

- which and how many plant species are at increased risk of population declines following the 2019-20 fires?
- to what extent did the 2019-20 fires affect native vegetation and what are the potential impacts on post-fire recovery?
- how did prior disturbance affect ecosystem resilience to bush fires?

Noting that this is a preliminary analysis and, for most species, does not yet incorporate post-fire field observations and data on recovery, the Research Hub found that:

- approximately 640 plant species endemic to NSW but not currently listed as threatened are predicted to have been burnt by the 2019-20 fires, and more than half of these (52%) were found to be at High or Medium risk of decline as a result of the 2019-20 fires⁷⁷⁷

⁷⁷⁶ Meeting with the NSW Bushfire Risk Management Research Hub on 17 June 2020.

⁷⁷⁷ NSW Bushfire Risk Management Research Hub (2020) 'Impact on priority NSW flora'.

- over 450 threatened plant species⁷⁷⁸ in NSW were burnt, and over 60% of these species are considered at High or Medium risk of decline due to the 2019-20 fires⁷⁷⁹
- of 114 Ecological Communities listed as threatened under the NSW *Biodiversity Conservation Act 2016*, 87 were wholly or partly within the 2019-20 bush fire footprint, and 15 of those had more than one-third of their estimated occurrence within the fire footprint.⁷⁸⁰

For 65% of the species rated at High and Medium risk of decline, high fire frequency was the main reason for this assessment, with drought also a key driver that may limit recovery.

High fire frequency is a risk to some species because it interferes with critical life cycle processes of both plants and animals. For example, the Hub explains that some plant species are particularly vulnerable to short fire intervals, for example, ‘obligate seeders’ (plants that do not resprout) that have the plants killed by fire and are completely reliant on recovery from seeds. And even among resprouting species that can be more resilient to fire, it is unclear how drought, both before and after the 2019-20 fires, may affect their ability to recover.

The Research Hub highlights that the number of species that were previously considered not at threat but that now may be at increased risk following the fires is a serious concern and will require proactive assessment and management.

As outlined by the Research Hub, many Australian ecosystems are resilient to particular bush fire regimes, and some even tolerate occasional high severity fires. However, the Research Hub notes that the extent and extreme severity of the bush fires in many places, on top of the impacts of previous fires and in combination with the interacting influences of drought, disease and anthropogenic disturbances, means that “post-fire recovery of some ecosystems could be slow or completely impeded, while some ecosystems will undergo long-term transformational changes, with implications for their diversity and provision of ecosystem services.”⁷⁸¹

For example:

- rainforests are fire-sensitive ecosystems that are dependent on a moist microclimate and many rainforest plants do not have fire-resistant recovery organs nor do they have seed banks for regeneration after fires.⁷⁸² The Research Hub estimates that over 300,000 hectares (37%) of NSW rainforests were burnt in the 2019-20 bush fire season, of which 14% burnt at moderate to extreme fire severity. This is likely to be one of the largest areas of rainforest burnt in recorded history in Australia
- alpine ecosystems are also very sensitive to fire and recover slowly. More than one-fifth (27,000 hectares) of alpine vegetation in NSW was within the 2019-20 season bush fire footprint, of which 18% burnt at moderate to extreme fire severity, adding to the extensive areas of alpine vegetation still regenerating after severe fires in 2002-03.⁷⁸³

As already mentioned, increasing fire frequency (or interval squeeze – reduced time between fires) is an issue. As a result of the 2019-20 bush fires:

⁷⁷⁸ As listed under the NSW *Biodiversity Conservation Act 2016*, Cth *Environment Protection and Biodiversity Conservation Act 1999*, and IUCN (International Union for Conservation of Nature).

⁷⁷⁹ NSW Bushfire Risk Management Research Hub (2020) ‘Impact on priority NSW flora’.

⁷⁸⁰ NSW Bushfire Risk Management Research Hub (2020) ‘Ecosystem Impacts’.

⁷⁸¹ Ibid.

⁷⁸² Ibid.

⁷⁸³ Ibid.

- seven NSW Rainforest community types, 46 Wet Sclerophyll Forest types and two alpine vegetation types have experienced successive fires in less than 50 years across more than 50% of their distributions.⁷⁸⁴
- twenty Dry Sclerophyll Forest types, three Heathland types and four wetland types experienced fire intervals of less than 15 years across more than half of their distributions.⁷⁸⁵

Further, as explained in Chapter 2, a key feature of this season was fire burning in areas that it usually doesn't, like rainforests and peat. Nolan et al (2020)⁷⁸⁶ explain that remnant rainforests have persisted amongst more fire-prone eucalypt forests and are usually too moist to carry fire. In fact, it is fire that has effectively created the borders between eucalypt forests and rainforests over thousands of years. The effects of this season's fires on these fire-sensitive ecosystems needs to be carefully studied.

The Research Hub also completed a case study on peatland ecosystems in the Blue Mountains.⁷⁸⁷ This work found that hydrological changes associated with underground longwall mining has reduced the resilience of these peatland ecosystems to the bush fires.⁷⁸⁸ It found that peatland sites that were relatively undisturbed before the fires are showing rapid recovery following severe fire. Other peatlands that are associated with earlier longwall mining have experienced ecosystem collapse and were still largely unvegetated 10 weeks after the fire.⁷⁸⁹

Of significance is the Research Hub's observation that, globally, "study of interactions between fire, environmental change and ecosystem resilience is in its infancy" and, for example, that studies of this type looking at the interactions between fire and hydrological change have not previously been done in Australian peatlands.⁷⁹⁰

⁷⁸⁴ Ibid.

⁷⁸⁵ Ibid.

⁷⁸⁶ Nolan, R et al (2020) 1039-1041.

⁷⁸⁷ These peatlands are listed as an Endangered Ecological Community under the NSW *Biodiversity Conservation Act 2016* and the Cth *Environment Protection and Biodiversity Conservation Act 1999*.

⁷⁸⁸ NSW Bushfire Risk Management Research Hub (2020) 'Ecosystem impacts case study'.

⁷⁸⁹ Ibid.

⁷⁹⁰ Ibid.

4.7 PLANNING AND ADAPTATION TO RISKS TO ECOSYSTEMS

Key points

- Forests support a range of social, environmental and economic values for the community – health, biodiversity, production, tourism, carbon storage – and management of the landscape over the long-term will influence how effectively the forested regions of NSW can continue to provide those things.
- The potential for an increasing incidence of megafires is increasing risks to ecosystems, especially in combination with other pressures (ongoing increases in temperature, drought, land use change etc), and may be speeding up the transition of some ecosystems to a different state to what we have now. Many species and ecosystems are at increased risk of decline after the 2019-20 fires, including ones that were not considered at threat before the season.
- There is also concern in the community about different land management practices and their influence on the flammability of the landscape. However, available research is not yet comprehensive enough to inform management decisions about these issues over the long term.
- There is a need to be very clear about the priority values the NSW community seeks from its forests and to manage the land in an adaptive way informed by much better long-term monitoring, modelling, forecasting, research and evaluation.
- There may also be a need to think big, and to be realistic about the effects of climate change and changing fire regime on ecosystems. What if certain ecosystems of high value can no longer persist where they are now because fire will be too frequent and the climate will not be suitable anymore? How will this challenge paradigms about threatened species/ecosystem management which assume the things we value stay where they are now, which in some cases may be increasingly unlikely, and how bold are we willing to be in our response to this?

The Terms of Reference ask the Inquiry to make recommendations about appropriate action to adapt to future bush fire risks to communities and ecosystems. Community adaptation to fire risk is covered in Chapter 3 and the earlier parts of this Chapter. This section deals with ecosystem change and land management issues.

It looks at some of the potential risks to NSW ecosystems from changing fire regimes and a warming climate, as well as the implications of the 2019-20 fires. It also looks at questions around land use and management, and how land management practices might contribute to or ameliorate bush fire risk.

These are complex and unresolved questions. Therefore, the key focus of this section is on identifying the key research questions that need to be examined to understand in depth what has happened, what might happen in the future, and what options there might be over the coming years and decades.

4.7.1 What about animals?

Less is known about effects of the 2019-20 fires on animal populations. Initial estimates from NPWS (provided 1 April) were that the bush fires affected the habitat of at least 293 threatened animals and that:

- 99 species have more than 10% of their historically observed locations within a fireground
- 5 species have more than 80% of their historically observed locations within a fireground.

Further, NPWS estimated that more than 25% of the most suitable koala habitat in eastern NSW was within fire affected areas.⁷⁹¹

Professor Chris Dickman, Professor in Terrestrial Ecology at the University of Sydney, prepared widely reported estimates of the number of animals likely killed by the bush fires in NSW. Professor Dickman estimated that more than 800 million animals were killed in NSW (and more than one billion nationally).⁷⁹² Professor Dickman explained that, among the animals not killed by fire, many will return to areas that don't have the resources to support them anymore while others will be under pressure from pest animals such as foxes and feral cats which tend to proliferate after fire events. The Inquiry acknowledges the current work NPWS is undertaking on feral animal and post-fire weed control after the 2019-20 fires.⁷⁹³

However, Professor Dickman also explained that these estimates could only ever be rough because, in the absence of any other reliable information, they were based on data reported in a World Wide Fund for Nature study in 2007.⁷⁹⁴ Professor Dickman explained that a long-term decline in ecosystem monitoring means that we don't really know what was out there to start with, let alone how the fires affected plant and animal populations, and that is a major problem.⁷⁹⁵

It is easier to generate initial estimates of vegetation communities that have been affected by fire, and how badly, using satellite imagery of the firegrounds and existing vegetation mapping, than it is to estimate how many animals (including insects and other invertebrates) may have been affected. However, Professor Bradstock advised that fire severity mapping will enable better understanding of the proportions of habitats of vulnerable animal species that have been affected, for example, arboreal mammals are extremely vulnerable to crown fires as opposed to very low intensity fires.⁷⁹⁶

The Commonwealth Wildlife and Threatened Species Bushfire Recovery Expert Panel has released a provisional list of 191 invertebrate species known or presumed to have been severely affected by the 2019-20 bush fires nationally.⁷⁹⁷ The panel explains distributional information is limited as there are few monitoring programs for invertebrates, and that many invertebrate species have small, localised ranges so it is likely that the fires will have severely affected many more invertebrate species than plant or vertebrate animal species. There is also limited information about the impacts of fire on invertebrates. Also, the Threatened Species Recovery Hub (under the national Environment Science Program)

⁷⁹¹ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 1 April 2020*.

⁷⁹² Professor Chris Dickman (2020, 8 January). More than one billion animals killed in Australian bushfires, *The University of Sydney News*. Retrieved from <https://www.sydney.edu.au/news-opinion/news/2020/01/08/australian-bushfires-more-than-one-billion-animals-impacted.html>.

⁷⁹³ NPWS (National Parks and Wildlife Service). Website Recovering from the 2019-20 fires. Retrieved from <https://www.environment.nsw.gov.au/topics/parks-reserves-and-protected-areas/fire/park-recovery-and-rehabilitation/recovering-from-2019-20-fires>.

⁷⁹⁴ Johnson, C., Cogger, H., Dickman, C. & Ford, H. (2007). *The Impacts of the Approved Clearing of Native Vegetation on Australian Wildlife in New South Wales*. WWF-Australia, Sydney. 37 pages. ISBN: 1 921031 17 4.

⁷⁹⁵ Meeting with Professor Chris Dickman on 27 May 2020.

⁷⁹⁶ Professor Ross Bradstock. (2020). *Advice to the Inquiry provided 21 July 2020*.

⁷⁹⁷ Department of Agriculture, Water and the Environment. Provisional list of invertebrates requiring urgent management intervention. Retrieved from <https://www.environment.gov.au/biodiversity/bushfire-recovery/priority-invertebrates>.

makes the general point that distributional data and modelling is often poor for many species not listed as threatened, and this is particularly the case for invertebrates.⁷⁹⁸

Bush fires also affect soil and soil organisms, and this is another area that requires further study to understand better how disruptions to soil biota from bush fire influence overall ecosystem recovery.

One of the reasons that we don't have good data on animal populations is because it is expensive and time-consuming to collect the data in the field. However, with sensor technology and greater automation there is some hope that over time this will get better.

Overall, the advice of several experts highlights a few key issues with respect to plant and animal species and ecosystem health:

- a need to understand better and consider the range of interacting pressures on landscapes that will influence the resilience of an ecosystem and its capacity to recover from bush fire, not just the direct impact of the fire itself (e.g. drought, disease, erosion, weed and pest invasion)
- that increasing fire frequency is a serious concern for many fire-sensitive ecosystems, and we may already be at a stage where we should expect some of them to be changing state to something different from what we have now.

4.7.2 Land management regimes and flammability

The Inquiry heard a range of views in the community about different land management practices that were seen as either increasing or decreasing the flammability of the landscape. Different land uses and land management practices, over decades, will likely have an influence on future bush fire risk, which presents serious questions about how we balance the values we seek from our forests – recreation, tourism, timber, biodiversity, carbon storage etc. – with potential future risks to lives, property and other assets we value.

To look at how the experience of the 2019-20 fires can help to provide some insight into this issue, the Research Hub did a preliminary analysis of some 2019-20 data from a case study of areas of the Bees Nest fire in northern NSW and the complex of fires on the South Coast, to look at the effect of recent native forest logging on fire severity.

The Inquiry has heard claims that logging reduces landscape flammability and arguments that more native forests should be opened to this activity in order to manage bush fire risk, and it has also heard claims that logging increases forest flammability by creating conditions for the forests to dry and creating forest structure that encourages bad fires.

The Research Hub outlined some of the existing research on this issue:⁷⁹⁹

- there is work that shows recent logging promotes higher severity fire, and that logging does not mitigate fire (study in Victoria after Black Saturday)⁸⁰⁰

⁷⁹⁸Dickman, C, Driscoll, D, Garnett, S, Keith, D, Legge, S, Lindenmayer, D, Maron, M, Reside, A, Ritchie, E, Watson, J, Wintle, B, & Woinarski, J (2020) After the catastrophe: a blueprint for a conservation response to large-scale ecological disaster, Threatened Species Recovery Hub. Retrieved from https://www.nespthreatenedspecies.edu.au/_images/Projects/After%20the%20catastrophe%20report_V5.pdf.

⁷⁹⁹ NSW Bushfire Risk Management Research Hub (2020) 'Logging and fire severity'.

⁸⁰⁰ Price, O, & Bradstock, R. (2012). 146-157.

- other work shows the effect of stand age on fire severity is of minor importance compared to weather⁸⁰¹
- recent work in Victorian forests (typically taller and wetter than the forests that predominantly burnt in NSW this season) concluded that logging exacerbated fire at the landscape scale in the 2019-20 fire season.⁸⁰²

The Research Hub's study of harvested and unharvested forests within the Bees Nest and South Coast fire areas found:

- no significant difference between harvested and unharvested areas in the probability of elevated fire severity
- inconsistent and minor effects of time since harvest on probability of elevated fire severity, with slightly higher probability of high severity in harvested areas in the 20-30 year age class.⁸⁰³

Similar results were found in a study completed by NSW Department of Primary Industries – that at the landscape scale, fire severity was much the same regardless of tenure and in State forests fire severity does not appear to have been influenced by harvesting.⁸⁰⁴

The results from the Hub's research are limited by the relatively small harvested areas within these fires and there will be much more to learn from the 2019-20 season when the data are examined more closely. But this analysis indicates the type of detailed study that is needed to test the assertions made about different land management practices, in the face of increasingly extreme weather conditions, to inform future management practices and the ideal spatial configuration of different land uses and management regimes within NSW forests.

4.7.3 The potential for increasing fire frequency needs serious study to understand what is going on and what adaptation may be possible

Overall, matters of landscape and ecosystem management are complex and the available research is not comprehensive or clear. The 2019-20 fires were a rare event, and it is important to take this opportunity to mine the available data intensively, get out into the field to understand what has really happened, and to start monitoring ecosystems and their responses much better than we have been.

The 2019-20 bush fires have shown us how the lack of continuity in data collection and monitoring impedes our ability to understand what has happened, how serious it is, and what it means for the future.

Better monitoring and forecasting will put NSW in a better position to ask and try to answer some of the big adaptation questions we are now facing:

- How do we plan for the long-term management of the landscape and the fire regime in a way that maintains the ecological, productive and social values of forests, in the face of drier and warmer conditions and the likelihood of more frequent fires?

⁸⁰¹ Bowman, D, Williamson, G, Prior, L, & Murphy, B, (2016). The relative importance of intrinsic and extrinsic factors in the decline of obligate seeder forests. *Global Ecology and Biogeography*, 25(10), 1166-1172.

⁸⁰² Lindenmayer, D, Hunter, M, Burton, P, & Gibbons, P. (2009). Effects of logging on fire regimes in moist forests. *Conservation Letters*, 2(6), 271-277.

⁸⁰³ Samples were of Wet Sclerophyll and Dry Sclerophyll vegetation formations.

⁸⁰⁴ NSW DPI (Department of Primary Industries). (2020). Fire Severity in harvested areas. Retrieved from https://www.dpi.nsw.gov.au/_data/assets/pdf_file/0020/1222391/fire-severity-in-harvested-areas.pdf.

- How will the structure of vertebrate, insect and vegetation communities change in the future as a result of warmer temperatures and more frequent fire, and how will this influence flammability of the landscape?
- What are the priority values we want our forests to provide/support for the community over the long-term and what are the implications of this for the spatial patterns of different land uses and land management practices across NSW when fires are more frequent and ecosystems may be transforming to different states?
- What should we be aiming for in a world that is several degrees warmer? What is the transformation that we should be expecting and what should we do about it?
- How do we adapt? Do we just accept that some valuable ecosystems will be written off? Do we try to establish buffer zones that are relatively fire resistant, for example around the rainforests in north-east NSW? Or do we try to transplant some of their species uphill or southwards?

Among these issues some specific and immediate priorities include:

- understanding what steps can be taken to find other locations where species can persist, if the whole range of a species is threatened by climate change and change in fire frequency
- a program of monitoring and forward-scenario research to prioritise areas where currently-dominant species are likely to be killed out by heatwave, drought or shortened fire intervals, and then to consider what should be dominant there instead, if and when that happens.⁸⁰⁵

A report by the Threatened Species Recovery Hub under the National Environment Science Program,⁸⁰⁶ highlights a number of key priorities post the 2019-20 bush fires, and also points out that we may need to reconsider policy and regulatory approaches to conservation, and our conservation objectives under a future that includes more frequent fire events, noting that “recovery to pre-fire environments and species assemblages may be impossible.”

Importantly, a program of improved data collection and monitoring should make better use of citizen science, and technology for remote sensing and automated data collection (for example, putting appropriate sensors on automated fire towers). The NSW Smart Sensing Network,⁸⁰⁷ an alliance of universities established to help solve problems for government and industry, was established by the NSW Government to be available to tackle these kinds of issues.

The Inquiry notes that the Government has asked the Natural Resources Commission to oversee a State-wide monitoring and evaluation process for NSW forests across all tenures (Forest Monitoring and Improvement Program), and this will provide an important baseline platform for other studies.⁸⁰⁸

⁸⁰⁵ Professor Mark Westoby (2020). *Advice to the Inquiry provided 14 July 2020*.

⁸⁰⁶ Dickman, C, Driscoll, D, Garnett, S, Keith, D, Legge, S, Lindenmayer, D, Maron, M, Reside, A, Ritchie, E, Watson, J, Wintle, B, & Woinarski, J (2020) After the catastrophe: a blueprint for a conservation response to large-scale ecological disaster, Threatened Species Recovery Hub, January 2020. Retrieved from https://www.nespthreatenedspecies.edu.au/images/Projects/After%20the%20catastrophe%20report_V5.pdf.

⁸⁰⁷ NSSN (NSW Smart Sensing Network). (2020). NSW Smart Sensing Network. Retrieved from <https://www.nssn.org.au/>.

⁸⁰⁸ NSW NRC (Natural Resources Commission). (2020). Forest Monitoring and Improvement Program. Retrieved from <https://www.nrc.nsw.gov.au/forest-monitoring>.

There is also an opportunity to make better use of the capabilities and resources of the Australian Royal Botanic Gardens and NSW zoos in this research effort.

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.

5 RESPONSE TO THE BUSH FIRES

5.1 INTRODUCTION

The Terms of Reference require the Inquiry to consider “responses to bush fires, 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*
- *equipment and communication systems.*⁸⁰⁹

The Inquiry is also required to make recommendations arising from the Inquiry as considered appropriate, including on:

- *emergency responses to bush fires, including overall human and capital resourcing*⁸¹⁰
- *coordination and collaboration by the NSW Government with the Australian Government, other state and territory governments and local governments*⁸¹¹
- *safety of first responders*⁸¹²
- *public communication and advice systems and strategies.*⁸¹³

Chapter 2 of this report outlined how the fires developed across NSW over the 2019-20 fire season. Chapters 3 and 4 assessed whether NSW’s preparation and planning ahead of the season was sufficient, particularly in light of the predicted conditions. This Chapter provides an overview of the response to the fires and an assessment of its effectiveness, as well as opportunities for improvement in the future. In particular, this Chapter examines:

- the role of firefighters and the community
- safety of first responders
- the role of Incident Management Teams
- strategies to control the fires including early suppression, backburning, the use of heavy plant, the protection and use of water, aerial attack and fire retardant
- communications systems
- operations centres at the local and State levels
- the Commonwealth Government’s role
- public warning systems, including Fires Near Me
- evacuation.

⁸⁰⁹ Term of Reference 3.

⁸¹⁰ Term of Reference 8.

⁸¹¹ Term of Reference 9.

⁸¹² Term of Reference 10.

⁸¹³ Term of Reference 11.

5.2 RFS VOLUNTEERS AND THE ROLE OF THE COMMUNITY

Key points

- RFS volunteers were at the heart of the 2019-20 fire fighting effort, and the community is overwhelmingly grateful for their hard work and sacrifice. Local community members also played a crucial role in protecting life and property.
- Local brigades were deployed around the State, often fighting fires in unfamiliar territory. There is a need to provide better information to out-of-area crews from all fire authorities to ensure they understand the environmental and community context they are working in.
- Local brigades often didn't have broader situational awareness of the fires which would have helped them to understand why certain strategic or operational decisions were being made by Incident Management Teams, including resource allocation across the fireground. This was a source of significant frustration for many local brigades.

5.2.1 Volunteer firefighters made an extraordinary contribution during the 2019-20 season

The Inquiry recognises all firefighters who put their lives on the line to fight the fires during the extraordinary 2019-20 bush fire season in NSW. The Inquiry particularly recognises the contribution of all the NSW Rural Fire Service (NSW RFS) members and their families. Tragically, three NSW RFS members lost their lives while protecting their communities, and their sacrifice will never be forgotten.

The strength of the NSW RFS member firefighter base was evident throughout the 2019-20 season. From August 2019 to February 2020, NSW RFS personnel (the vast majority of whom were volunteers) undertook over 186,000 fire fighting shifts fighting more than 11,000 fires⁸¹⁴. In terms of the number of firefighters on the firegrounds, 27 November 2019 was the peak, with 3,739 firefighters operating on that single day.⁸¹⁵ Beyond the statistics, which are staggering in and of themselves, the personal sacrifice made by volunteers putting their community ahead of their own interests must be acknowledged. The NSW RFS advised the Inquiry that many NSW RFS members suffered personal loss, such as their homes and livelihoods being destroyed, whilst protecting their communities.⁸¹⁶

In every community meeting and in many written submissions to the Inquiry, the community's gratitude to NSW RFS volunteers was overwhelming. The Inquiry notes that some community members also expressed dissatisfaction towards the NSW RFS.

*Firstly, I would like to offer deep thanks to all in the RFS and relevant government agencies for their selfless efforts in extraordinarily difficult times.*⁸¹⁷

*The RFS volunteers did a magnificent job, above and beyond anything that could have been expected. A bad situation could have been a whole lot worse.*⁸¹⁸

⁸¹⁴ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

⁸¹⁵ Ibid.

⁸¹⁶ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 4 May 2020*.

⁸¹⁷ John Stein, Submission to the Inquiry.

⁸¹⁸ Martin Darling, Submission to the Inquiry.

*Our local Penrose and Wingello Bush Fire Brigades worked tirelessly over the 27 days that the Morton fire raged around Penrose and Wingello. They carried out hazard reductions, created containment trails, dealt with major and minor fire outbreaks and reignitions and worked around the clock in some instances to actively defend their villages. We are all very proud of the work carried out by these amazing volunteers.*⁸¹⁹

*A timely thank-you to the Bodalla Rural Fire Service whose response and regular patrols in our road helped us make the right decisions at each critical point in the bush fire crisis, and to our police force for visit each individual property to advise of upcoming bad days and offering assistance if needed!*⁸²⁰

As discussed in Chapter 2, the 2019-20 fire season followed severe drought conditions across NSW, which not only affected fire behaviour and spread, but also affected the availability of rural and regional NSW RFS volunteers. The NSW RFS advised that, as volunteers needed to stay on farms to perform daily feeding, watering and other duties, their availability was reduced.⁸²¹ As finances or feed availability depleted, and with resultant destocking actions, volunteer availability increased. The Inquiry recognises the significant strain these volunteers were under both financially and personally as the impacts of the drought continued to be felt. The Inquiry heard that many volunteers worked on their farm and then went straight to a volunteering shift, and for many people this continued for months on end.

*I am a landowner and farmer in the Braidwood region ... In total I attended at fires over 50 days either on a NSW Rural Fire Service (RFS) tanker or assisting using my own vehicle.*⁸²²

*I don't know how many times I got off a shift at 3 or 4.00am, to then go back to the shed for a 7.00am briefing the same morning. I wasn't looking after our farm most of the time, that was mostly being done by my brother and 16 year old son.*⁸²³

The NSW RFS advised the Inquiry that, even in non-drought conditions, overall volunteer availability tends to be higher in regional and metropolitan areas compared to rural areas. This additional availability and capacity provide the community with a critical surge capacity for fires across NSW, particularly those in rural areas.⁸²⁴

The importance of this surge capacity was demonstrated in the 2019-20 season. In addition to deploying local firefighters, the NSW RFS deployed 1,229 Strike Teams made up of 15,584 out-of-area firefighters and 5,128 Incident Management Team (IMT) personnel (IMTs are further discussed later in this Chapter).⁸²⁵ NSW RFS members worked alongside firefighters from Forestry Corporation of NSW, Fire and Rescue NSW and NSW National Parks and Wildlife Service (NPWS), many of whom were also required to move around the State as fires developed. These firefighters were a crucial part of the overall fire fighting effort, and also provided the NSW RFS with additional surge capacity within NSW. In total,

⁸¹⁹ Anne Pidcock, Submission to the Inquiry.

⁸²⁰ Gloria Tommy, Submission to the Inquiry.

⁸²¹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 4 May 2020*.

⁸²² Michael McGrath, Submission to the Inquiry.

⁸²³ Name withheld, Submission to the Inquiry.

⁸²⁴ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 4 May 2020*.

⁸²⁵ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 15 April 2020*.

NSW firefighters completed 277,415 shifts.⁸²⁶ A total of 1,294 individual NPWS staff was deployed, conducting over 43,000 person days of fire fighting operations.⁸²⁷ As the fires started in the north of the State and moved south, resources were deployed accordingly which required fire fighting personnel to travel long distances over the course of the season.

Given the scale of the firegrounds across the State, there were understandably some logistical challenges associated with moving personnel across large distances, which are further discussed later in this Chapter. Notwithstanding these challenges, the NSW RFS advised the Inquiry that NSW surge capacity arrangements worked well overall.

5.2.2 Local brigades were well-supported by personnel from NSW, interstate and overseas

The immense fire fighting efforts of the NSW RFS were supported by personnel from NSW combat agencies including FRNSW, NPWS, Forestry Corporation, NSW State Emergency Service and the NSW Police Force. The NSW RFS also acknowledged the critical support of other NSW Government and non-government agencies,⁸²⁸ including the NSW Soil Conservation Service and Transport for NSW⁸²⁹ which provided equipment and trained personnel to undertake works requiring the use of heavy plant (discussed further later in this Chapter).

As discussed in Chapter 3, there are existing arrangements in place to facilitate interstate and international assistance through the National Resource Sharing Centre (NRSC). The NSW RFS advised the Inquiry that over the course of the 2019-20 season, over 5,600 interstate and international personnel were deployed in fire fighting, IMT and aviation roles, with each deployment lasting from three to 35 days.⁸³⁰

Given the demands on NSW personnel, the Inquiry considers the interstate and international deployments coordinated through the NRSC were vital to managing the number and scale of fires during the 2019-20 season. While there are some opportunities for process improvements (see Chapter 3 for further discussion), overall the Inquiry found that current arrangements are very effective and that no changes to current roles and responsibilities in coordinating these deployments are required.

Throughout the course of the Inquiry there was open acknowledgement that resources (both personnel and equipment) were stretched due to the extraordinary nature of the 2019-20 season. However, as discussed in Chapter 3, there was also broad stakeholder acknowledgement that ‘no amount of firefighters could have extinguished these fires, as they

⁸²⁶ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 5 June 2020*.

⁸²⁷ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 1 April 2020*.

⁸²⁸ NSW agencies included Corrective Services NSW, Local Land Services NSW, NSW Ambulance, NSW Department of Education, NSW Department of Justice (Office of Emergency Management), NSW Department of Planning, Industry & Environment (Energy), NSW Department of Primary Industries, NSW Environment Protection Authority, NSW Health, NSW National Parks & Wildlife Service, NSW Police Force, NSW Public Works, NSW State Emergency Service, NSW Telecommunications Authority, Office of the Sheriff NSW, Transport for NSW and WaterNSW. Other emergency services/non government agencies included Association of Independent Schools (NSW), Australasian Fire & Emergency Services Authorities Council, Catholic Schools NSW, Volunteer Marine Rescue NSW, NSW Volunteer Rescue Association, Surf Lifesaving NSW and St Johns Ambulance (NSW).

⁸²⁹ TfNSW (Transport for NSW). (2020). *Advice to the Inquiry provided 15 May 2020*.

⁸³⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 15 April 2020*.

were just too big'.⁸³¹ The Inquiry recognises that, while additional fire fighting staff would always be welcome, in the prevailing conditions during the 2019-20 season it is unlikely that additional fire fighting personnel would have made a significant difference to the outcome during the season.

5.2.3 Local brigades and out-of-area crews would benefit from broader situational awareness

The extensive deployment of out-of-area NSW firefighters this season (both from within the NSW RFS and other fire authorities), together with interstate and international deployments, highlighted the need for improved situational awareness of the environmental and community context these crews were working in. NSW is incredibly varied, with different types of terrain, vegetation and ease of access, all of which impact on fire behaviour and associated fire fighting techniques. It is essential for out-of-area crews from all agencies to be briefed on these nuances before they arrive on a fireground to ensure they have all relevant information, rather than relying on personal experience which may relate to very different environments. This is particularly true of environments prone to dynamic fire behaviours. The Inquiry notes the NSW RFS provided clear and succinct information to out-of-area crews on drought conditions during the 2019-20 season, which could be enhanced and used as a model for providing additional information on types of terrain and fuels.⁸³²

In addition, as described in Chapter 3, the priorities for protection from fire can change from community to community. For example, the Inquiry heard that some communities considered pasture and fencing to be more valuable than houses, particularly in the context of the drought. As discussed in Chapter 4, the Inquiry recommends further work is undertaken to provide clear guidance on the relative value of particular assets. Once complete, this information should also be integrated into information for out-of-area crews as required.

Beyond improving situational awareness of the local environment firefighters were operating in, a number of NSW RFS brigade members raised concerns about the underlying rationale of decisions made by Incident Management Teams (IMTs), which are deployed when a Section 44 declaration is made (as explained in Chapter 3). There was often a lack of understanding as to why certain strategies were or were not pursued, and sometimes from an individual's perspective there appeared to be a disconnect between the strategies pursued by an IMT and local priorities (further discussed later in this Chapter). In discussions with both IMT members and local brigade members, it became clear to the Inquiry that there was sometimes a lack of broader situational awareness at the local level. The local perceptions of fire crews can sometimes be at odds with the larger scale problem that expansive bush fires will present. For example, the dynamics of extreme bush fires/pyroCB are better appreciated from tens of kilometres away (or even from space) and may not be fully appreciated by local crews observing fire dynamics at special scales of 1 km or less.

This was particularly evident during the Inquiry's discussions about the Gospers Mountain megafire in the Central Coast, Hawkesbury Blue Mountains and Lithgow regions. At the Lithgow community meeting, local NSW RFS members expressed their frustration at the lack of resources committed to proposed backburning operations in the Capertee, Wolgan Valley and Glen Davis areas and felt this should have been prioritised by the IMT. However, the IMT briefed the Inquiry on the size and extent of the Gospers Mountain fire, which at one

⁸³¹ Meeting with Greg Mullins, Emergency Leaders for Climate Action on 10 February 2020.

⁸³² RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 17 March 2020*.

point was threatening communities on both sides of the Bells Line Road. This meant the IMT needed to focus available fire fighting resources on protecting life and property in these areas, given the potential for serious damage and loss of life. As in all major incidents, the IMT was responding to a constantly evolving situation and making decisions about resource allocation taking into account a range of competing priorities, associated risks and finite resources. However, this broader situational awareness was not always available to local brigades.

Due to the size of some IMT area commands during the 2019-20 season, it was often difficult to communicate what was happening across the firegrounds to local brigades as part of regular daily briefings. There is no suggestion that if local brigades had this information they would or should have made different operational decisions on the ground. Rather, had this situational awareness been present at the time, local brigades may have better understood the rationale behind why the IMT was pursuing certain strategies. This may also have alleviated the understandable frustration many brigade members felt as a result of being ordered to implement particular strategies (or refrain from taking particular actions) which didn't always seem to align with local priorities. This again comes down to better appreciation of how differences in scale of bush fire dynamics can influence the overall behaviour/progression of large fires.

The Inquiry considers that information to support broader situational awareness at the local level is desirable, and may become critical if training does not provide firefighters with a better appreciation of the importance of broader scale considerations in large bush fires to local brigades implementing Incident Action Plans.⁸³³ Providing situational awareness should not unduly delay daily verbal briefings, given the importance of local brigades entering the firegrounds as early as possible before weather conditions deteriorate later in the day.

The Inquiry considers the most efficient way of delivering this information is via Mobile Data Terminals (MDTs) in all NSW RFS fire fighting vehicles, as this would provide local brigades with immediate access to the evolving situation via briefings, maps and other relevant material. The Inquiry notes that other combat agencies including FRNSW and the NSW Police Force already have MDTs in their vehicles and recommends the NSW RFS should also have access to this equipment. The NSW RFS has identified installation of MDTs in NSW RFS fire fighting vehicles as a priority for 2020-21 and has committed to a pilot ahead of a staged rollout.⁸³⁴ Given the importance of ensuring local brigades can access up-to-date information quickly in often dynamic and changing circumstances, the Inquiry supports accelerating the rollout of MDTs in all NSW RFS fire fighting vehicles to ensure implementation of the full roll-out by the 2021-22 fire season. This is further discussed later in this Chapter.

Recommendation 37: That, in order to ensure all firefighters understand how local situational awareness reflects (or may not reflect) the broader scale situation presented by a large/extreme bush fire and the implications this may have on asset protection and fire suppression strategies, the NSW RFS:

⁸³³ An Incident Action Plan (IAP) is a tool used to define and communicate the incident objectives, strategies, resources and other information relevant to the control of an incident.

⁸³⁴ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

- a) develops information packages for all types of operating environments to improve out-of-area crews' understanding of the local terrain and fuels, and distributes information to out-of-area crew members from all fire authorities
- b) accelerates the roll out of Mobile Data Terminals into all fire fighting vehicles to improve delivery of briefings and incident information/intelligence to field commanders.

5.2.4 Submissions were largely silent on financially compensating volunteers for their service

The reliance on volunteer firefighters in NSW (and Australia more broadly) is not unique. Other countries including the United States and Russia also have large numbers of volunteer firefighters, and on raw figures Australia has the ninth-largest number of volunteer firefighters by nation.⁸³⁵ However, given the extent to which Australia, and NSW, is prone to bush fires, questions have been raised as to whether our reliance on volunteer firefighters compared to paid firefighters is appropriate.

The issue of providing volunteer firefighters with financial compensation for their service was the subject of media coverage over the course of the season.⁸³⁶ In December 2019, the Commonwealth Government announced a one-off payment to NSW RFS and State Emergency Service volunteers who are self-employed or work for small and medium businesses and who were called out for more than 10 days of service during the 2019-20 season (not limited to fire fighting roles). These payments recognised the extraordinary nature of the season and the impact on volunteers' livelihoods. The payments provided some compensation for lost income for up to \$300 per day, up to a total of \$6,000 per person.⁸³⁷

Service NSW administered the payment on behalf of the Commonwealth Government and advised the Inquiry that 2,232 volunteers have applied for the payment to date, with an average claim amount of \$4,542 per applicant.⁸³⁸ As the NSW RFS was unable to provide an estimate of the number of NSW RFS members eligible for the payment, the Inquiry was unable to determine the overall take up rate. However, submissions to the Inquiry and participants in community meetings were largely silent on this issue, and there was not a strong view from stakeholders (including NSW RFS members) that financial compensation was a major concern. While there was acknowledgement of the financial sacrifice that was made in service of the community, this was not accompanied by a call for financial compensation.

Fortunately for the Brigade, many of our senior officers and members are self-employed meaning they have greater flexibility around organising work. However,

⁸³⁵ Cull, Michelle. (2020, 23 January). Value beyond money: Australia's special dependence on volunteer firefighters, *The Conversation*. Retrieved from <https://theconversation.com/value-beyond-money-australias-special-dependence-on-volunteer-firefighters-129881>.

⁸³⁶ Dalzell, Stephanie. (2019, 21 December). Should volunteer firefighters get paid?, *ABC*. Retrieved from <https://www.abc.net.au/news/2019-12-21/volunteer-firefighters-deserve-compensation/11820016>.

⁸³⁷ <https://www.nsw.gov.au/media-releases/new-payments-to-support-nsw-volunteer-firefighters>

⁸³⁸ SNSW (Service NSW). (2020). *Advice to the Inquiry provided 11 May 2020*.

*these members sacrificed tens of thousands of dollars in foregone wages to lead and make up crews and to serve their community.*⁸³⁹

The take up rate of the payment by fire fighting volunteers in the ACT was particularly low, with only eight volunteers applying for the payments. The ACT Volunteer Brigades Association emphasised that while the volunteers were grateful for the payments, remuneration was not a motivating factor and community service was considered to be far more important.⁸⁴⁰ This echoes sentiments the Inquiry heard from NSW RFS members, and affirms the Inquiry's conclusion that ongoing financial compensation for volunteers is not required. The submission from the Emergency Leaders for Climate Action supported this view, stating that paying volunteers for their services "would be unlikely to increase [volunteer] numbers in the short or long term".⁸⁴¹

5.2.5 Flexible leave and employment protections are crucial to enable NSW RFS volunteer deployment

Flexible leave arrangements and employment protections were critical in enabling NSW RFS volunteers to participate in such a long season. Studies by the Bushfire and Natural Hazards CRC have confirmed that competing demands of work or business are the most frequently cited factor limiting volunteer participation.⁸⁴²

In NSW, a Volunteer Protection Order is enacted under section 60D of the *State Emergency and Rescue Management Act 1989* (SERM Act) by the Premier or authorised officer to protect the employment of volunteer emergency workers. A declaration under Section 44 of the *Rural Fires Act 1997* does not of itself bring these protection measures into effect.

A Volunteer Protection Order applies to NSW RFS volunteers and volunteer emergency workers from other agencies.⁸⁴³ There are penalties under the SERM Act for employers who victimise staff for being absent if those individuals are emergency service volunteers engaged in emergency operations while the Volunteer Protection Order is in force. However, the order does not obligate employers to release employees or provide paid leave.

Eleven Volunteer Protection Orders were enacted during the 2019-20 bush fire season, ranging in duration from 48 hours to 14 days.⁸⁴⁴ This is notably more than the three Volunteer Protection Orders enacted in each of the 2018, 2017 and 2013 bush fire seasons.⁸⁴⁵ This highlights the extraordinary nature of the 2019-20 season.

The NSW RFS advised the Inquiry that many employers, including local government, actively supported and promoted the release of NSW RFS volunteers during the fire season, particularly at its peak, and in some cases employers continued to remunerate their

⁸³⁹ Katoomba/Leura Rural Fire Brigade, submission to the Inquiry.

⁸⁴⁰ Giannini, Dominic. (2020, 10 June). Only eight volunteers accessed Commonwealth compensation after bushfires, *RiotACT*. Retrieved from <https://the-riotact.com/only-eight-volunteers-accessed-commonwealth-compensation-after-bushfires/381200>.

⁸⁴¹ Emergency Leaders for Climate Action, Submission to the Inquiry.

⁸⁴² RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 4 May 2020*.

⁸⁴³ NSW State Emergency Service (SES), Fire and Rescue NSW (FRNSW), Ambulance Service of NSW and NSW Volunteer Rescue Association.

⁸⁴⁴ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 15 April 2020*.

⁸⁴⁵ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

employees while they were volunteering.⁸⁴⁶ The Inquiry commends these employers for their support.

The NSW Government provides unlimited paid leave to all State public service employees who volunteer with the NSW RFS or other emergency services, and they are also able to take rest leave to allow time for them to recover before returning to work.⁸⁴⁷ There is no requirement for a Volunteer Protection Order to be in place before employees can access this leave. In a meeting between the Inquiry and Unions NSW,⁸⁴⁸ Unions NSW submitted that leave arrangements were applied differently across agencies, and praised Transport for NSW for its flexible and compassionate approach.

5.2.6 Community members also played a crucial fire fighting role during the 2019-20 season

The Inquiry heard from multiple sources about the invaluable assistance provided by farmers/landholders using smaller vehicles with water tanks on the back to assist NSW RFS volunteers on the . They were commonly referred to at community meetings as the ‘slip on brigade’ or the ‘Mozzies’,⁸⁴⁹ referring to their ability to swarm onto their neighbours’ properties to assist. The NSW RFS formally refers to private landholders working alongside the NSW RFS as ‘farm fire units’ and has acknowledged that ‘farmers are a critical part of the fire fighting effort, and an important partner in managing and responding to the threat of fire’.⁸⁵⁰

One of these groups, the ‘Mongarlowe Mozzies’, was featured in the ‘From the Embers’ podcast series by the Community Broadcasting Association of Australia.⁸⁵¹ The small town of Mongarlowe, made up of around 300 homes, was threatened by the Currowan fire in late 2019 and early 2020. The NSW RFS brigade had two fire trucks to defend the town, and there were no additional resources available due to the number of other fires burning around the State. The local community galvanised together to support the NSW RFS brigade and fought alongside it. Using their own equipment and water supplies, the ‘Mozzies’ were on the firegrounds day and night fighting intense fires. While the region was severely affected, there was no life or property lost in Mongarlowe as the community ‘banded together’ to protect each other. Community members in such circumstances must, however, have a comprehensive understanding of the full spectrum of potential fire behaviours and what these might present, otherwise they may present as a hindrance rather than as assistance to fire authorities. The Inquiry strongly supports early messaging/warnings to the community to leave if under significant threat.

The Mongarlowe Mozzies is just one of many stories the Inquiry heard, which are a testament to the incredible resilience and strength of communities across NSW who were threatened by fire.

⁸⁴⁶ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 4 May 2020*.

⁸⁴⁷ DPC (Department of Premier and Cabinet). (2009). Circular C2009-05 Leave for Staff Affected by the Bush Fire Emergency. Retrieved from <https://arp.nsw.gov.au/c2009-05-leave-staff-affected-bush-fire-emergency/>

⁸⁴⁸ Meeting with Unions NSW on 14 April 2020.

⁸⁴⁹ Capital to Coast Community Meeting on 13 May 2020.

⁸⁵⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

⁸⁵¹ Ansara, Alice. (2020). From the Embers – The Mosquito Army, *Community Broadcasting Association of Australia*. Retrieved from <https://www.cbba.org.au/embers-podcast-mosquito-army-ep-3>.

If not for the “ute brigade” with 1000L IBCs to fight the fires and save homes, with little or no support from the RFS or NSW Fire and Rescue, more property and houses would’ve been lost⁸⁵²

...my younger neighbours and community in the Tuntable and Terania valleys stayed put and fought the fire successfully with the support of our trained RFS members and some RFS equipment. No houses were lost.⁸⁵³

My husband and I and other family members assisted local firefighters to back burn in our area to stop fires leaving Girard’s state Forrest to enter pastoral land.⁸⁵⁴

The mozzies were amazing. The Braidwood Community Help Fund provided fuel vouchers to over 200 mozzies who worked with the RFS.⁸⁵⁵

The Inquiry acknowledges all NSW citizens who helped defend their communities and recognises the important contribution they made to fire fighting during the 2019-20 season.

5.2.7 Safety concerns were raised regarding private landholders on the firegrounds

The Inquiry heard it is relatively common for farmers/local community members to use their own equipment (utes and tanks) to protect their own property and/or their neighbour’s property in the event of a rural fire. A number of stakeholders⁸⁵⁶ and community members expressed concern about the protective equipment (or lack thereof) being used by farm fire units on the fireground. Multiple examples were given of local landholders turning up in boots and shorts to assist their neighbours. While these landholders aren’t working under the direction of the NSW RFS, and therefore aren’t issued personal protective equipment or personal protective clothing, it is important for them to take appropriate action to protect themselves while fire fighting.

The Inquiry understands that, at this stage, there are no formal protocols governing the engagement and tasking of farm fire units. The issue of fireground safety and engagement with farmers/private landholders was the subject of a recommendation from the 2019 Coroner’s Inquiry into the 2017 Sir Ivan fire:

That the NSW RFS, in consultation with NSW farmers, extend and expand primary producer engagement strategies to include a focus on how private landholders within farming communities can work with the RFS, including a focus on ... fire ground management structure and firefighter safety.⁸⁵⁷

The Inquiry notes the NSW Government is yet formally to respond to this recommendation. However, on 7 May 2020 the NSW RFS Commissioner Rob Rogers AFSM released nine

⁸⁵² Barry Patten, Submission to the Inquiry.

⁸⁵³ Ian Dixon, Submission to the Inquiry.

⁸⁵⁴ Susan Grogan, Submission to the Inquiry.

⁸⁵⁵ Capital to Coast Community Meeting on 13 May 2020.

⁸⁵⁶ Meeting with NSW RFS Association on 13 May 2020.

⁸⁵⁷ Coroners Court New South Wales. (2019). Fire at ‘Flagview South’, Sir Ivan Dougherty Drive, Leadville February 2017. pp 2-3. Retrieved from <http://www.coroners.justice.nsw.gov.au/Documents/Sir%20Ivan%20Doherty%20Drive%20Leadville%20Fire%20Findings.pdf>.

priorities that the NSW RFS will be focusing on in 2020/21, one of which is 'Farm Fire Unit Integration'.⁸⁵⁸ The NSW RFS has committed to working with farmers in order to:

- strengthen farm fire unit integration and increase take-up of the Farm Fire Plan
- ensure a shared understanding of response capabilities, responsibilities and priorities of farmers and farm fire units
- agree on shared in-field communication devices which better direct operational response efforts.

The Inquiry supports the farm fire unit priorities identified by the NSW RFS, and notes it is important for the NSW RFS to work with other relevant agencies to create a shared understanding across government that facilitates farmers' contribution to the fire fighting effort. In particular, the Inquiry notes the importance of agreeing on fireground communication protocols to ensure a coordinated response. While fireground safety is currently missing as an explicit focus area, a list of protective clothing that should be worn while fire fighting is included in the RFS' 'Farm Fire Plan'.⁸⁵⁹ In light of the safety concerns raised during the 2019-20 season, the Inquiry recommends that the NSW RFS emphasises the importance of protective clothing as part of delivering the 'Farm Fire Unit Integration' priority for 2020-21.

Recommendation 38: That, in order to ensure the safety of local landholders on firegrounds, the NSW RFS emphasises the importance of local landholders using protective clothing while fire fighting as part of the RFS' 'Farm Fire Unit Integration' priority for 2020-21.

5.3 SAFETY OF FIRST RESPONDERS

Key points

- Respiratory protection for firefighters was a significant issue over the season, which the NSW RFS is currently reviewing. The Inquiry supports the review and encourages the NSW RFS to keep members informed of the review's findings and outcomes.
- Given the length of the season, many NSW RFS members noted difficulties associated with only being issued one set of personal protective clothing (PPC). The Inquiry recommends NSW RFS members and FRNSW firefighters involved in bush fire fighting are issued two sets of PPC to ensure they are well prepared for future campaigns.
- The Inquiry noted that NSW fire authority fire fighting vehicle fleets have varying standards of vehicle protection. As a minimum, the Inquiry recommends all frontline fire fighting vehicles have radiant heat protection blankets, wheel and 'halo' sprays fitted to ensure firefighter safety.
- Firefighters' mental health and wellbeing is critical, particularly after such a long and arduous season. The Inquiry notes that the impact of the season on firefighters' mental health is likely to continue into the medium to longer term and recommends the NSW RFS expands in-house mental health support for its members.
- Sustenance to firefighters was inconsistent, and logistical issues impeded the timely delivery of food to firefighters on the fireground. Further work is needed to ensure

⁸⁵⁸ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

⁸⁵⁹ RFS (NSW Rural Fire Service). Get Ready for Fire on your Property. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0020/106814/Farm-Fire-Plan.pdf, p19.

firefighters have adequate food and water, particularly considering the arduous conditions they work in over potentially long periods of time.

5.3.1 Safety – respiratory protective equipment

In December 2019, then Deputy Commissioner Rob Rogers AFSM confirmed to NSW RFS members that a “review of personal protective equipment, which include helmets, goggles, boots and face masks” was scheduled to commence at the end of the fire season.⁸⁶⁰ This commitment was reiterated in May 2020 by, now Commissioner, Rob Rogers when he stated the NSW RFS will “determine and make available the most suitable face masks, goggles and flash hoods to volunteers” to provide respiratory personal protective equipment (PPE) that will be “evidence-based; fit-for-purpose; member supported”.⁸⁶¹

In Australia, most disposable respirators and filters that give protection against dusts and other particles are classified and marked as P1, P2 or P3, in accordance with the Australian Standard AS/NZS 1716:2012.⁸⁶² A P3 mask provides the highest level of protection; however, P3 protection can only be achieved if the P3 filter is used in a full-face respirator.⁸⁶³

The Inquiry is aware that throughout the 2019-2020 bush fires there was media attention on the PPE used by NSW RFS members, particularly their masks.⁸⁶⁴ Concerns about masks were also raised in submissions made to the Inquiry.⁸⁶⁵ In response to an increasing number of crowdfunding actions by different volunteer units, the NSW RFS issued an Operational Brief in December 2019 noting that:

*NSW RFS firefighters are provided all necessary tools and equipment to undertake their work. ... The NSW RFS provides disposable P2 fire resistant masks to members. This provides a practical solution for managing exposure to bush fire smoke, when taking into account other risks.*⁸⁶⁶

In 2018, the Australasian Fire and Emergency Service Authorities Council (AFAC), developed the safe work guideline *Managing Bushfire Smoke Exposure* to assist fire fighting, land management and emergency service organisations to develop consistent, yet organisationally specific, procedures and practices to mitigate the risks posed by bush fire

⁸⁶⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 18 May 2020*.

⁸⁶¹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

⁸⁶² Safework NSW. (2020, 5 May). Supply of fake face masks. Retrieved from <https://www.safework.nsw.gov.au/safety-alerts/safety-alerts/supply-of-fake-face-masks>.

⁸⁶³ WorkCover Queensland. (2019, 28 October). Respiratory protective equipment. Retrieved from <https://www.worksafe.qld.gov.au/injury-prevention-safety/managing-risks/personal-protective-equipment-ppe/respiratory-protective-equipment-rpe>.

⁸⁶⁴ Thackray, L, Rubbo, L, Murphy, B & Doherty, P. (2019, 11 December). NSW firefighters crowdfunding upgraded face masks amid claims RFS gear insufficient, *ABC*. Retrieved from <https://www.abc.net.au/news/2019-12-11/nsw-bush-fires-firefighters-raise-money-to-buy-face-masks/11790096>.

⁸⁶⁵ Stephen Currie; Peter Sargent, Submissions to the Inquiry.

⁸⁶⁶ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 18 May 2020*.

smoke exposure.⁸⁶⁷ AFAC supports the use of a P2 mask as the minimum level that should be contemplated, if respiratory protection is required.⁸⁶⁸

The P2 mask is the most commonly used type of respiratory protection at a bush fire and is suitable for filtering out any airborne particulates.⁸⁶⁹ During the 2019-2020 fire season, the NSW RFS issued single-use disposable P2 masks, which had the benefits of quick disposal of any contaminants when discarded (reusable masks need to be decontaminated after use and before reuse, which can take considerable time and focus during fire fighting operations), and easy storage on a firefighter's person or in fire fighting vehicles, to enable quick access when the need arises.⁸⁷⁰

P3 masks are currently only available for use with reusable respirators. The Inquiry was informed that challenges with P3 masks that the NSW RFS will consider as part of the review include:

- the potential for an increase in an individual's metabolic heat, created by the amount of face covered
- the potential for canister filtering to cause restricted breathing
- the compatibility of P3 masks with existing personal protective clothing (PPC), including the need to maintain the integrity and complementary fit of various components in existing PPC, i.e. helmet, goggles etc.⁸⁷¹

AFAC also recognised that the use of reusable respirators is increasing during bush fire response, but their suitability for extended use remains questionable, due to:

*the increased effort to breathe through cartridge type filters and the ability to maintain an ongoing face seal due to sweat and facial hair. Replenishment of cartridges can also create supply issues when workers are working remotely or are inaccessible.*⁸⁷²

In March 2020, the NSW RFS commenced a review of respiratory protective equipment, divided into two phases. The first phase includes an activity and risk-based assessment of hazards using the hierarchy of controls. The controls include elimination, substitution, engineering controls, administrative controls and PPE. As part of the review, the NSW RFS will seek specialist advice from an occupational hygienist with respiratory protection expertise. This phase of the review will be undertaken in conjunction with the review of PPE and PPC to ensure that all respiratory protective equipment is compatible with existing or updated PPE/PPC.

The second phase of the project is an ongoing respiratory protection program, enabling the NSW RFS to review and validate the results and conclusions of initial assessments, including in the test environments. The Inquiry was informed that it is intended, where possible, to deploy teams to test air constituents and composition for analysis, in order to assure the NSW RFS that the risk mitigation strategies put in place are valid and effective.

⁸⁶⁷ AFAC (Australasian Fire and Emergency Service Authorities Council). (2018, 25 October). Managing Bush Fire Smoke Exposure (AFAC Publication No. 3062), Melbourne, Australia. Provided by RFS (NSW Rural Fire Service). (2020) on 18 May 2020.

⁸⁶⁸ Ibid, p 13.

⁸⁶⁹ Ibid.

⁸⁷⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 18 May 2020.*

⁸⁷¹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 18 May 2020.*

⁸⁷² AFAC (Australasian Fire and Emergency Service Authorities Council). (2018, 25 October). Managing Bush Fire Smoke Exposure (AFAC Publication No. 3062), p 13. Provided by RFS (NSW Rural Fire Service). (2020) on 18 May 2020.

The program will be ongoing for at least two years.⁸⁷³ The Inquiry supports the NSW RFS' review of respiratory protection and encourages the NSW RFS to keep members informed of the review's findings and outcomes. The impact of smoke on the community was discussed in Chapter 4.

5.3.2 Personal protective clothing (PPC)

Personal protective clothing (PPC) issued to NSW RFS members in fire fighting roles complies with Australian and international standards, and covers all parts of the body, incorporating helmet, eye protection, gloves, boots, jackets and pants. The NSW RFS' PPC has been subject to incremental development and improvements for over 20 years, with testing conducted at the University of Alberta's Protective Clothing and Equipment Research Facility in Canada.⁸⁷⁴ All PPC meets the requirements of Australian Standard AS/NZS 4824 – *Protective Clothing for Firefighters*.⁸⁷⁵

The NSW RFS informed the Inquiry that constant reviews and examination of new fabrics on the market were undertaken. The 'older' PPC was constructed of 'proban' treated cotton and weighed 340 grams per square metre; the next generation fabrics are considerably lighter ranging between 235 and 270 grams. The product also gives a comparable level of radiant heat protection that allows metabolic heat to escape more easily.⁸⁷⁶

The issuing of PPC or PPE is managed at a District level. The Inquiry was informed by community meetings and submissions that many NSW RFS members were issued with one set of PPC, and that this season, due to the prolonged nature of the fires, they were sometimes wearing the same set of PPC for weeks on end. The NSW RFS has advised the Inquiry that ahead of the next fire season (2020-2021), an audit will be undertaken to ensure, where appropriate, operational members (and other members requiring PPC) will have two full ensembles of PPC made available to them.⁸⁷⁷

Fire and Rescue NSW members in non-bush fire environments wear a fire resistant, synthetic fabric tunic (pants/jacket) which retains its structural strength after fire exposures and resists cuts and tears. A separate bush fire jacket is issued and is designed primarily for bush fire fighting applications. It is lightweight and affords the wearer moderate levels of both radiant and thermal protection, while minimising the possibility of heat stress.⁸⁷⁸ FRNSW informed the Inquiry that the current allocation of bush fire coats is one per firefighter, and two items of all other PPC. The bush fire jacket is essentially unchanged since its first use by FRNSW in 2002, with modifications limited to the placement of reflective tape to meet the requirements of Australian Standards.⁸⁷⁹

By contrast the NSW RFS has periodically reviewed and tested its PPC, with the current PPC outfit introduced in 2017, and available in both male and female sizing. As noted in the improvements made to the NSW RFS clothing, modern bush fire coats have improved in

⁸⁷³ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 18 May 2020*.

⁸⁷⁴ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 19 April 2020*.

⁸⁷⁵ Standards Australia. (2006). AS/NZS 4824-2006. <https://www.standards.org.au/standards-catalogue/sa-snz/manufacturing/sf-049/as-slash-nzs--4824-2006>.

⁸⁷⁶ QFES (Queensland Fire and Emergency Services). (2018). New Generation Wildland Firefighting Fabrics. Retrieved from rfaq.org/201812-infosheet-newgenerationfabric.

⁸⁷⁷ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 19 April 2020*.

⁸⁷⁸ FRNSW (Fire and Rescue NSW). (2020). Uniforms and Equipment. Retrieved from www.fire.nsw.gov.au/page.php?id=164.

⁸⁷⁹ FRNSW (Fire and Rescue NSW). (2020). *Advice to the Inquiry provided 18 June 2020*.

terms of fabric weight and texture as well as changes to the fitted features, such as pocket placement. These improvements reduce heat stress, improve comfort and reduce exposure to bush fire smoke through reduction in gapping of garments.

The AFAC *Managing Bushfire Smoke Exposure Guideline* identifies that prolonged exposure to bush fire smoke and particulates carries the potential for toxic substances to build up in unlaundered PPC. Regular laundering of PPC is recognised as important, and PPC exposed to bush fire smoke should be laundered appropriately.⁸⁸⁰

As previously stated, the Inquiry had a number of submissions identifying that many firefighters only have access to one set of PPC, and they described the difficulty of washing and keeping the one set serviceable.⁸⁸¹ The NSW Rural Fire Service Association acknowledged that the ability of members to access a second set of PPC varies throughout the State, but that reports of members being unable to obtain a second set of PPC were sufficiently widespread to support a coordinated and consistent approach for the benefit of all members.⁸⁸² A second set of PPC for each active member would enable them to be laundered after incidents without affecting a member's availability for subsequent incidents.

For the reasons outlined above, a second bush fire coat should also be part of the allocation to FRNSW firefighters. An increased allocation, and review of the FRNSW bush fire jacket, will reduce exposure of bush fire contaminants through secondary exposure.

The NSW RFS provides procedures about how to wash PPC, which is primarily done in a home laundry by the majority of NSW RFS members. However, it acknowledges the need to investigate the provision of facilities or services to provide better laundry solutions, potentially including sending items away for washing or providing washing machines at brigade stations (noting that some members may not wish to remain at the station while the PPC is being washed).

The laundering of PPC will be included as part of the review that the NSW RFS has committed to undertaking, and the Inquiry supports this review occurring as a priority.

Recommendation 39: That, in order to ensure frontline personnel have appropriate personal protective clothing during bush fires:

- a) FRNSW review the current design of its bush fire jacket, noting improvements that have been made since 2002 that meet AS/NZS4824:2006 *Protective clothing for firefighters*, and increase the allocation of bush fire coats to two jackets per member
- b) NSW RFS issue two sets of personal protective clothing to operational members, and others as appropriate.

5.3.3 Fire fighting vehicles and appliances

The NSW RFS has a fleet of over 6,300 vehicles/appliances throughout NSW, each of which is identified as being in one of 22 vehicle categories. Categories 1-9 are different sized tankers. A light tanker carries less than 800 litres, a medium category 7 tanker carries

⁸⁸⁰ AFAC (Australasian Fire and Emergency Service Authorities Council). (2018, 25 October). *Managing Bush Fire Smoke Exposure* (AFAC Publication No. 3062), p 13. Provided by RFS (NSW Rural Fire Service). (2020) on 18 May 2020.

⁸⁸¹ Terry O'Leary, submission to the Inquiry.

⁸⁸² NSW Rural Fire Service Association, Submission to the Inquiry.

between 800 and 1,600 litres and a heavy category 1 tanker carries up to 4,000 litres. The type of appliances are listed in Appendix Eight.

In 2018, the NSW RFS developed a draft *Fleet Total Asset Management Draft Plan* which was refined and is the basis of the 2020-21 document of the same name. It provides for the centralisation of the recording of the appliances, so that Engineering Services within the NSW RFS is able to accurately plan and report on the State fleet and its capabilities.⁸⁸³ Councils continue to have a role in fleet management and maintenance, which has led to inconsistent practices across the State and increased the risks to fleet safety and compliance. The devolved fleet management practices have also made it difficult to accurately account for maintenance expenditure. For example, fleet maintenance costs for 2017 can only be estimated as being \$61 million, due to inconsistent record keeping in corporate systems.⁸⁸⁴ The Inquiry supports the move to a centralised fleet management program which will give greater corporate oversight and accountability of expenditure, ensure consistency of asset maintenance and potentially deliver economies of scale. Where appropriate, the centralised system should continue to support repairs being conducted in local communities.

The NSW RFS has developed criteria for the disposal of old appliances, so that the:

- maximum age of fire fighting appliances (Categories 1 to 11) and other heavy vehicles will be 25 years
- maximum age for light vehicles (Categories 12 and 16) and vessels (Category 15) will be 15 years.

The Inquiry was informed that criteria have been developed for the replacement of vehicles that factor in the age of an appliance, identify high usage appliances and then weight the age and usage of the vehicle to determine where new appliances are placed. Older appliances (6-25 years) may be placed through the Secondhand Appliance Program (SHAP) to less busy locations. Since the introduction of the Fleet Asset Management Plan, the NSW RFS will improve the maximum age of a Category 1 vehicle from 40 years in 2018-2019 down to 28 years at the completion of the 2020-2021 Financial Year Fleet Plan.⁸⁸⁵ (The Inquiry notes that, given NSW RFS members attend a range of incidents including bush and grass fires, house and structure fires, storm damage and bush fire mitigation, the NSW RFS also has a Road Crash Rescue vehicle in accordance with the requirements of the State Rescue Board and is in the process of accrediting brigades in road crash rescue).⁸⁸⁶ The Inquiry understands that the current fleet enhancement is a one-off, and ongoing investment will be required.

FRNSW has over 700 emergency response vehicles in its fleet. According to the 2019-20 NSW Infrastructure Statement, FRNSW has spent more than \$122 million on its Replacement of Fire Appliances Program since 2011.⁸⁸⁷ It has acknowledged in its advice to the Inquiry that 82 appliances are operating in excess of their targeted replacement age.

⁸⁸³ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 19 April 2020*.

⁸⁸⁴ Ibid.

⁸⁸⁵ Ibid.

⁸⁸⁶ Resilience NSW. (2019). State Rescue Board Annual Report 2018-19, p 11. Retrieved from <https://www.emergency.nsw.gov.au/Pages/publications/reports-and-corporate/annual-reports/State-Rescue-Board-Annual-Reports.aspx>.

⁸⁸⁷ 2019-20 State Budget Paper No.2, Infrastructure Statement, pp 5-36. Retrieved from https://www.budget.nsw.gov.au/sites/default/files/budget-2019-06/5_General_Government_Sector_Projects-BP2-Budget_201920..pdf.

This represents just over one-tenth of its appliances. The Inquiry also notes that the average age of FRNSW appliances is still well below targets.⁸⁸⁸

The Inquiry is concerned that FRNSW indicated that 33 of 158 bush fire tankers do not meet current safety measures in that they do not have fixed curtains or cabin sprays to provide protection in the event of a burn over.

Vehicle safety is an essential element of protecting firefighters, with the three deaths this season of NSW RFS volunteers occurring while in their vehicles.^{889 890} Research reported by Risk Frontiers in its January 2020 Newsletter found that, of 65 deaths from bush fires in Australia from 2010 to January 2020, 26 were in a land vehicle (this includes ‘civilians’, not just firefighters).⁸⁹¹

Over the past decade, safety improvements have been periodically incorporated into NSW RFS appliances. These have been in the areas of burn over protection, rollover protection systems (ROPS) and falling object protection systems (FOPS).



Photo 5-1: Truck safety. Source: Nick Moir, The Sydney Morning Herald.

5.3.3.1 Burn over protection systems

Protection systems for burn over include wheel protection sprays, a cabin spray that discharges water directly onto critical areas of the cabin, drop down curtains inside the cabin window surfaces to minimise radiant heat entering the cab, and fire protection blankets in the cabin for all crew members. The fuel and brake lines are lagged (protected) with a material tested by CSIRO to mitigate direct flame impact to these areas. Any electric circuits that are necessary to keep the pump engine running (used to operate the spray) are also protected from fire and heat damage.⁸⁹² The self-protection spray is colloquially known as ‘halo’ and it is not uniformly fitted across all NSW RFS vehicles used in fire fighting.

Since 2009, NSW RFS Category 1 and Category 7 appliances are delivered with full CSIRO-approved crew protection systems, which includes the radiant heat curtains installed inside the cab, vehicle water sprays and lagging of critical vehicle systems. In 2010, a program

⁸⁸⁸ FRNSW (Fire and Rescue NSW). (2020). Advice to the Inquiry provided 27 July 2020.

⁸⁸⁹ RFS (NSW Rural Fire Service). (2019, 20 December). NSW RFS Statement. Retrieved from <https://www.rfs.nsw.gov.au/news-and-media/media-releases/nsw-rfs-statement>.

⁸⁹⁰ RFS (NSW Rural Fire Service). (2019, 30 December). NSW RFS Statement. Retrieved from <https://www.rfs.nsw.gov.au/news-and-media/media-releases/nsw-rfs-statement2>.

⁸⁹¹ Risk Frontiers. (2020). Newsletter, Volume 19 (1). Retrieved from https://riskfrontiers.com/rf2018/wp-content/uploads/2020/02/newsletter_V19_Issue1_Jan_2020.pdf.

⁸⁹² RFS (NSW Rural Fire Service). (2020). Advice to the Inquiry provided 19 April 2020.

commenced to retrofit Category 1 and Category 7 in 2008 model vehicles to comply with the CSIRO standards.⁸⁹³ The NSW RFS has advised that pre-2008 vehicles (approximately 2,294 vehicles) do not comply with the standards. Submissions were received that support the retrofitting of the halo self-protection spray and burn over curtains in all NSW RFS appliances.⁸⁹⁴ The use of the sprays was described in one submission in the following manner:

*While working to save properties in Bell, our truck was hit by the fire storm and myself and my crew leader survived, because of quick action by the crew leader to get myself and him to shelter in the truck and turn the truck protection sprinklers on. Being inside our fire tanker surrounded by fire all around/above was quite a traumatic experience which did not impact on me till days later. Once the firefront had passed, and we were able to get out of truck, we picked the rest of our crew up who were sheltering inside Bell RFS shed and went about trying to save as many properties as possible.*⁸⁹⁵

The fixed radiant heat curtains are quick reaction drop down fire shield curtains to protect the crew from radiant heat in the event of a fire overrun. In less than 10 seconds the curtains can be dropped and cover every piece of glass in the crew cabin. Older vehicles rely on the crew covering themselves with woollen blankets, in a system that is slower, more cumbersome and less effective than the newer system.

Submissions were also received that all 'fire fighting' vehicles should have crew protection systems, regardless of their agency (NSW RFS/FRNSW/NPWS), with one submission suggesting that FRNSW should only do property protection in villages as their trucks are not designed to fight bush fires, and that the absence of protection was a duty of care issue. As noted above, FRNSW has a dedicated bush fire tanker fleet for bush fire fighting.

The Inquiry received advice from NPWS in the context of vehicle protection systems that "vehicle/crew protection is not mandated and is considered as an option as vehicles are replaced".⁸⁹⁶ A key distinction between the NPWS and NSW RFS is that the primary purpose of the NPWS fleet is not for fire fighting. NPWS operates a fleet of 288 Toyota Landcruiser cab/chassis Category 9 light fire vehicles which are designed for operation in remote, rugged and steep terrain. They are not intended for structural or property fire protection work in interface areas. Rather, each vehicle is fitted with a tray exchange system that enables the loading of a steel tray for day to day park operations, and when required for fire fighting, this tray can be exchanged with a slip-on fire unit.⁸⁹⁷

The Category 9 vehicles carry 500 litres of water, and are fitted with pumps and hose reels, safety equipment including fire blankets and first aid kits, and fire fighting equipment such as hand tools, drip torches and chainsaws. The additional weight of cab sprays and heat shield curtains would reduce the water capacity to meet GVM requirements. This, combined with the already limited volume of water available on the Category 9 vehicles, precludes such safety features being fitted, as the water carried for fire fighting purposes would need to be kept in reserve to operate the safety spray systems. The Category 9 vehicles do have fire extinguishers and fire blankets fitted for crew protection.⁸⁹⁸ NPWS advised the Inquiry that its

⁸⁹³ Ibid.

⁸⁹⁴ Terry O'Leary, Submission to the Inquiry.

⁸⁹⁵ Peter Redman, Submission to the Inquiry.

⁸⁹⁶ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 8 May 2020*.

⁸⁹⁷ Ibid.

⁸⁹⁸ Ibid.

approach is to ensure crews do not place themselves in potential vehicle burn over situations, which is reinforced through NPWS firefighter training, staff development and fire preparedness.⁸⁹⁹

NSW RFS Category 9 vehicles are fitted with a single point crew protection safety spray system⁹⁰⁰ that provides additional crew protection, which are not currently installed in Category 9 NPWS vehicles.

In addition to the Category 9 light fire vehicles, NPWS operates 17 Category 1, 2, 3 and 7 vehicles. Of these 17 vehicles, 13 have additional vehicle/crew protection equipment fitted including over cab and tyre spray systems and heat shield curtains. NPWS advised the Inquiry that further replacement of dedicated NPWS Category 1, 2, 3 and 7 fire trucks will incorporate vehicle and crew protection.⁹⁰¹

5.3.3.2 Roll over protection system (ROPS)

Since 2000, NSW RFS appliances have had a form of roll over protection system, which was subject to continued improvement until the current design was established in 2006. The current ROPS consists of a headboard at the rear of the crew cabin that is made of structural steel secured to the fire fighting platform, which is in turn secured to the chassis.⁹⁰²

NSW RFS fire fighting appliances comply with the European Standard ECEr29 which outlines the provision for the protection of occupants in the cab of a vehicle specifically during a rollover. All regulations adopted by ECE are replicated in the Australian Design Rules, which set national standards for vehicle safety.

The design and construction of the fire fighting tank also minimises vehicle damage during a rollover. The combined design of the tank, the utilisation of the headboard and the compliance of the cab chassis with the European Standard ECEr29 all contribute to risk mitigation during rollover incidents. All appliance categories constructed since 2000 have this level of protection, noting that pre-2000 vehicles still remain in use in the NSW RFS.⁹⁰³

5.3.3.3 Falling object protection system (FOPS)

Falling object protection requires the cabin to be encased in a frame integrated to the chassis both in the front and the rear of the cabin itself. The Inquiry was informed that, due to the increase in the number of falling object incidents over the past season, the NSW RFS has committed to investigate the potential incorporation of FOPS into future designs for its fleet.⁹⁰⁴

On 2 June 2020, the NSW Government announced a funding boost of \$34.4 million to upgrade the NSW RFS fire fighting fleet. This will deliver 120 new vehicles and 70

⁸⁹⁹ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 16 June 2020*.

⁹⁰⁰ RFS (NSW Rural Fire Service). (2015, June). Category 9 Ultra Light Single Cab Fact Sheet 6.

Retrieved from

<https://www.loftusrfs.org/images/stories/Appliance%20Fact%20Sheets/Cat%209%20Fact%20sheet.pdf>.

⁹⁰¹ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 16 June 2020*.

⁹⁰² RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 19 April 2020*.

⁹⁰³ Ibid.

⁹⁰⁴ Ibid.

refurbished trucks by the end of the 2020-2021 financial year.⁹⁰⁵ This investment needs to be ongoing in respect to fleet upgrade.

As noted previously, the NSW RFS intends to investigate falling object protection systems due to the number of incidents in the past fire season. The Inquiry recommends that all fire fighting agencies review and consider safety enhancements to frontline fire fighting vehicles, and that at a minimum all agencies incorporate the halo and wheel and cabin spray systems and the radiant heat protection blankets into frontline fire fighting vehicles.

In May 2020 the NSW RFS announced in the document *Focusing On What Matters Most*⁹⁰⁶ that the design of their fire appliances was a priority and that they needed to be fit for purpose, including the cabins' ability to withstand tree strikes. The Inquiry supports the NSW RFS undertaking research to determine the most appropriate cabin protection for the different frontline vehicles.

Recommendation 40: That, in order to improve firefighter safety, Government fire authorities:

- a) ensure all light tankers used as part of active frontline bush fire fighting operations are fitted with a single point crew protection safety spray system and radiant heat protection blankets as a minimum standard across all NSW fire authorities
- b) ensure all medium/heavy tankers are fitted with radiant heat protection blankets, wheel and 'halo' sprays fitted as a minimum standard across all NSW fire authorities
- c) undertake additional research to determine the most appropriate cabin protection for the different frontline vehicles.
- d) provide ongoing investment for NSW RFS fleet upgrades.

5.3.4 Mental health support is critical to ensuring first responders' safety

The Inquiry recognises the significant and potential long-term impacts of the 2019-20 fire season on firefighters' mental health and considers mental health support to be an essential component of ensuring first responder safety. Beyond the direct impact of fire fighting on first responders' mental health, the Inquiry also heard of conflicts arising in some communities which also affected young people. The Inquiry raised these issues with the Advocate for Children and Young People and the NSW Department of Education for appropriate action.

Before the start of the 2019-2020 fire season, the NSW RFS, FRNSW, Forestry Corporation and National Parks and Wildlife Service (NPWS) all facilitated access to Employee Assistance Programs (EAPs) which provide general counselling services. The NSW RFS and FRNSW both provide chaplaincy services with two dedicated Chaplains in each agency, and they both operate peer support programs. In the NSW RFS, there were 50 Critical Incident Support Service (CISS) Peer Support Officers and a Manager for Mental Health. FRNSW operates a Critical Incident Support Program⁹⁰⁷ with 100 Peer Support Officers, three Wellbeing Coordinators and two Occupational Psychiatrists. These positions coordinate the agencies' peer support programs for their members.

⁹⁰⁵ NSW Government. (2020, 2 June). NSW gearing up for bush fire season. Retrieved from <https://www.nsw.gov.au/news/nsw-gearing-up-for-bush-fire-season>.

⁹⁰⁶ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

⁹⁰⁷ FRNSW (Fire and Rescue NSW). (2020). Employee Support. Retrieved from <https://www.fire.nsw.gov.au/page.php?id=9222>.

The NSW RFS Mental Health Framework 2018-2023⁹⁰⁸ focuses on three key areas of Protection, Promotion and Intervention:

- **Protection** – *protecting Mental Health by reducing work related risk factors for Mental Health conditions and increasing protective factors*
- **Promotion** – *promoting positive Mental Health that includes increasing member awareness, reduction of stigma, early identification and help seeking behaviour*
- **Intervention** – *addressing Mental Health issues and conditions among members, regardless of whether the workplace was a contributing factor.*⁹⁰⁹

Similarly, FRNSW has in place its Health and Safety Plan 2018-2020, a three-year strategy to improve the safety of its operational and support staff across the organisation.

Before the fire season, NPWS established a Peer Support Program to directly provide services to frontline firefighters and IMT personnel, and following the fires, NPWS is implementing a Mental Health Plan.⁹¹⁰

During the 2019-20 season the NSW RFS increased its capacity to provide support to members and their families by accessing an additional 120 CISS Peer Support Officers from other agencies and extended the reach of these services by proactively contacting members identified as at-risk. This included making contact with NSW RFS Incident Controllers, District Staff and Major Incident Coordination Teams (at NSW RFS Headquarters), to seek information on member mental wellbeing issues or distress, in order to reach out and offer additional support.⁹¹¹

The NSW RFS also expanded its Member/Employee Assistance Program to include all members and their immediate families, renamed it the Member Assistance Program and increased the engagement of trauma-specific clinical care where required. Direct referrals to professional clinical care increased by 152% between 1 July 2019 and 31 March 2020, when compared to the average of the previous three years. The NSW RFS acknowledges that this is likely to increase further by the end of the reporting period, as members recognise the burden the fire season placed on them.⁹¹²

Corporate support of mental health was also demonstrated through a mandatory Mental Health and Wellbeing component being introduced to the Brigade Captain and State Operations After Action Reviews. This component provided an opportunity to acknowledge the pressures, demands and challenges experienced by members during and after the fire season, and to offer and facilitate pathways for support and/or higher levels of mental health assessment and care. These sessions offered brigade leadership an opportunity to help identify mental wellbeing issues and concerns among their membership, as well as providing an opportunity to increase members' understanding and awareness of the available support and resources.⁹¹³

The NSW RFS also distributed fact sheets to its members covering:

- Common Reactions After a Major Event
- Coping After a Critical Incident

⁹⁰⁸ NSW RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 9 June 2020.*

⁹⁰⁹ Ibid.

⁹¹⁰ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 8 May 2020.*

⁹¹¹ NSW RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 4 May 2020.*

⁹¹² Ibid.

⁹¹³ Ibid.

- Helping Children Cope with Traumatic Stress
- Supporting Children After a Major Event
- Tips for Supporting Family, Friends and Colleagues.

In April 2020, the NSW RFS launched the NSW RFS Connect portal online, with the aim of keeping members connected to the Service and one another, as well as providing advice via webinars on topics including Health Anxiety, Resilience and Mindfulness.⁹¹⁴ Additionally, in June 2020, the NSW RFS initiated a focused approach of identifying and supporting members who are ‘doing it tough’ following the bush fire season. It incorporates prioritising areas that were hardest hit by the fires, and brings District and brigade leaders together with mental health personal to identify members in need and triaging for appropriate referral and intervention.⁹¹⁵

5.3.5 Further support is needed to ensure members are supported in the medium to longer term

The Inquiry acknowledges the extensive efforts the NSW RFS has made to look after its members, but is also aware of the impact the fires may have into the future, with over 100 submissions to the Inquiry raising the mental stress that the fires caused and continued to have in the months afterwards. One general practitioner (GP) from southern NSW, who asked to remain anonymous, wrote to the Inquiry in April 2020 noting that it was then, a few months after the fires, that they were seeing firefighters “not coping with their horrific experiences” and that checks done in the first few weeks were at a time when firefighters were just happy to be alive and things seemed okay.⁹¹⁶

The NSW RFS has acknowledged there is a gap in the resources and funding to enable sustainable and effective mental health support for its members,⁹¹⁷ and advised there is willingness to develop an appropriately resourced service focused on psychological and physical safety of members. This would incorporate:

- developing a mental health education and capability framework
- conducting routine psychological Well Checks as standard operating procedure
- confirming standard operating procedures for Peer Support Officers and increasing resourcing to provide psychological support after exposure to potentially traumatic events
- implementing systems to monitor rostering and workplace management – noting that in a volunteer workforce responding to callouts and high tempo operations may result in working for longer periods without adequate rest and recovery time
- adopting effective reporting systems to track lead and lag indicators of psychosocial risks and potentially traumatic events and use the data to support strategic decisions and directions.

The Inquiry agrees that mental health for NSW RFS members must be an ongoing priority that is resourced appropriately and supports the NSW RFS expanding its in-house mental health support capability.

⁹¹⁴ Ibid.

⁹¹⁵ NSW RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 30 June 2020*.

⁹¹⁶ Name withheld, Submission to the Inquiry.

⁹¹⁷ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 30 June 2020*.

Recommendation 41: That, in order to ensure all NSW RFS members can access the mental health support they need, the NSW RFS expands in-house mental health support for members.

5.3.6 GPs are an important means of accessing mental health support

Professor Sandy McFarlane AO, Professor of Psychiatry at the University of Adelaide,⁹¹⁸ shared with the Inquiry information he provided to the Royal Commission into National Natural Disaster Arrangements. That included research done following the 1983 Ash Wednesday Fires, where approximately 450 South Australian Country Fire Service volunteer firefighters were recruited and followed for approximately nine years. The study found that a high percentage presented to their GPs complaining of ongoing health problems, with physical ill health the primary symptom of presentation of their post-traumatic stress disorder.⁹¹⁹

In discussions with the Inquiry, Professor McFarlane noted that people often require counselling around two and a half years later, which is generally after acute counselling services have ceased, and that the financial cost can be a barrier to access.⁹²⁰ The Inquiry agrees with Professor McFarlane's suggestion that a new Medicare Benefits Scheme item number be created for firefighters accessing mental health screening via their GP, and that gap payments should be waived if additional treatment is required. This should not be limited to fire affected regions, to ensure out-of-area firefighters are captured. The Inquiry notes this is a matter for the Commonwealth Government.

In a submission to the Inquiry, a GP from the South Coast was concerned that offers of short-term mental health counselling were not adequate, and that offering Medicare Benefits Scheme item numbers to GPs can be problematic when most GPs do not have the required training. Her suggestion was that training should be provided urgently and for free to GPs in bush fire affected communities.⁹²¹ The Inquiry endorses this suggestion and considers the new Medicare Benefits Scheme item number should be accompanied by a training package for GPs.

Recommendation 42: That, to ensure firefighters can access mental health support through GPs, Government work with the Commonwealth Government to:

- provide a free mental health screen to firefighters post-fire event and waive any gap payments if additional treatment is required
- create a new Medicare Benefits Scheme item number to enable Governments to track demand for mental health services from firefighters over time and ensure an appropriate level of support is available.

⁹¹⁸ Professor McFarlane was commissioned by the NSW Ministry of Health to provide expert advice on mental health recovery for bushfire impacted communities.

⁹¹⁹ Professor Sandy McFarlane AO, Submission to the Royal Commission into National Natural Disaster Arrangements. Retrieved from <https://naturaldisaster.royalcommission.gov.au/system/files/submission/NND.001.01056.pdf>.

⁹²⁰ Meeting with Professor Sandy McFarlane on 6 April 2020.

⁹²¹ Name withheld, Submission to the Inquiry.

5.3.7 Fatigue management was a concern during the 2019-20 season

The protracted and intense nature of the 2019-20 season meant that fatigue was an issue for many firefighters and was highlighted in submissions to the Inquiry:

*Fatigue management was in [sic] extraordinarily difficult issue for the Brigade to manage this fire season, not only on the basis on individual shifts, but across the entirety of the fire season. While there were attempts to generally keep crew shifts to a maximum of 12 hours, it was not unusual for day and night shifts to extend to 14 and sometimes 16 hours at a time. These extended shifts occurred because in many cases it was simply not possible to leave the fire unattended, the fires breached containment lines at the end of a night shift when the sun rose or replacement day crews were delayed by briefings/feeding and were unable to relieve night time crews who were left in the field. This did not include additional travel time that some members had to add after their shift had finished.*⁹²²

Submissions also noted that travelling long distances to and from the firegrounds was a compounding factor, which “often meant that these teams were not returning to the base camp inside 16 or even 20 hours”.⁹²³

Management of fatigue for FRNSW and NPWS is somewhat different to the managing of fatigue for the NSW RFS. FRNSW and NPWS are a paid workforce which can be rostered and monitored, with an expectation that staff who are not working are able to rest appropriately. NPWS also looked to manage fatigue to reduce proactively the risk of accidents on the fireground during the fires. This included establishing the temporary role of Safety Advisor Fatigue Management specifically to identify measures to address staff fatigue in line with guidelines for fatigue management found in the *NPWS Fire Management Manual*.⁹²⁴

However, for the NSW RFS, managing fatigue is further complicated by the fact that it does not have oversight of the volunteers’ activities outside of NSW RFS actions. For some volunteers, fighting fires occurred between meeting paid employment commitments, farmers on the land and family responsibilities.

The NSW RFS *Operational Protocol 1.4.4 Fatigue Management and Service Standard 3.1.14 Fatigue Management* include recommendations for maximum shift duration (12 hours), minimum rest periods (9 hours) and limits on consecutive days as part of an Incident Management Team (5 days or 3 nights).⁹²⁵ However, the NSW RFS acknowledges that fatigue management requirements may be altered in circumstances where life and property are at imminent and serious risk.

The NSW RFS advised the Inquiry that the 2019-2020 fire season highlighted the need for the NSW RFS to implement an improved system to manage rostering in order to enhance the coordination of thousands of members working each day across the State. To that end, the Resource Management and Availability Application that is being developed will be the first step in implementing an online resource management system. This will improve

⁹²² Darren Rodrigo, Submission to the Inquiry.

⁹²³ Andrew Kaye; David Williams; Stephen Currie, Submissions to the Inquiry.

⁹²⁴ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 8 May 2020*.

⁹²⁵ NSW RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 22 June 2020*.

oversight of members and in turn assist with fatigue management,⁹²⁶ and the Inquiry strongly supports this initiative.

The 2019-20 season highlighted NSW RFS members' commitment to protecting their community, often at great personal cost. While guidelines and management systems are an important part of fatigue management, culture change is also required to ensure members value their own safety and wellbeing. Given the long-term mental health impacts that can result, as well as the physical safety implications, encouraging a culture of fatigue awareness and self-management is a critical part of ensuring policies and standards are implemented by members in practice.

5.3.8 Issues were raised regarding the safety of NSW RFS members on Defence land

The Department of Defence manages over 200 land holdings within NSW that include major bases through to defence training areas.⁹²⁷ The approach to bush fire management on Defence land is aligned to the *National Bushfire Management – Policy Statement for Forests and Rangelands*.⁹²⁸ The Inquiry was informed that Defence-specific policy for bush fire management is located in the Department of Defence's *Manual for Fire Protection and Engineering* and *Environment and Heritage Manual*.

The Commonwealth Department of Finance and the NSW Government (Department of Customer Service) have a Memorandum of Understanding (MoU) covering the fire fighting response for Defence bases in NSW. In addition, there is an MoU between Defence and the NSW RFS, and a Mutual Aid Agreement covering many key Defence properties. Defence also employs an external company to provide a first response bush fire fighting capability at a number of bases.⁹²⁹

The Inquiry heard from Incident Management Teams⁹³⁰ and NSW RFS members about restricted access to specific bases classified as Major Hazardous Facilities. In one case, mobile phones were required to be handed in prior to entry to the base. Defence, in its submission, acknowledged that mobile phones are not permitted on such premises due to the potential ignition risk they pose to the material stored there.⁹³¹ NSW RFS members' attendance at these sites needs to be under very strict protocols to ensure their safety. Whether the Department of Defence should be required to provide its own fire fighting response is a question that needs to be asked.

5.3.9 Sustenance for firefighters

5.3.9.1 The Inquiry received a lot of negative feedback about firefighter sustenance

The 2019-20 fire season presented protracted difficulties in providing sustenance to firefighters. Logistically it was challenging due to the sheer number of firefighters in the field,

⁹²⁶ Ibid.

⁹²⁷ Department of Defence, Submission to the Inquiry.

⁹²⁸ Forest Fire Management Group. (2014). National Bushfire Management: Policy Statement for Forests and Rangelands. Retrieved from <https://www.environment.nsw.gov.au/research-and-publications/publications-search/national-bushfire-management-policy-statement-for-forests-and-rangelands>.

⁹²⁹ Department of Defence, Submission to the Inquiry.

⁹³⁰ Meeting with Glenn Innes Incident Management Team on 9 March 2020.

⁹³¹ Department of Defence, Submission to the Inquiry.

coupled with the fact that firegrounds covered extremely large geographic areas in many instances.

Sustenance for firefighters in the field was raised with the Inquiry at Incident Management Team Briefings,⁹³² community meetings⁹³³ and in submissions. The Inquiry heard that in some cases firefighters in the field were not provided with sustenance in a sufficiently timely manner. In other cases, the quality or volume of sustenance did not meet NSW RFS standards – including the provision of drinking water to stay hydrated.

The following feedback was provided to the Inquiry in written submissions:

*Are you telling me that it is healthier for a firefighter on a twelve-hour shift to eat nothing rather than a subway salad sandwich?*⁹³⁴

*Most of the food was of a generally good standard during these fires. But at times there were also some very poor meals. On several occasions firefighters received sandwiches which consisted of plain vegemite or a single slice of cheese between two slices of dry bread which just could not be swallowed with a dry mouth.*⁹³⁵

The following sustenance arrangements currently apply for different classes of fires:

- Class 1 & 2 fires: the control agency normally provides catering for all firefighters – for NSW RFS Districts, the Senior Management Team (staff and volunteers) is responsible for planning; however it is often a different team running the fire on the day
- Class 3 fires (under a section 44 declaration): the provision of sustenance to firefighters is managed through the logistics functions within the relevant IMT, supported by State Operations.

Overall, the Inquiry found there was no consistency in the planning and provision of sustenance across all classes of fires during the 2019-20 fire season. The relevant NSW RFS standards for sustenance arrangements are provided in the following documents: *Fireground Standard Operating Procedures (1999)*⁹³⁶ and *Service Standard 3.1.11 Application of Food Safety Standards (2007)*.⁹³⁷ Hydration is addressed on the NSW RFS webpage: *Effects of Heat – Information for your health and safety*⁹³⁸ and the *NSW RFS Firefighters' Pocket Book (2010)*.⁹³⁹ These documents are 10-21 years old and require urgent review by the NSW RFS, in consultation with volunteers and a dietician.

5.3.9.2 Alternative sustenance arrangements should be explored

The Casino IMT⁹⁴⁰ reported that the provision and quality of meals improved with the assistance of the ADF, which is used to providing sustenance (often fresh food) for large

⁹³² Meeting with Casino Incident Management Team on 1 May 2020.

⁹³³ Glenn Innes Community Meeting on 9 March 2020, Snowy Valley Community Meeting on 29 April 2020.

⁹³⁴ Letter from North Shore Rural Fire Brigade to NSW RFS Commissioner dated 3 November 2019.

⁹³⁵ Katoomba/Leura Rural Fire Brigade, Submission to the Inquiry.

⁹³⁶ RFS (NSW Rural Fire Service). (1999). Fireground Standard Operating Procedures, Version 1.0.

⁹³⁷ RFS (NSW Rural Fire Service). (2007). Application of Food Safety Standards, Version 2.0, Service Standard 3.1.11.

⁹³⁸ RFS (NSW Rural Fire Service). (2015). Effects of Heat - Information for your health and safety. Retrieved from <https://www.rfs.nsw.gov.au/about-us/our-districts/canobolas/latest-news/effects-of-heat>.

⁹³⁹ RFS (NSW Rural Fire Service). (2010). Firefighters Pocket Book December 2010, p 12. Retrieved from http://www.yassriverbfb.org/resources/NSW_RFS_Pocketbook.pdf, also available as an app.

⁹⁴⁰ Meeting with Casino Incident Management Team on 1 May 2020.

numbers of personnel over long distances. This scale of sustenance provision requires large scale commercial arrangements that should not be put in place in an ad hoc manner during a fire season, but instead require sufficient advance planning. The Inquiry supports the suggestion from the North Shore Rural Fire Brigade that the NSW RFS investigate 12-hour food packs, which would enable firefighters to be self-sufficient for up to 12 hours in the field.⁹⁴¹

While the Inquiry understands that engaging local suppliers to provide catering is an important way of supporting regional economies, this should not occur at the expense of timely and sufficient catering to firefighters on the firegrounds. The 2019-20 fire season demonstrated the challenges associated with providing sustenance for large numbers of firefighters, and that alternative approaches need to be explored.

In addition to reviewing existing food standards and procedures, the Inquiry recommends the NSW RFS review catering (including input from dietitians) and logistical arrangements, including the viability of sourcing commercial contracts and the provision of 12-hour food packs to firefighters.

Recommendation 43: That, in order to ensure firefighter sustenance is of sufficient volume and quality, the NSW RFS reviews food standards and procedures in consultation with volunteers. The review should include catering service standards, including food safety, as well as the viability of sourcing commercial contracts and providing 12-hour food packs to firefighters.

5.4 INCIDENT MANAGEMENT TEAMS

Key points

- IMTs demonstrated exceptional leadership during the 2019-20 fire season, with a truly collaborative approach across all participating agencies. Incident Controllers and IMT members welcomed robust discussion to ensure strategies and decisions were 'stress-tested' and informed by a range of perspectives.
- Due to the scale and spread of fires, IMTs were required to manage considerably larger firegrounds compared to a 'normal' season, which meant local knowledge was crucial. While IMTs reported a high level of reliance on local knowledge when making strategic and operational decisions, further work is needed to demonstrate this to the community, including local landholders and NSW RFS local brigades.

5.4.1 Incident Controllers were appointed under Section 44 declarations

There were 43 Section 44 declarations made by the NSW RFS Commissioner in the 2019-20 bush fire season (see Chapter 3 for further discussion of Section 44 declarations). The first was issued in August 2019 in Northern NSW and the last was revoked on 4 March 2020 in Bega Valley and Eurobodalla in Southern NSW.⁹⁴²

Under a Section 44 declaration, an Incident Controller is appointed by the NSW RFS Commissioner. In selecting an Incident Controller, the NSW RFS Commissioner may take

⁹⁴¹ Letter from North Shore Rural Fire Brigade to NSW RFS Commissioner dated 3 November 2019.

⁹⁴² RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

into account local recommendations for candidates but isn't bound by these. The Incident Controller is supported by and reports to State Operations with their responsibilities being discharged through a range of resources (see Appendix Nine for governance diagrams).

The Incident Controller is responsible for controlling, commanding and coordinating their designated area. In undertaking these functions, the Incident Controller forms an Incident Management Team (IMT) and may seek assistance at the State or regional level if sufficient personnel are not locally available.⁹⁴³ Generally speaking, Incident Controllers are appointed from within the NSW RFS, and IMTs (including Deputy Incident Controllers) are resourced in conjunction with fire authority agencies, many of whom already have close working relationships. In some cases, IMTs also include staff from interstate and overseas fire authorities, depending on their location and/or resourcing needs (see Chapter 3 for further information on IMT training requirements).

NSW RFS personnel were appointed as Incident Controllers in all instances during the 2019-20 season, except for S44-19/20021 (Tamworth, Upper Hunter, Liverpool Plains and Gunnedah LGAs) on 11 November 2019, where the Incident Controller was from Fire and Rescue NSW. Deputy Incident Controllers were appointed from:

- NSW RFS (232 personnel)
- Fire and Rescue NSW (34 personnel)
- National Parks and Wildlife Service (88)
- Forestry Corporation of NSW (36)
- ACT Fire and Rescue (1 person)
- ACT Parks and Conservation (1 person)
- Queensland Fire and Emergency Services (1 person)
- Tasmania Fire Service (1 person)
- South Australian Country Fire Service (1 person).



Photo 5-2: Multi-agency IMT Glen Innes, image provided by NSW RFS 8 July 2020.

The State Operations Controller is responsible for strategic resource allocation across the State, in consultation with Incident Controllers (ICs). Resources (e.g. aircraft, fire fighting

⁹⁴³ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 13 March 2020.*

appliances and personnel) are allocated depending on the immediacy and severity of need, with the primary objective to protect life and property. The State Operations Controller is in regular contact with Major Incident Coordinators and ICs to ensure State Operations maintains an up-to-date picture of how fires are spreading across the State and the associated resources that are needed to manage them.

There were 18 IMTs established for major fires during the 2019-20 season. At the IMT level, ICs are responsible for determining overall fire fighting strategies, as well as how resources allocated to the IMT will be applied. In the 2019-20 season IMTs were required to manage very large geographical areas with multiple fire fronts, due to the number and size of the fires. This required resources to be constantly re-prioritised across the firegrounds in response to changing weather conditions and fire fighting strategies.

The size of the fires being managed by single IMTs was much larger compared to previous seasons, and once again highlighted the extraordinary nature of the 2019-20 season. Typically, a Section 44 declaration is based on a Local Government Area (LGA), or parts thereof if a fire crosses over an LGA boundary. The NSW RFS acknowledged this usually works well, as it ensures existing relationships with local brigades can be relied upon to provide the IMT with local knowledge. However, the number, size and complexity of the fires during the 2019-20 season necessitated a different approach to ensure IMTs were staffed with sufficiently trained personnel to manage fires at a 'campaign' level. The size of the fires crossed several LGA boundaries (e.g. the Green Wattle fire crossed five LGAs, and at one stage the multiple fires in the Northern Tablelands crossed seven LGAs). While IMTs still relied upon local knowledge (further discussed below), the large size of the fires meant they could not be managed at the local level.

5.4.2 Considerable pressure was placed on Divisional Commanders

The size of the fires placed significant additional pressure on Divisional Commanders in the field, who were required to manage an extensive range of fire fighting personnel and equipment across large firegrounds. Divisional Commanders play a crucial role and their responsibilities include:

- implementing their portion of the Incident Action Plan, including determining the tactics to achieve the plan's strategies and objectives
- coordinating and allocating resources under their supervision
- providing situation reports, operational progress updates, emerging risks and the status of resources.⁹⁴⁴

Due to the scale and spread of the fires during 2019-20, there was an unusually high demand for suitable personnel to fill Divisional Commander roles. The pressure on Divisional Commanders was exacerbated by a lack of trained personnel in other roles, including heavy plant managers and supervisors (further discussed later in this Chapter), which added to Divisional Commanders' responsibilities in some areas. Given these responsibilities, the Inquiry considers it important to identify suitably skilled and experienced personnel who can undertake the role before a significant fire incident, but should wherever possible include local knowledge. This should be done as part of the standard operations planning process undertaken by Bush Fire Management Committees, required under sections 52(1)(a) and 53 of the *Rural Fires Act 1997*.

⁹⁴⁴ AFAC (Australasian Fire and Emergency Service Authorities Council). (2004). Australasian Inter-service Incident Management System (AIIMS) Manual.

Recommendation 44: That, in order to ensure suitably skilled and experienced personnel operate as Divisional Commanders during major fire incidents, Bush Fire Management Committees identify appropriate personnel as part of their plan of operations.

5.4.3 IMTs worked very effectively and demonstrated best practice leadership

The Inquiry met with a range of Incident Management Teams (IMTs) who were responsible for managing bush fires under Section 44 declarations over the 2019-20 season.⁹⁴⁵ Every IMT demonstrated a high level of collaboration across agencies, and overall there was a very cooperative and collegiate approach in often difficult circumstances. IMT members generally attributed this to a combination of high-quality training and strong local relationships.

In each discussion with IMTs the Inquiry was impressed with the calibre of leadership and teamwork. Incident Controllers welcomed robust discussion and disagreement amongst IMT members to ensure strategies and decisions were ‘stress-tested’ and informed by a range of perspectives. IMT members were very open about the strategies they pursued and the challenges they faced, and reflected on lessons learned, demonstrating a strong commitment to continuous improvement. Examples of best practice leadership demonstrated by IMTs are highlighted below.

5.4.3.1 The ‘table of knowledge’

The Blue Mountains IMT invited experienced firefighters from the local area to critique strategies and identify other options, to ensure they had considered all perspectives and minimised any ‘blind spots’. These firefighters were colloquially referred to as the ‘table of knowledge’ and between them represented over 325 years of fire fighting experience. The Blue Mountains IMT reported that their collective advice aligned with the IMT’s proposed strategies, and they were an invaluable source of local knowledge during a very challenging season.

This collaborative approach was also demonstrated across regions, as the Blue Mountains IMT advised the Inquiry that daily conversations with other IMTs were important to maintain situational awareness across large firegrounds, and that strategies were often modified as a result of advice from other IMTs.⁹⁴⁶

5.4.3.2 ‘Badge off’ approach

In discussions with the Glen Innes IMT (and repeated elsewhere), members described how they took a ‘badge off’ approach and worked collectively to develop and execute the agreed strategy, without considering tenure or other agency-specific issues. The Inquiry was pleased to see that this underpinning principle of incident management learned in training was put into practice by the Incident Controller and was constantly reinforced given frequent changeovers of staff.

⁹⁴⁵ The Inquiry met with Incident Management Teams from Hawkesbury, Blue Mountains, Glen Innes, Mid North Coast, Far South Coast, Green Wattle fire, Currowan fire, Dunns Road fire, Cooma and Casino.

⁹⁴⁶ Meeting with Blue Mountains Incident Management Team on 25 February 2020.

It was evident to the Inquiry that IMT member agencies have a very complementary set of skills and capabilities and were able to draw on this expertise as it was needed. For example, Forestry Corporation of NSW resources were used for difficult tree-felling tasks, regardless of whether the trees were on Forestry's estate,⁹⁴⁷ and NPWS personnel were recognised for their remote fire fighting skills. FRNSW's 'safety culture' was also drawn upon, as FRNSW Safety Officers were requested at Glen Innes, Wollondilly, Katoomba, Hawkesbury and Shoalhaven Fire Control Centres to manage Strategic Safety for the respective IMTs.⁹⁴⁸ The appointment of FRNSW safety officers received positive feedback from both the NSW RFS and FRNSW, noting that safety officers were drawn from all agencies for these fires.

5.4.3.3 Leveraging senior volunteers' expertise

In discussions with the Hawkesbury IMT, the Inquiry was impressed at the level of knowledge and expertise from local NSW RFS volunteers and was pleased to see this experience was leveraged by the IMT. Senior volunteers were engaged in IMT roles and had input into fire fighting strategies based on their knowledge of the local area.⁹⁴⁹

5.4.4 Ensuring local knowledge informs IMT decisions

Given the number and spread of the fires in the 2019-20 season, IMTs were often required to cover very large geographical areas. The Inquiry has heard from multiple members of the community and NSW RFS brigades that IMT decisions about fire fighting strategies and resource prioritisation should be informed by local knowledge, including NSW RFS volunteers and local landholders. Concerns were raised that decisions about local fire fighting strategies were being made by IMTs who were over 75km away from the fire front, and sometimes by people who had limited experience fighting fires in the local area. However, other submissions to the Inquiry demonstrated that local knowledge was sought out and relied upon by IMTs.

*I was called in to assist in the planning and construction of fire breaks. ... The terrain is very rugged in this area and difficult to access. The reason I was called in was purely to provide local knowledge and experience from previous fires that I have dealt with in this area. The incident controllers and the local brigade Captain were totally lacking the essential intrinsic knowledge of the area.*⁹⁵⁰

*As long time residents of this property we have conducted hazard reduction burns and had local knowledge on how the fire may behave in our area. Apparently, this information was useless to the attending authorities and they would not listen to our ideas or pleas for help. Ignoring their 'expert' advice we did stay and successfully defended our property and the neighboring [sic] properties.*⁹⁵¹

*It took about 3 weeks in the fire fighting operation for the IMT to activity [sic] seek out our local knowledge. Prior to that I was having to drive to up to the fire control center every few days to make sure they were considering local needs and the situation.*⁹⁵²

⁹⁴⁷ Meeting with Glen Innes Incident Management Team on 9 March 2020.

⁹⁴⁸ FRNSW (Fire and Rescue NSW). (2020). *Advice to the Inquiry provided 19 June 2020*.

⁹⁴⁹ Meeting with Hawkesbury Incident Management Team on 24 February 2020.

⁹⁵⁰ Ken Ainsworth, Submission to the Inquiry.

⁹⁵¹ James Bunn, Submission to the Inquiry.

⁹⁵² Robert Morse, Submission to the Inquiry.

*In the fires I worked on Fire Control made extensive use of my local knowledge and 40 years' experience in the area. Most of the control strategies and the local of control lines and fire behaviour were acted on.*⁹⁵³

*Local knowledge is critical, but so is the big picture and technical expertise.*⁹⁵⁴

There are multiple references in NSW RFS policies and procedures requiring IMTs to access local knowledge. Local Bush Fire Management Committees (BFMCs) are required to prepare a Plan of Operations setting out how they will respond to a bush fire, which is based on their local understanding of the surrounding area and informed by mandatory community consultation. These plans pre-identify appropriately trained personnel for IMT roles and identify local knowledge representatives.⁹⁵⁵

In addition, the Bush Fire Coordinating Committee policy 2/2006 *Management of Bush Fire Operations* states:

*Under a Section 44 appointment, the Incident Controller will form an Incident Management Team. The Incident Management Team must include a person who has local knowledge of the area and can assist the IMT in effecting suppression activities".*⁹⁵⁶

This is consistent with the NSW RFS training manual for Incident Controllers, which states that:

IMTs will incorporate local knowledge, where available and appropriate, by including local people:

- *in relevant incident management roles, where appropriately trained*
- *as advisors to IMT members*
- *in the incident site command structure, including guides and local resources in visiting teams".*⁹⁵⁷

When a Section 44 declaration is made, the appointment letter from the NSW RFS Commissioner to the appointed Incident Controller clearly states in respect to local knowledge input:

*You must also consider how the IMT can best access local knowledge and wherever possible utilise local members of the NSW RFS in the operations and functions of the IMT.*⁹⁵⁸

In addition to these requirements, following the 2017 Sir Ivan fire, the NSW RFS developed an additional IMT role, called the Rural Liaison Officer (RLO). The RLO position was created in response to stakeholder feedback about the need for local landholders to have direct input into IMT strategies. The RLO is responsible for establishing relationships with affected farmers during large fire emergencies and communicating their concerns and suggestions directly to the Incident Controller and IMT.⁹⁵⁹ One of the key components of the RLO role is visiting landholders at risk of fire threat to engage and provide an avenue for feedback or

⁹⁵³ Brian and Cynthia Tomalin, Submission to the Inquiry.

⁹⁵⁴ Ian Brown, Submission to the Inquiry.

⁹⁵⁵ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

⁹⁵⁶ RFS (NSW Rural Fire Service). Policy No 2/2006 Bush Fire Coordinating Committee, p 19.

⁹⁵⁷ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

⁹⁵⁸ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 8 May 2020*.

⁹⁵⁹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

concern to the IMT. This is based on feedback the NSW RFS has received from stakeholders such as NSW Farmers who suggested a 'go to farmer' approach, rather than waiting for landholders to go to the RFS.⁹⁶⁰

The NSW RFS advised that RLOs were appointed to each of the 18 IMTs operating during the 2019-20 season and that, due to the need to manage fatigue, the role was not limited to a single individual for the duration of the fire incident. In total, 53 people were deployed to fulfil the RLO roles, assisted by 78 Community Liaison Officers (CLO). The NSW RFS has advised that RLOs are not deployed if an IMT is established locally and the IC is satisfied there are sufficient mechanisms within existing Incident Management Teams that enable local landholders to contribute to the fire fighting effort (i.e. both fire suppression and inputting local knowledge).⁹⁶¹ Where RLOs are appointed, their role is not to replace the existing local engagement and knowledge processes, but rather to provide additional support where the complexity of the fire situation warrants this type of additional engagement and interaction with local landholders.⁹⁶²

Submissions to the Inquiry and community consultations made it clear that, at least in some areas, some local landholders had little to no awareness of who the RLO was and their function. The NSW RFS advised that the Incident Controller (IC) or Public Liaison Officer is responsible for communicating the RLO's appointment to the community, and that ICs were strongly advised to reach out to members of the local BFMC, specifically the NSW Farmers representative. However, community meetings demonstrated that in some areas there also appears to be minimal awareness of the local BFMC and its role, while in other areas, there is a strong relationship between BFMCs and the local community, including private landholders.

The Inquiry recognises there are many experienced volunteer firefighters and local landholders, with rich experience and expertise developed over many years, who are an invaluable source of knowledge for IMT decision-makers. The Inquiry agrees that local knowledge is critical to inform strategy development and associated resource allocations, and that this may require multiple inputs from different regions. This is particularly important when an IMT's area of command encompasses a large geographic area, as fire behaviour and terrain can vary greatly within a particular region.

In discussions with IMTs across the State, it was evident that local knowledge of fires in the region was considered to be an essential input to IMT decisions, and there were multiple examples of local knowledge shaping IMT strategies. In addition to the examples highlighted above, Cooma IMT appointed a local brigade Captain to a leadership role, to ensure local knowledge was embedded.⁹⁶³ A review of NSW RFS policies and procedures relating to IMTs confirms there are sufficient processes in place to ensure local knowledge is a central part of IMTs.

However, in light of the strong concerns raised by some community members and NSW RFS members about the need for local input, it is clear that further work is needed to communicate how local knowledge is being used, ensure local landholders are aware of communication channels with the Incident Controller and IMT, and to strengthen local

⁹⁶⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 7 July 2020*.

⁹⁶¹ Ibid.

⁹⁶² Ibid.

⁹⁶³ Meeting with Cooma Incident Management Team on 27 April 2020.

BFMCs' engagement with the community in some areas. The Inquiry considers the NSW RFS should continue its proactive approach to ensure local landholders' expertise informs IMT decisions and provide a clear avenue to raise any concerns, and bolster community engagement efforts at the local BFMC level.

5.4.5 Cross-border IMT representatives were effective

The Victorian Inspector-General for Emergency Management (IGEM) noted he had received very positive feedback regarding the placement of cross-border liaison officers (LOs) in IMTs (i.e. Victorian LOs were present in NSW IMTs managing cross-border fires and vice-versa). Liaison arrangements were also in place with the ACT. The Inquiry received similar feedback during discussions with IMTs managing fires on both the Victorian and ACT borders and encourages this practice to continue.

5.4.6 Interstate and international IMT personnel provided an invaluable contribution

Given the large numbers of people required to staff IMTs (at times on a 24-hour basis), NSW benefitted from interstate and international personnel to bolster local resources. In discussions with IMTs the Inquiry noted there were clear benefits in being able to access different perspectives and that continuity was particularly important. Longer-term postings enabled interstate and international IMT representatives to establish strong working relationships and gain a deeper understanding of local issues, as opposed to short-term shifts, which at times were necessary given resourcing demands but did not enable these broader benefits to be captured.

5.5 STRATEGIES TO CONTROL THE SPREAD OF FIRES

5.5.1 Early suppression and initial aerial attack

Key points

- Over the past five years the NSW RFS has exceeded performance targets to contain 70% of fires within 10 hectares; however, this wasn't the case in the 2019-20 season.
- Similarly, NPWS has maintained a five-year rolling average of keeping 70% of fires starting on-park within 10 hectares, compared to 60% in 2019-20.
- Improved technology would enable fire authorities to detect fires earlier, as discussed in Chapter 2. Fire fighting models used in South Australia and Victoria have demonstrated the efficacy of initial aerial dispatch once a fire is detected, followed by ground crew support, to achieve early fire suppression.
- The Inquiry recommends the NSW RFS trial initial aerial dispatch in areas at high risk of bush fire, supported by ground crew, to provide more opportunity on heightened fire days to enhance NSW's ability to keep fires small. 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.

5.5.1.1 Early fire suppression during the 2019-20 season was challenging

As discussed in Chapter 2, as the 2019-20 season progressed it became increasingly difficult to detect new ignitions as smoke from existing fires and dust in the atmosphere

affected thermal imagery. Even when fires were detected early, it was not always possible to dispatch remote fire fighting teams due to prevailing conditions (discussed further below).

The Inquiry's recommendation that Government accelerate spatial technologies to improve fire authorities' capability to sense new detections precisely and rapidly through heavy smoke, dust and fog, will only lead to improved outcomes if early detections are accompanied by an appropriate response. That is, fires that are detected early must also be suppressed early.

5.5.1.2 Early suppression of bush fires is essential to minimise the likelihood of bush fires growing into potentially large damaging events

In any one year, the size and distribution of bush fires varies depending on the coincidence of extreme bush fire weather conditions and ignitions, and the capacity of response agencies quickly to detect fires and safely contain them. The NSW RFS' Key Performance Indicator (KPI) in relation to early suppression is to keep 70% of new fires contained under 10 hectares.⁹⁶⁴ The NSW RFS' performance against its KPI has considerably improved over the past 10 years (see Figure 5-1), and the percentage of bush fires contained to 10 hectares or less in the 2018-19 season was 93.58%. NPWS does not have a KPI requiring it to keep a certain percentage of fires that start on-park within 10 hectares. However, NPWS advised that the five-year rolling average of keeping fires under 10 hectares (including the 2019-20 season) was 70%.

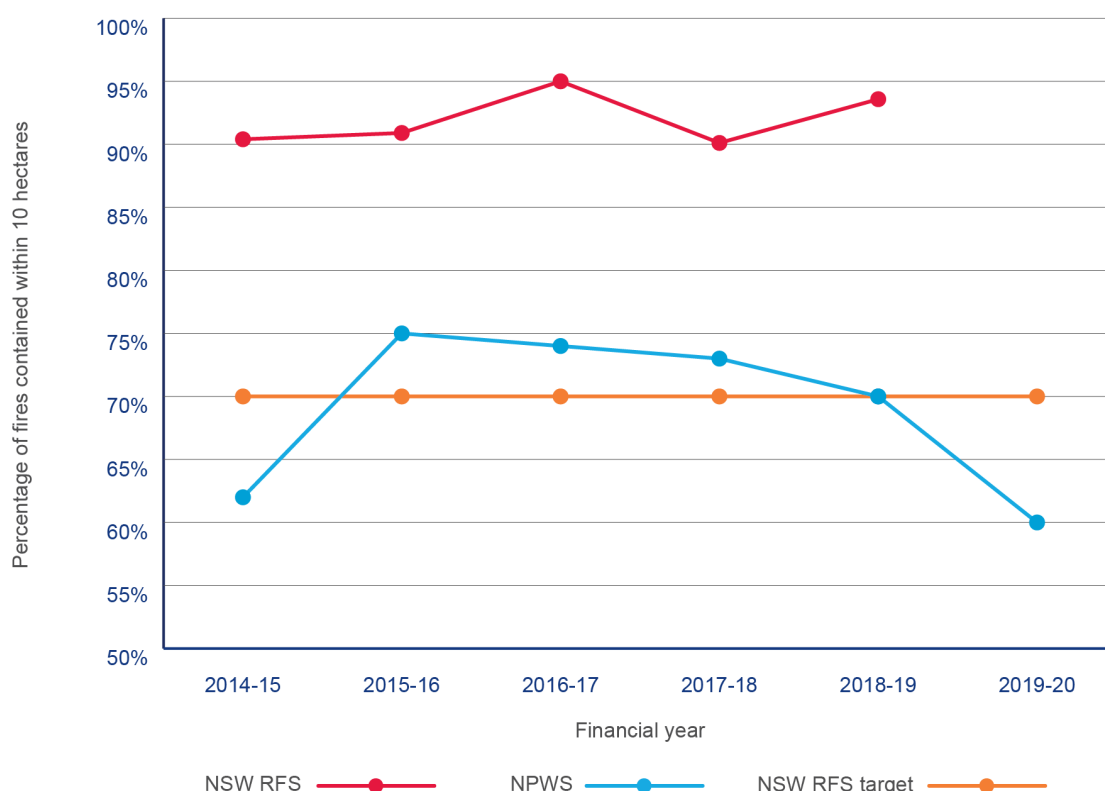


Figure 5-1: Percentage of fires kept under 10 hectares by NSW RFS and NPWS.⁹⁶⁵

⁹⁶⁴ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 26 February 2020*.

⁹⁶⁵ Ibid; NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 9 July 2020*. For 2019-20, data for the RFS was unavailable at the time of writing. NPWS data is as at 20 February 2020.

Extreme dryness over the past two years coupled with adverse fire weather produced conditions which made fire containment more difficult during the 2019-20 season, with many fires very quickly exceeding the 10-hectare threshold before crew arrived. A vast number of fires in remote areas were caused by lightning, where it was difficult to suppress fires early for a variety of reasons (e.g. flying conditions, not having the most appropriate aircraft for task, lack of access for ground crew). The Inquiry notes that increased turnaround times for Large Air Tankers/Very Large Air Tankers have previously been identified as an issue in this context.⁹⁶⁶

The NSW RFS has advised that consolidated figures for the 2019-20 season are not yet available to determine performance compared to previous years. However, anecdotal evidence provided to the Inquiry suggests the percentage of fires contained to 10 hectares or less will be considerably less than previous seasons. NPWS has advised that 60% of fires starting on parks (approximately 145 of 243 fires in total) were kept to less than 10 hectares in size during the 2019-20 season (as at 20 February 2020), compared to the five-year rolling average of 70%.⁹⁶⁷

Given the NSW RFS has a target relating to keeping fires under 10 hectares but a similar target does not exist for NPWS, the Inquiry recommends the 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.

5.5.1.3 Remote Area Fire fighting Teams are critical in keeping fires small

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 using helicopter access and dry fire fighting techniques. Early suppression of fires in remote areas is critical in preventing large fires developing and becoming a major threat.

Remote area fire fighting involves unique challenges and significant potential operational risks which require consideration. Remote Area Fire fighting Teams (RAFTs) are established as a pivotal tool to enable Incident Controllers to deal with these situations. RAFT deployment is task based and by its nature requires hard, protracted physical activity. Personnel must meet strict medical, physical and competency standards.⁹⁶⁸ Deployment of RAFT 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 RAFT crews).

The Rapid Aerial Response Team (RART) program is a joint NPWS and NSW RFS initiative that assembles RAFT crews and dedicated rotary aircraft for immediate or rapid deployment on days when bush fire ignition is likely (such as following lightning storms) or when there is

⁹⁶⁶ Department of Sustainability and Environment. (2007). Air Attack Supervisor Learning Manual. Fire and Emergency Management Dept. of Sustainability and Environment, Melbourne, Victoria.

⁹⁶⁷ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 1 April 2020*.

⁹⁶⁸ NPWS (National Parks and Wildlife Service) & RFS (NSW Rural Fire Service). (2011) OP 1.1.2 Joint Operational Protocol For Remote Area Firefighting Between New South Wales Rural Fire Service And National Parks and Wildlife Service. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0015/42306/OP-1.1.2-Remote-Area-Fire-fighting-RAF.pdf

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. A NSW interagency *RART Joint Operational Protocol* between NPWS and NSW RFS also guides the delivery of RART programs by both agencies, including the coordination of initial attack operations for cross-tenure bush fires.⁹⁶⁹ Over 80% 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.



Photo 5-3: Rapid Aerial Response Teams Gospers Mountain Fire. Provided by NSW RFS 8 July 2020.

The NPWS RART and NSW RFS RAFT program's KPI is to contain 80% of fires to under 10 hectares, which has been met on average over the last five years. For clarity, this KPI only applies once a RART team has been dispatched and does not apply to all fires that start on national parks.

⁹⁶⁹ Ibid.

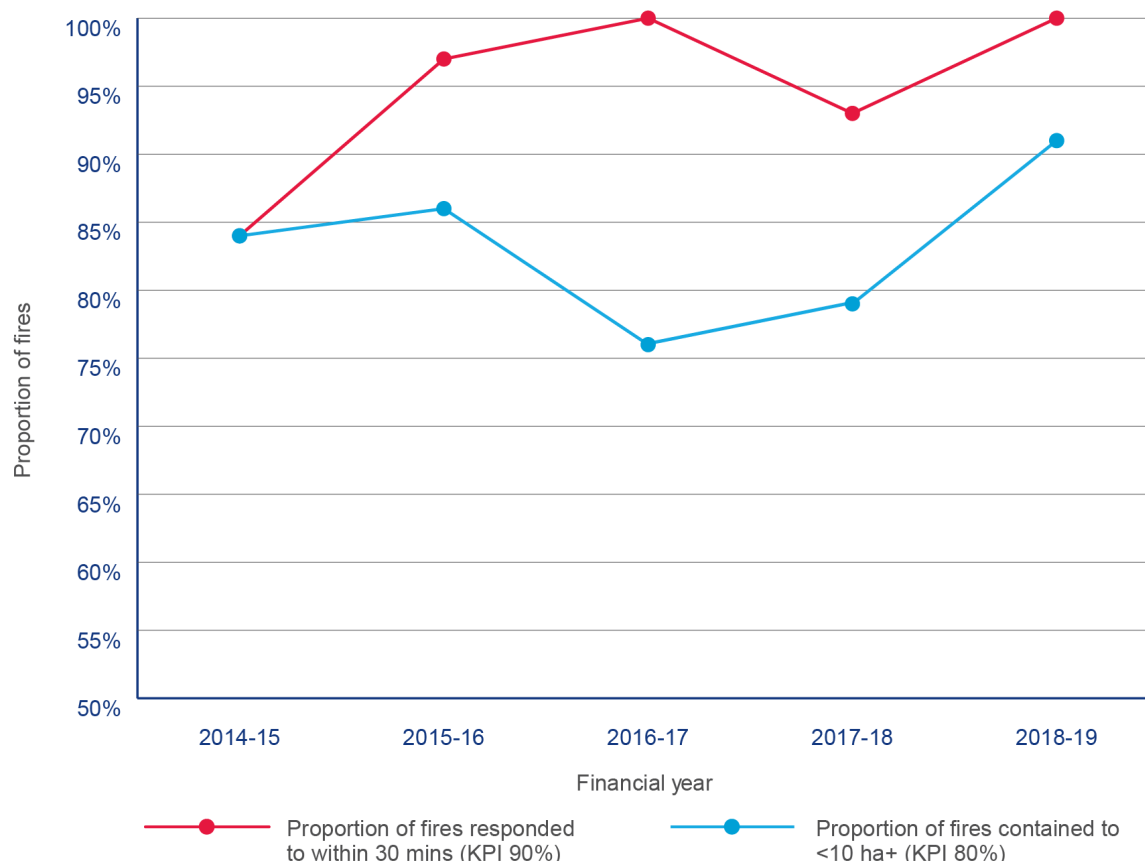


Figure 5-2: The proportion of fires managed under the NPWS RART program that were responded to within 30 mins and were contained to less than 10 ha per annum for the period mid-2014 to mid-2019..⁹⁷⁰

The benefits of remote aerial fire fighting were supported by a cost benefit analysis undertaken by the University of Wollongong into the Wollemi National Parks fires of 2006. In the submission to the Productivity Commission Inquiry into Natural Disaster Funding Arrangements,⁹⁷¹ the conclusions were that:

- if more resources had been available on the first ignition day in November 2006, the largest of the fires could probably have been prevented and several million dollars saved
- adding additional RAFT teams (4 firefighters) would yield a 2-4-fold investment return (i.e. an outlay of \$0.5 million per year would yield a net saving of \$1-2 million per year).
- if more ignitions are controlled, less area will be burnt by bush fire, so for environmental and risk-management purposes some or all of the burnt area saved would need to be replaced by prescribed burning—that cost was factored into the cost-benefit analysis
- climate change was likely to increase bush fire activity, and this would make rapid initial attack an even more cost-effective option.

⁹⁷⁰ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 1 April 2020*.

⁹⁷¹ NSW Government. (2014). NSW Factual Information Productivity Commission Inquiry into Natural Disaster Funding Arrangements. Retrieved from <https://www.pc.gov.au/inquiries/completed/disaster-funding/submissions/submissions-test/submission-counter/sub103-disaster-funding.pdf>.

These conclusions underpin the importance of Remote Aerial Fire fighting as an early suppression strategy.

The Inquiry was informed that Remote Aerial Fire fighting Teams were used to great effect throughout the 2019-20 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 fires on NPWS managed land. Of the 243 fires that started on national parks during the 2019-20 season, a total of 161 (66%) was contained on park and 145 fires (60%) were kept to less than 10 hectares in size.⁹⁷²

Where RAFT teams could be deployed this season, they were effective. During the 2019-20 fire 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 RAFT to an average fire size of less than 1.2 hectares. All of the fires were in remote and rugged terrain and the response involved highly trained and skilled crews winching in from helicopters.⁹⁷³ Whilst over 80% or 850,000 hectares of the Greater Blue Mountains World Heritage Area was impacted by fire, successful remote fire suppression by NPWS RAFT crews was critical in ensuring the remaining 20% remained unburnt. NPWS RAFT also contributed to saving the last remaining wild stands of Wollemi Pines in the world (Refer to Appendix Ten: NSW National Parks and Wildlife Service (NPWS) – Wollemi Pine Operation Case Study, May 2020).

However, NPWS advised that there were many days during the season where the extreme weather and conditions on the ground meant it was unsafe to deploy RART crews. The 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. At other times, RAFT crews were deployed to high priority non-RAFT fire operations which reduced their availability to undertake remote fire fighting.⁹⁷⁴

The Inquiry has found that fire fighting strategies need to adapt to cope with extreme fire weather and behaviour like that experienced during the 2019-20 fire season and predictions of increasing fire risks associated with factors such as climate change (as discussed in Chapter 2). The success of rapid response operations in extinguishing fires while they are still small (even under extremely dry conditions) suggests that priority should be given to increasing this rapid response capacity. This recommendation was supported by a number of submissions to the Inquiry.^{975 976 977 978}

⁹⁷² NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 1 April 2020*.

⁹⁷³ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 14 April 2020*.

⁹⁷⁴ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 1 April 2020*.

⁹⁷⁵ Blue Mountains Conservation Society Inc, Submission to the Inquiry.

⁹⁷⁶ Emergency Leaders for Climate Action, Submission to the Inquiry.

⁹⁷⁷ Australian Workers Union (AWU) NSW Branch, Submission to the Inquiry.

⁹⁷⁸ The Colong Foundation for Wilderness Ltd., Submission to the Inquiry.

The Inquiry notes 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%),⁹⁷⁹ as well as an additional helicopter.⁹⁸⁰

In addition to expanding RAFT capacity in light of increasing fire risks, deployment decisions must also be based on enhanced research and predictive modelling (as discussed with the Mid-North Coast IMT) to ensure early suppression is prioritised. This may sometimes require prioritising the deployment of RAFT to enable rapid initial attack of new remote area ignitions over ongoing suppression operations in already active fires. In discussions with the Glenn Innes IMT the Inquiry heard that this approach was adopted mid-way through the season, when multiple lightning strikes led to new ignitions while other fires continued to burn. The Inquiry noted this represented a significant paradigm shift, which is likely to be needed in future extreme fire seasons. The decision to prioritise deploying RAFT over ongoing suppression activities should be made on a case by case basis, informed by an assessment of the relative risks. This model was taken up by other IMTs as the season progressed.

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% is an appropriate KPI for the NSW RFS and NPWS
- b) NSW fire authorities deploy remote area fire fighting 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.

5.5.1.4 Initial aerial attack combined with ground support is effective in keeping fires small

Acknowledging the importance of the RART program in early suppression, a number of submissions to the Inquiry also supported introducing a 'Rapid Initial Response' aerial capability within NSW⁹⁸¹ to enhance early suppression outcomes. In two Australian states, the use of aerial suppression in rapid initial response to control bush and grass fires has become a routine strategy.⁹⁸² When a new fire is detected, an initial aerial rapid response is dispatched in concert with suitable ground fire fighting resources (which may include RAFT), with the aim of limiting the spread of the fire.⁹⁸³ The objective is to keep fires small and limit their spread across the landscape, particularly fires in remote areas. Research shows this

⁹⁷⁹ O'Malley, Nick. (2020, 8 June). More aerial rapid-response firefighters for NSW National Parks, *Sydney Morning Herald*. Retrieved from <https://www.smh.com.au/environment/climate-change/more-aerial-rapid-response-firefighters-for-nsw-national-parks-20200607-p550b7.html>.

⁹⁸⁰ Minister for the Environment. (2020). Firefighter Funding Boost for Next Fire Season. Retrieved from <https://www.environment.nsw.gov.au/news/firefighter-funding-boost-for-next-fire-season#:~:text=NSW%20is%20set%20to%20benefit,the%20next%20fire%20season%20hits>.

⁹⁸¹ Emergency Leaders for Climate Action; Craig Lapsley, Submissions to the Inquiry.

⁹⁸² AFAC (Australasian Fire and Emergency Service Authorities Council). (2016). Multi-agency trial project accelerates evidence based aerial suppression practice.

⁹⁸³ Plucinski M, Gould J, McCarthy G & Hollis, J. (2007). The effectiveness and efficiency of aerial firefighting in Australia. Bushfire and Natural Hazards CRC Technical Report.

corresponds with the increased likelihood of earlier control and a smaller total area burnt.⁹⁸⁴⁹⁸⁵

An outline of initial aerial dispatch models used in South Australia and Victoria is at Appendix Eleven. Based on a review of these models, the Inquiry considers that effective early suppression requires:

- the right mix of aircraft that are able to respond within very tight timeframes
- pre-positioning of aircraft in strategic locations (i.e. in areas of high bush fire risk, understanding the different risks presented as discussed previously)
- logistical support on the ground.

5.5.1.5 NSW should trial initial aerial dispatch to enhance early suppression capability

The NSW Government has demonstrated considerable support for aerial operations for many years, including the purchasing of one Large Air Tanker (LAT). The NSW RFS currently uses a range of fixed-wing and rotary aircraft to respond to various incidents. There are also exclusive use contracts in place through the National Aerial Firefighting Centre (NAFC) that includes fixed-wing bombers, medium winch helicopters, type one high volume helicopters and further Large Air Tankers (LAT). Despite the range of aircraft available, aerial dispatch is not always automatically triggered when a fire is initially detected in NSW.

In order to improve NSW's ability to suppress fires early and keep them small in conditions rated severe and above, the Inquiry recommends the NSW RFS trial the dispatch of suitable aircraft (at time of call), coordinated via the State Air Desk,⁹⁸⁶ building on the research that has already been undertaken by AFAC.⁹⁸⁷ The trial should be targeted in pre-determined geographical areas that are at high risk of bush fire and align with enhanced operational doctrine incorporating lessons learnt from the 2019-20 bush fire season. The trial should also be linked to the introduction of early detection technology as previously discussed in Chapter 2. Trialling initial aerial dispatch would complement the existing RART program, as it would enable aerial retardant/water-bombing to commence before RART crew arrive.

The Inquiry recommends that, as part of the trial, the NSW RFS also undertakes a review of all air bases and determines the level of infrastructure that would/may be required at different air bases to appropriately support initial rapid response and ongoing operations.

Any trial should also review the performance, cost effectiveness and most appropriate operating model for different aircraft. This review will inform aircraft targeted for various roles, including immediate dispatch and those most appropriate to form part of any single government fire fighting fleet managed through the State Air Desk. The Inquiry has received a range of submissions highlighting potentially suitable aircraft that may assist to inform the trial design, examples of which are at Appendix Twelve.

⁹⁸⁴ Plucinski, M. (2012). Modelling the probability of Australian grassfires escaping initial attack to aid deployment decisions. *International Journal of Wildland Fire* 22(4) 459-468.

⁹⁸⁵ Waters, K & Fuller, S. (2020) The impact of utilizing airtankers in fighting forest fires. Accessed from <https://wildfiretoday.com/documents/AirTankerImpactOnForestFires.pdf>.

⁹⁸⁶ Peter Clark, Submission to the Inquiry.

⁹⁸⁷ AFAC (Australasian Fire and Emergency Service Authorities Council). (2016). Multi-agency trial project accelerates evidence based aerial suppression practice.

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.

5.5.2 Backburning: containing fires from the ground

Key points

- Backburning is a common containment method. However, some backburns did not work as intended and broke containment lines, in some cases damaging or destroying property. Factors that led to this outcome included unusual and unforeseen weather conditions, including sudden changes in wind direction and/or low levels of relative humidity, as well as communication breakdowns which led to a lack of situational awareness for ground crews.
- There is currently no requirement to record backburns and their outcome, which needs to be addressed. The Inquiry's recommendation to accelerate the proposed roll out of MDTs in all NSW RFS fire fighting vehicles would also address concerns about a lack of situational awareness.
- The Inquiry found that the NSW RFS has investigated some unsuccessful backburns to ensure these lessons can be incorporated into future practices and procedures. Stronger community engagement is needed to ensure these lessons are shared with the community, noting the serious consequences that can eventuate if a backburn is unsuccessful.
- In light of changing weather conditions and more extreme fire seasons, further research is needed about the potential risks and benefits of introducing more fire into the landscape during severe, extreme or catastrophic fire conditions.

5.5.2.1 There were highly polarised views on backburning from the community and firefighters

Most large-scale bush fires during the 2019-20 season were successfully contained using backburning. However, some backburns did not work as intended: instead of stopping the fire, they escaped identified containment lines.

The Inquiry found that the topic and act of 'backburning' caused much comment from the community and firefighters and the views in many instances were polarising in nature. In some communities, there was a strong feeling that more backburning should have been done to contain the fires. In other communities, particularly in those where backburns broke containment lines, people were understandably angry and upset and questioned why the backburns had been carried out in severe fire danger conditions.

The back-burning technique has been over-used, often inappropriately. It can be a valuable tool but should be used judiciously, not indiscriminately. Over the summer its ubiquitous use often introduced more dangerous fire into the landscape (e.g. Yaouk Nature Reserve), which sometimes escalated into damaging new wildfire (e.g. Bilpin).⁹⁸⁸

⁹⁸⁸ John Stein, Submission to the Inquiry.

*When the fires were ready to exit the parks into more accessible areas, their intensity, size and ferocity was such that backburning efforts were marginal or ineffective.*⁹⁸⁹

*Given the high number of escaped ground and aerially ignited backburns during the 2019-20 bushfires, the use of fire (backburning) as a suppression tool to control high intensity bushfires should be critically reviewed by the inquiry.*⁹⁹⁰

*There were several examples of backburning operations escaping under conditions of elevated bushfire danger, sometimes destroying properties. Veteran firefighters described the associated decision-making processes as “damned if you do, damned if you don’t”, as the alternative was often to place firefighters in front of an intense approaching fire front, or to allow a fire to run unimpeded until weather conditions moderated sufficiently to enable some form of direct attack. This highlights the need for new firefighting approaches to be developed.*⁹⁹¹

*Having done many night shifts, it was frustrating when cool, humid conditions, weren’t used to proactively put in back burns and containment lines.*⁹⁹²

*Why couldn’t the back burning be done before Kiah and Wonboyn were hit, the Fire had several days to get from Mallacoota up through the bush to Kiah and Wonboyn, out to Towamba and Pericoe, I believe that if the back burning had been allowed then those areas of a Wonboyn and a Kiah, especially, may not have suffered so badly.*⁹⁹³

The Inquiry notes that the NSW State Coroner is currently investigating the 26 deaths that occurred during the 2019-20 season, which in some cases may necessitate a review of any relevant backburns that were undertaken in the adjacent area. The Inquiry is therefore unable to make definitive judgments as to the impact of particular backburns.

However, in response to the concerns raised, the Inquiry has examined the broader practice of backburning as a containment method during the 2019-20 season. The Inquiry has focused on how backburning practices and procedures can be improved in future seasons, particularly during severe, extreme or catastrophic fire conditions.

5.5.2.2 Backburning is a containment method used during an active fire

Backburning is often confused with hazard reduction (or prescribed burning). Hazard reduction is a preventative measure, which takes place in the absence of a specific fire threat. Backburning is undertaken after a fire has started as a containment method to reduce its spread, severity and/or intensity.

A backburn is defined as “a fire started intentionally along the inner edge of a Fireline during indirect attack operations to consume fuel in the path of a bush fire”.⁹⁹⁴ Backburning will often commence from a containment line such as a fire trail and involves lighting the fire side or the ‘inner edge’. It is effective in many instances as it removes the fuel ahead of the fire and provides an opportunity for firefighters to contain the fire.

⁹⁸⁹ Eurobodalla Coastal Alliance, Submission to the Inquiry.

⁹⁹⁰ Park Watch NSW, Submission to the Inquiry.

⁹⁹¹ Emergency Leaders for Climate Action, Submission to the Inquiry.

⁹⁹² Hugh Howell, Submission to the Inquiry.

⁹⁹³ Maree O’Neill, Submission to the Inquiry.

⁹⁹⁴ AFAC (Australasian Fire and Emergency Service Authorities Council). (2012). Bushfire Glossary, prepared by Rural and Land Management Group for AFAC Agencies, page 3.

5.5.2.3 The difference between ‘tactical’ and ‘strategic’ backburning needs to be better defined

In normal conditions, the introduction of additional fire into or near the fireground is an inherently risky undertaking. As a matter of course, the decision to backburn is made based on a risk analysis and careful planning of resources is required to support the backburn.

NSW RFS Incident Management Teams (IMTs) and Field Command have come to categorise backburns as either 'strategic' or 'tactical' in nature (see diagram below). In summary, the Inquiry was advised that:

- (a) **Strategic backburning** is used as the primary means to halt the main fire. Strategic backburns are often major operations that need to be carefully co-ordinated, assessed and resourced according to the outcomes of the Strategic Decision Cycle. Strategic backburns can only be conducted under orders from the Incident Controller, who is responsible for ensuring they are carried out in accordance with operational standards and procedures.
- (b) **Tactical backburning** is used to protect a specific asset when impact or a threat to containment lines is imminent. It is of a much smaller scale and usually highly time sensitive. Tactical burning may generally be conducted under orders of Field Command, or appliance Officer-in-Charge, by reference to information available at the time, provided that it does not interfere with the broader strategy for halting the main fire⁹⁹⁵ and is not specifically excluded by the Incident Action Plan. The requirements for undertaking a tactical backburn, and when one is not to be undertaken, are clearly outlined in the NSW RFS *Tactical Standard Operating Procedures*, Section 17 (Backburning activities).

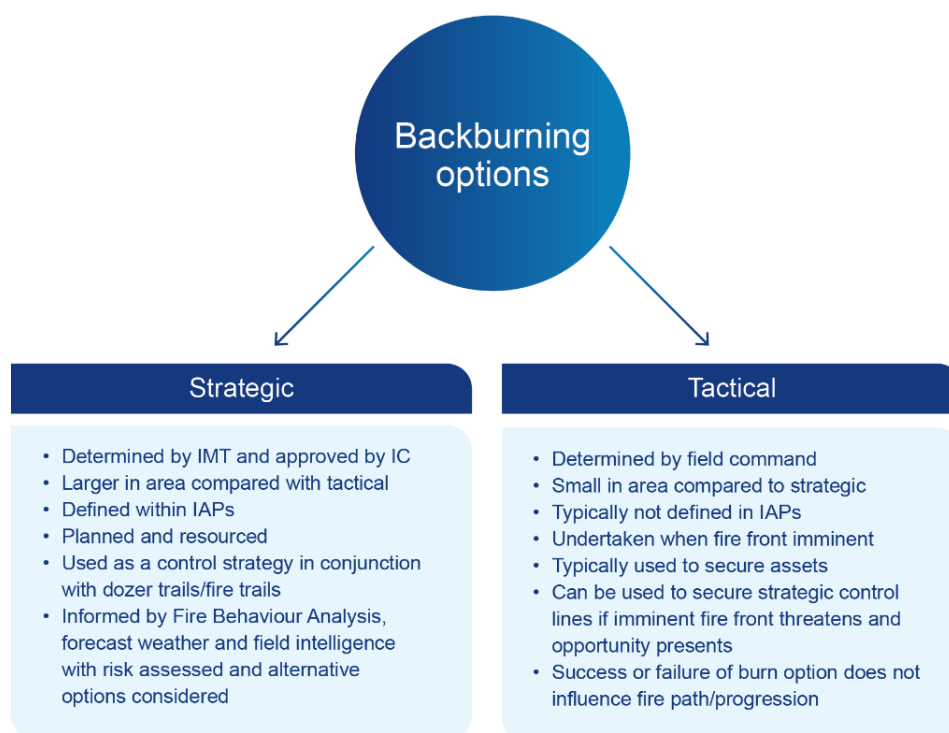


Figure 5-3: Backburn options⁹⁹⁶

⁹⁹⁵ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 8 May 2020*.

⁹⁹⁶ Ibid.

While the difference between tactical and strategic backburns appeared to be generally understood in the field, there is currently no definition of tactical or strategic backburning in legislation or in formal NSW RFS protocols. It is essential that all firefighters have a strong understanding of the difference between tactical and strategic backburning, and when it should and should not be undertaken. The Inquiry recommends that the NSW RFS reviews and improves definitions of strategic and tactical backburning and establishes protocols for each category within operational and training doctrine to ensure a considered, risk-based approach to backburning operations.

5.5.2.4 Record keeping of backburns needs to be improved

The Incident Controllers' and IMTs' process, risk considerations and decisions relating to strategic backburns are recorded in the Incident Action Plan (IAP), that is in some instances placed onto ICON. This is, however, still a paper-based IAP system and there is no function within ICON that allows a search for the number of strategic backburns conducted within a specific period of time. This has to be done by way of a manual search through individual IAPs, which does not lend itself to extracting trends or lessons learnt at the end of any given season.

The Inquiry requested the NSW RFS to provide details of the backburns conducted in the 2019-2020 season, shown in Table 5-1. Not every backburn was captured within ICON and a high proportion of those recorded were identified under 'tactical' in nature.⁹⁹⁷ The figures that were provided were done so as a sample data set to demonstrate the number of backburns in each month of the 2019-20 season.

To provide additional context, the table includes the number of backburns each month that were reported to have spotted outside the designated burn zone, and the number of backburns that were unauthorised by NSW RFS or another fire agency (noting that the data set is incomplete).

Month	Reported backburns	No spotting	Spotting	Unauthorised
July	13	13	0	0
August	94	90	4	0
September	120	115	5	1
October	169	161	8	0
November	197	191	6	2
December	260	242	18	1
January	187	184	3	0
February	27	26	1	0
Total	1067	1022 (95.8%)	45 (4.2%)	4 (0.3%)
No Spotting:	ICON intelligence log records a completed backburn without incident or otherwise makes no reference to spotting.			
Spotting:	ICON intelligence log referenced to spotting activity outside of the designated burn zone.			
Unauthorised:	ICON log reference to a burn undertaken by persons (other than NSW RFS or other authorised agency) that was not approved.			

Table 5-1: Backburns conducted during the 2019-20 Bush Fire Season – Sample Data.

⁹⁹⁷ Ibid.

In the absence of a complete data set, the Inquiry was unable to draw firm conclusions about how many backburns broke containment lines, or how many were unauthorised. Although the Inquiry heard anecdotal evidence that private landowners were putting in their own (unapproved) backburns, these are not all captured in the limited data set provided to the Inquiry. Given the public scrutiny of backburns that breach containment lines and may result in the loss of life and/or property, it is essential that NSW RFS maintains robust records of all backburns that are undertaken. The Inquiry therefore recommends that the NSW RFS modifies 'ICON' to implement the capability to record all backburns, including whether or not they breach containment lines.

5.5.2.5 Further research is needed on backburning during severe and above fire conditions

The Inquiry established that in NSW backburning is a commonly accepted method of containing well established and large fires that have evolved well beyond the capability of fire fighting resources and aircraft for direct attack. However, special consideration needs to be given to backburning during extreme conditions. Research submitted to the Inquiry demonstrated that these extreme fires develop in association with zones of deep widespread flaming, and as such the introduction of more fire into the landscape while an extreme bush fire is active has the potential to result in further escalation of the fire. The risks associated with backburning in extreme intensity fires that are accompanied by strong pyrogenic winds and other fire-atmosphere interactions can greatly increase, and as such may fail to achieve the desired result or in fact worsen the fire.⁹⁹⁸

In light of the fact that extreme fire conditions are likely to be more frequent in the future, combined with the challenges experienced by firefighters undertaking backburns during the 2019-20 season, the Inquiry considers further research is needed into the potential risks and benefits of backburning during severe, extreme and catastrophic conditions. The NSW RFS should use this research to inform future backburning protocols and training.

5.5.2.6 An additional layer of scrutiny for backburns in severe fire conditions is required

As noted above, the decision to backburn is taken very seriously, and a thorough risk assessment is undertaken before a backburn is implemented. A search of the records maintained located seven instances where requests by local landholders or brigades to undertake backburns were not approved by either the Incident Management Team or the Incident Controller for the following reasons:

- a. current or forecast weather conditions did not permit the backburn taking place
- b. crew safety
- c. availability of resources to execute the backburn
- d. the existence of available control lines to enable the backburn to occur.

The Inquiry found that, even despite appropriate planning, risk analysis and precautions, there were still times when approved backburns breached containment lines and caused damage or loss to property. This was often due to unforeseen extreme weather conditions, which were a feature of the 2019-20 season. While these backburns may have ultimately been successful in preventing more widespread damage from occurring, this does not console those who lose property as a result.

⁹⁹⁸ Professor Jason Sharples, Submission to the Inquiry.

The 2019-20 fire season demonstrated that even when all risks are seemingly taken into account, there are still occasions when strategic backburns do not achieve the intended outcome. While there is an existing administrative mechanism that enables Incident Controllers to raise an issue for adjudication by a more senior officer (i.e. at State Operations level), the time sensitivity of fire operations and the complexity of containment strategies can make a formal appeal process impractical, particularly where a bush fire is being fought on multiple fronts.

In light of the heightened risk that backburning presents in severe, extreme or catastrophic fire conditions, a process of reviewing planned strategic backburns in these circumstances should be implemented before the strategic backburn is undertaken. This would involve identification of suitably qualified officers (not involved in the local Incident Management Team) to carry out an independent review of the appropriateness of the planned backburn. In particular, the review should include the likelihood of success of the strategy, along with the risk and consequence of failure.

5.5.2.7 Community concerns about backburns must be acknowledged

As previously stated, feedback from the community about backburning was polarised. In some areas the feedback was that not enough backburning was done to protect properties, and in others that too much was done.

The Inquiry found that the NSW RFS routinely undertakes 'independent' investigations (conducted by an NSW RFS investigator/s independent of the relevant IMT to avoid any conflict of interest) into backburns of significance to ensure they are thoroughly investigated and that the learnings from those investigations are incorporated into their practices and procedures. The purpose of these investigations is not to lay blame or 'scapegoat' any individual or agency, but rather to learn from mistakes and improve future practices.

The Inquiry requested the NSW RFS to provide details of four independent investigations for the following fires/locations, understanding that some of these fires are subject to a Coroner's Inquiry:

- Green Wattle Creek Fire (Balmoral, within the Wollondilly LGA)
- Currowan Fire (Conjola, within the Shoalhaven LGA)
- Gospers Mountain Fire (Mt Wilson and Bilpin, within the Hawkesbury LGA)
- Grose Valley Fire (Blackheath to Lawson, within the Blue Mountains LGA).

5.5.2.7.1 Green Wattle Creek Fire:

On Thursday 19 December 2019, the eastern containment line of the Green Wattle Creek Fire was breached, resulting in fire affecting the communities of Balmoral, Bargo and Buxton. There was community comment that the breach of the containment line had occurred as a result of efforts made to contain an earlier backburn which had been extended beyond its authorised termination point on 14 December 2019.

The Inquiry was informed that the Green Wattle Creek Fire was a bush fire in the Lake Burragorang area that had been burning since 27 November 2019. On the day of the backburn, the fire was more than 127,000 hectares in size and classified as out of control. The backburn in question was undertaken within the Buxton Sector of the Dry Lakes Division located in the Nattai National Park to the west of the village of Buxton. The purpose of the backburn was to establish a containment line to prevent the fire extending to the east and avoid impact on a number of Southern Highland villages between Picton and Mittagong.

The NSW RFS has investigated that incident to determine the sequence of events which led to the impact and provided the resulting reports to the Inquiry. There appeared to be a lack

of shared situational awareness within plans (i.e. there was a disconnect between the knowledge held by the IMT and the crews executing the backburn). This meant that local crews did not have appropriate clarity on how the existing containment line and the backburn would align, resulting in an inadvertent extension of the backburn. Once the error was identified, there was insufficient time to execute the fall back (i.e. establish a holding line further behind the fire perimeter) due to a diminished window of opportunity.⁹⁹⁹ The NSW RFS reported that the outcome was highly regrettable and weighs heavily on the NSW RFS senior management and is personally devastating for those directly involved.

The Inquiry has recommended the NSW RFS accelerate the planned roll-out of MDTs in all NSW RFS fire fighting vehicles (as discussed earlier in this Chapter). MDTs in vehicles would ensure that ground crews had real-time information and full situational awareness during backburning operations and would mitigate future risk of backburns breaching containment lines.

5.5.2.7.2 Currowan Fire:

On Thursday 31 December 2019, the eastern containment line of the Currowan Fire was breached in the Conjola area, resulting in fire affecting the communities of Yatte Yattah, Conjola Park and Lake Conjola. It was alleged that this breach occurred as a result of backburning operations undertaken to build an eastern containment line from Wandandian to Little Forest up until 30 December 2019.

The Currowan Fire was a bush fire that had been burning between Batemans Bay and Nowra and east of Braidwood since 26 November 2019. By 22 December, the Currowan Fire joined with a fire to its north, the Tianjara Fire, which had been burning since 19 December 2019. The two fires joined to the north west of the Conjola Park area within the Tianjara Military Area. The backburning operations undertaken up until 30 December 2019 were part of a long-term strategy to establish a secure eastern containment line extending from Wandandian in the north to Milton in the south. The strategy was adopted following the assessment of options after a significant escalation in the Tianjara and Currowan fires on 21 December 2019.¹⁰⁰⁰

On 30 December, the backburn was tied into the northern side of Pointer Gap Rd in anticipation of elevated fire danger on the following day. By 20:33, a line scan indicated backburning within Yatte Yattah Sector substantially completed.¹⁰⁰¹

The NSW RFS reported to the Inquiry that the conditions observed on 31 December 2019 were extraordinary, exceeding the Ulladulla forecast and most closely matching Nerriga which is not normal. The bush fire that caused the major impact on Conjola Park is likely to have originated from spot over on a powerline easement near Golden Flats Lane. Noting that this fire is the subject of a Coronial Inquiry, it is not appropriate for the Inquiry to make any findings as to the cause of this fire.

5.5.2.7.3 Gospers Mountain Fire:

On Saturday 14 December 2019, the southern containment line of the Gospers Mountain Fire was breached, resulting in fire affecting the Mt Wilson and Bilpin communities. It was alleged that the breach was a result of backburning operations undertaken along Bells Line

⁹⁹⁹ NSW RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 2 April 2020*.

¹⁰⁰⁰ Ibid.

¹⁰⁰¹ Ibid.

of Road and Mount Wilson Road, between Mount Wilson and Flag Staff Hill on Saturday 14 December 2019. The backburning operations formed part of the broader strategy to build a continuous southern containment line from Bell to Mount Irvine.¹⁰⁰²

The Gaspers Mountain Fire was a bush fire across Singleton, Cessnock, Hawkesbury Central Coast, Blue Mountains, Greater Lithgow and Mid-Western Local Government Areas that had been burning since Saturday 26 October 2019. On 3 December 2019, the fire edge moved south towards Mountain Lagoon and a decision to backburn to protect properties was approved, but a concern for bushwalkers in the area suspended the operation for 17 hours and delayed the backburning until 4 December 2019 by which time the fire weather conditions were poor. The backburning occurred between Colo Heights, Mountain Lagoon and Bilpin.

The NSW RFS reported to the Inquiry that the strategy as well as a trigger and plan for implementation had been developed through a rigorous planning process and extensive consultation with local brigades and the community. Whilst there was consensus on the strategy, some local stakeholders were reportedly anxious for the backburn to be implemented before the agreed trigger was reached, due to concern over earlier instances of rapid-fire progression.¹⁰⁰³

It is reported that the weather forecast on 13 December 2019 revealed a better than expected window of opportunity, with an expected elevated fire danger on 18, 19 and 21 December 2019. The IMT brought the backburn forward to 14 December 2019. Whilst the backburn commenced well, the weather conditions rapidly deteriorated, resulting in wind speed and directions being markedly different in comparison to the forecasted conditions. It is reported that multiple spot fires occurred east of the Mount Wilson Road, affecting the southern interface of the Mount Wilson township.¹⁰⁰⁴

The conditions caused the fire and embers to affect Mount Irvine, Warawalong, Mount Tomah and Bilpin. The escaped backburn continued to breach Mount Wilson Road, Hungerford Track, Mount Banks Trail and Darling Causeway before spreading towards the Grose River and Grose Valley. On 21 December 2019 the fire affected the Bilpin community, resulting in property losses.

5.5.2.7.4 Grose Valley Fire:

The Northern Strategic Line (NSL) is a series of fire trails, hand tool lines and power line easements that create a containment line that runs north of the Great Western Highway, from Mount Victoria generally east to Hawkesbury Heights. Sections of the NSL have been used to control fires since the 1950s, although it wasn't until 1994 when those sections were brought together into a single coordinated strategy. Since 1994 the line was utilised in part in 2003, 2006 and most recently as a fall-back option in 2013. Up until 2010, the Northern Strategic Line was not a formalised strategy and consisted of a series of separate fire trails, hand tool lines and power line easements, linked by hand tool lines. In 2010-11, the NSW RFS and NPWS commissioned a project to fully scope, map and document the strategy for future use.

¹⁰⁰² RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 22 June 2020*.

¹⁰⁰³ Ibid.

¹⁰⁰⁴ Ibid.

The Grose Valley Fire was a bush fire burning in the Blue Mountains National Park between Bells Line of Road and the Great Western Highway that had been burning since a spot fire from the Gospers Mountain Fire on 14 December 2019 spread into the Grose Valley and was designated by the NSW RFS as a separate fire on 20 December 2019 to formalise its management as part of the Blue Mountains Section 44. Once in the Grose Valley, there were no effective containment options other than the Northern Strategic Line (NSL) to the south before fire reached populated areas of the ridge top towns along the Great Western Highway. There is little doubt that fire entering the valley placed thousands of homes at risk in townships from Mt Victoria in the west to Blaxland, Glenbrook and Winmalee in the east.

On 24 December 2019, a strategic backburn between Blackheath and Leura and then into Wentworth Creek was undertaken as part of a broader containment strategy¹⁰⁰⁵ for the Grose Valley Fire. The backburn successfully prevented the fire affecting communities along the Great Western Highway in the Blue Mountains, utilising portions of the Northern Strategic Line, and containing the southern perimeter of the fire. This was despite challenging conditions including soil dryness, difficult terrain, vegetation, weather and resource constraints.

The NSW RFS reported to the Inquiry that, by using the Northern Strategic Line strategy combined with the Lawson's Ridge Hazard Reduction and the eastern containment option implemented by the Hawkesbury IMT, the community was successfully protected from the Grose Valley Fire.¹⁰⁰⁶ The success of this operation was further enhanced as existing trails and containment lines had been pre-prepared.

It is important to ensure the findings and lessons learnt from these and other backburn investigations are shared with the community in instances where a backburn has resulted in unintended consequences. The Inquiry recommends that, where there is widespread concern within a community about backburning, the NSW RFS offers to undertake a community consultation/information session with affected residents to discuss the backburn and any investigation undertaken and relevant findings. The community consultation should include the NSW RFS Incident Controller, Public Liaison Officer, Local Officers and a Planning and Predictive Services representative, and suitable representatives from other involved agencies.

The Inquiry notes this has already occurred in one community following major backburns undertaken in the 2019-20 season. On Thursday 7 May 2020, the NSW RFS held a virtual community meeting (due to the impacts of COVID-19) for residents and affected people in the Conjola and surrounding areas.

Eliminating backburning would remove a highly effective technique from the fire fighting toolkit, in circumstances in which the technique is regularly conducted without incident to protect a high number of properties (and lives) in the direct path of an active fire that otherwise may not be capable of being controlled through other direct or indirect fire fighting techniques.

Recommendation 47: That, in order to enhance fire fighting strategies in severe conditions, the NSW RFS implements the following in respect to backburning:

¹⁰⁰⁵ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 9 June 2020*.

¹⁰⁰⁶ Ibid.

- a) establish protocols for each category (tactical and strategic) within their operational and training doctrine. These protocols should include lessons learnt from the 2019-20 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
- 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.

5.5.3 Fire fighting strategies during extreme drought: the use of heavy plant

Key points

- In the context of the drought and limited water supplies available for fire fighting, heavy plant was a critical element of the fire fighting strategies implemented in the 2019-20 season.
- There is a need for additional personnel to be trained as heavy plant supervisors and managers to ensure appropriate levels of supervision in future significant fire seasons.
- Heavy plant is sourced from both NSW Government agencies and external contractors, and vehicles are unable to be tracked remotely. This lack of visibility creates challenges for field commanders who are tasking and keeping track of heavy plant in their area, and is an area for improvement in future fire seasons.

5.5.3.1 Heavy plant is an essential fire mitigation and suppression tool, particularly during drought

'Heavy plant' is also referred to as plant, heavy machinery, heavy equipment or earth moving machinery and includes a wide array of machinery types including: bulldozers, graders, excavators, front end loaders, tractors, mulchers/tritters, bulk water tankers and refuelling tankers.¹⁰⁰⁷ In a fire management context, heavy plant is used for two primary purposes:

- **actively supporting fire suppression** by constructing strategic and tactical earth breaks and reducing fuel on the ground, such as grass, leaf litter, dead wood and fallen trees. Plant is also used to:
 - create tracks and trails allowing access to other fire resources and to establish or re-establish containment lines
 - 'brush up' existing trails to remove fuels (e.g. leaf fall) and ensure safe access for firefighters

¹⁰⁰⁷ RFS (NSW Rural Fire Service). (2011). Heavy Plant in the NSW RFS. Bush Fire Bulletin 33(3). Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0017/23525/Bush-Fire-Bulletin-2011-Vol-33-No-3-LIFTOUT-Heavy-Plant-Reference-Guide.pdf.

- mop up backburn operations (or mopping up more generally) by pushing dangerous trees and unburnt fuels back into burnt areas
- **fire mitigation** by constructing and maintaining fire trail networks to ensure safe and effective access to fires and to increase readiness, decrease response times and decrease environmental impacts. Plant is also used for vegetation management in APZs and on verges of roads and trails.

Heavy plant has always played an important role in fire suppression and is used to supplement traditional manual methods with mechanical means to accomplish tasks more rapidly and efficiently. This fire season, heavy plant played an even more critical role due to drought and the need to reduce the burden of water usage. Fire agencies and land managers have recognised the benefits of using machinery in fire operations particularly with respect to worker safety, productivity and cost efficiency. The benefits of heavy plant include that it:

- acts as a force multiplier for crews, increasing their capability and productivity, when used in containment line construction
- frees up fire fighting resources to focus on other critical tasks
- provides a safer means to deal with problem trees compared to manual tree felling
- facilitates faster and safer broad acre fire suppression requiring fewer fire fighting crews.

5.5.3.2 Heavy plant is sourced from private contractors and NSW agencies

The NSW RFS Heavy Plant Register includes private contractors (including Forestry Corporation of NSW), councils and other government agencies including NPWS and NSW Soil Conservation Service (SCS). Private contractors must be insured and meet a range of safety and communication equipment specifications in order to be accepted onto the register.¹⁰⁰⁸ Currently, there are 600 contractors on the register with the number of items of heavy plant totalling 4000.¹⁰⁰⁹ All agencies can access the register, which provides access to a skilled workforce and specialised equipment.

NPWS owns and operates 236 pieces of plant and machinery to assist in its fire fighting efforts. These machines are strategically located at depots and can be floated to site by truck and heavy trailers located with the machine. NPWS operates 141 heavy trucks and 33 heavy trailers with capacity to float and transport the equipment within their legal weight limits.¹⁰¹⁰

The SCS has operated heavy plant for most of its 80-year history. At one stage the business had around 120 large bulldozers, but now maintains a smaller specialist fleet of 28 machines which are D6 or equivalent size. SCS has had a long and productive relationship with the NSW RFS, especially in relation to the management and deployment of heavy plant on active fires and the construction and maintenance of fire trails.¹⁰¹¹ The Inquiry found that agencies regarded SCS as the benchmark for heavy plant standards and expertise.

The Forestry Corporation owns 15 bulldozers, five front end loaders and nine graders for road and trail maintenance and fire suppression. Before each fire season the Forestry

¹⁰⁰⁸ RFS (NSW Rural Fire Service). RFP2012-01 (State-wide Registration of Heavy Plant). Retrieved from https://www.rfs.nsw.gov.au/data/assets/pdf_file/0016/14650/Request-for-Proposal-Part-E-Special-Conditions.pdf.

¹⁰⁰⁹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 6 May 2020*.

¹⁰¹⁰ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 7 May 2020*.

¹⁰¹¹ SCS (NSW Soil Conservation Service). (2020). *Advice to the Inquiry provided 22 May 2020*.

Corporation's fleet is supplemented by pre-season hire agreements with contract plant operators, to supply an additional 65 bulldozers and 16 graders on a 'call when needed' contract basis.¹⁰¹²

5.5.3.3 The 2019-20 season demonstrated the need for more trained heavy plant supervisors

Depending on the scale of a bush fire, heavy plant can be managed by fireground commanders including Divisional or Sector Commanders, the Operations Officer or a dedicated resource. In larger bush fires, a dedicated plant management unit (PMU) is usually set up and reports to the Operations Officer. Depending on the scale of the operation the PMU will include a Plant Operations Manager and/or a number of Heavy Plant Supervisors to ensure heavy plant operators have a clear understanding of the required tasks. In addition, heavy plant operators must be accompanied by a fireground escort, as follows:

- where three or more items of heavy plant are in use on a fireground, a Heavy Plant Supervisor should be appointed. This is a specialist whose primary role is to monitor the safe, effective and efficient use of heavy plant. They are responsible for overseeing the tactical operation of heavy plant in accordance with the operational plan and in consultation with the Divisional or Sector Commander
- where five or more items of heavy plant are in use on a fireground under a Section 44 declaration, a Plant Operations Manager is recommended to be appointed, reporting to the Operations Officer. This is a specialist role to oversee the management of the heavy plant in use, in addition to the Heavy Plant Supervisor/s. They are responsible for the overall coordination, management and tracking of heavy plant used at an incident.

Bush Fire Management Committees are responsible for identifying suitable people for both these roles as part of operational planning. At this point in NSW there are around 150 trained Heavy Plant Supervisors and around 80 trained Plant Operations Managers across NSW Government agencies.¹⁰¹³ Additional heavy plant supervision capacity is available through the NSW Soil Conservation Service and other agencies such as local councils and Transport for NSW.

Due to the scale and spread of the fires during the 2019-20 fire season, coupled with high demands for heavy plant, in lieu of water-based fire fighting strategies, the call on trained heavy plant supervisors was much higher than usual. As a result, the resources available to manage and supervise heavy plant across numerous firegrounds were stretched. In discussions with the Cooma IMT, it was noted that more heavy plant supervisors were needed on the fireground than were available.¹⁰¹⁴ While the Inquiry isn't aware of any major incidents that occurred as a result, additional supervisors would have greatly enhanced the productivity and safety of heavy plant in use across the State, as plant operators could have been provided with more timely instructions about required tasks and fireground safety could have been better monitored. Therefore the Inquiry recommends increasing the number of trained heavy plant supervisors and managers to ensure an appropriate level of supervision in future significant fire seasons.

¹⁰¹² FCNSW (Forestry Corporation of NSW). (2020). *Advice to the Inquiry provided 26 March 2020*.

¹⁰¹³ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 3 July 2020*.

¹⁰¹⁴ Meeting with Cooma Incident Management Team on 27 April 2020.

5.5.3.4 Improvements are needed to heavy plant contracting and auditing requirements

The Inquiry heard that, before the 2019-20 season, NSW RFS had identified improvements to heavy plant contractual management and operational engagement. The 2019-20 season reinforced the need for improvements as there was a range of challenges for both heavy plant operators and the NSW RFS as the contracting agency, including:¹⁰¹⁵

- lack of transparency in the engagement and allocation of heavy plant both “on and off” the Heavy Plant Register
- purchase orders lacking detail on tasking and hourly rates
- appropriate approvals missing on completion of tasking/s to expedite payment
- manual capture of data
- lack of assessment and appropriateness (fit for purpose) of heavy plant equipment
- IMT limited resources to locally engage and manage contractors
- differing rate scales across the same types of heavy plant equipment
- inconsistencies in standards/quality of work undertaken.

The current NSW RFS heavy plant contract is about 7 years old and the Inquiry recommends a review of the contractual process. Heavy plant should be categorised into types, sizes and functionality along with an opportunity to develop a standardised hourly rate for that category of equipment. This is similar to the ARENA system for aviation. This would improve transparency in contractual arrangements across all contractors. The Incident Controller at the local level of engagement would have an improved understanding of the costs they are approving at the time of engagement.

The NSW RFS should also undertake a review of the current practice of auditing of heavy plant. In localised engagement it is sometimes difficult to undertake on-site checking to ensure that machines deployed match those on the Heavy Plant Register and are compliant with the contract specifications. The NSW RFS, in consultation with NSW Soil Conservation Service, should work on the development of a self-assessment system by contractors accompanied by the submission of documents and photographs that substantiate the self-assessment. This could be conducted beforehand via a QR/bar code that is issued for each machine. These QR/bar codes could then be scanned by the Heavy Plant Supervisor before commencing work. This is a system that is undertaken by Heavy Plant Operators on construction sites. However, any change in the system would require consultation and assistance to small businesses who supply heavy plant to ensure they understand the process and are not excluded from it.

5.5.3.5 Expanding ARENA to include heavy plant would improve tracking and accountability

The ARENA system used by the National Aerial Firefighting Centre (NAFC) manages aviation contracts and operational taskings and tracking by state/territory fire and emergency agencies. ARENA includes details on aircraft rates, contract service periods, aircraft location and availability, and provides real time data to the NSW RFS State Air Desk (further discussed later in this Chapter).

The lack of tracking of heavy plant on the fireground created concerns about safety, fire fighting and validating hours worked and the associated costs.¹⁰¹⁶ While many of the

¹⁰¹⁵ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 6 May 2020*.

¹⁰¹⁶ SCS (NSW Soil Conservation Service). (2020). *Advice to the Inquiry provided 22 May 2020*.

contracted heavy plant suppliers have a GPS tracking capability, this is not a requirement for inclusion on the Heavy Plant Register. The Inquiry learnt that the Forestry Corporation requires contracted plant to have tracking, and use the tracking to validate invoices, measure productivity and ensure safe operations. However, this is not standard practice across all NSW fire authorities.¹⁰¹⁷

The Inquiry recommends the expansion of the ARENA software to include the Heavy Plant Register to improve contractual compliance and to facilitate better the identification and tasking of appropriate localised heavy plant contractors. This would improve accountability for supplier selection, enable Key Performance Indicator assessments, improve safety compliance requirements and improve situational awareness of resources. The heavy plant system would operate on the same principles as aviation.

The current manual paper-based system of engagement and invoicing/payment is outdated and cumbersome. The Inquiry heard of lengthy delays in contractors receiving payment, or invoices being returned as details were missing. The introduction of ARENA would eliminate most manual processing and streamline the approval of supplier invoices if it is effectively integrated into the SAP system.

The small number of cross-border assistance requests is managed locally through the existing interstate mutual cooperation arrangements, previously discussed. The Inquiry does not support the establishment or development of a national approach for heavy plant.

Recommendation 49:

That, in order to maximise the efficiency and effectiveness of heavy plant used in dry fire fighting techniques, the NSW RFS expand and introduce the following in respect to heavy plant:

- a) increase the number of trained Heavy Plant Supervisors and Managers to ensure an appropriate level of supervision in future significant fire seasons
- b) expand ARENA software to include the Heavy Plant Register, including the introduction of GPS tracking for all agency and contracted plant, to improve contractual compliance and to facilitate better the identification and tasking of appropriate localised heavy plant contractors; and review the feasibility of linkage to the SAP system for invoicing improvements. This should be introduced prior to the 2020-21 fire season
- c) review the existing contractual process to ensure all heavy plant is categorised into types, size and functionality along with exploring potential for a standardised hourly rate for that category of equipment
- d) work with Soil Conservation Service to ensure appropriate standards for the engagement and management of heavy plant to deliver safe and effective heavy plant service, including the delivery of standards and auditing.

¹⁰¹⁷ FCNSW (Forestry Corporation of NSW). (2020). *Advice to the Inquiry provided 2 June 2020*.

5.5.4 The protection and use of water during the fires

Key points

- NSW fire authorities emphasised the use of dry fire fighting techniques given the ongoing drought conditions. Where water was available, innovative strategies were developed to maximise its utility.
- Water catchments were well protected and damage to water infrastructure was relatively minimal; however, power outages affected water availability for fire fighting in some communities which caused considerable distress.
- While there were clearly some challenges, the Inquiry considers the NSW fire authorities appropriately adapted their strategies to the resources available in very challenging circumstances.

5.5.4.1 Innovative fire fighting techniques and pumping systems capitalised on available water

Due to the severity of the drought, water for fire fighting was a scant and valuable resource, with priority going to drinking and stock uses in rural areas severely affected by fire. A NSW RFS operational brief was issued in July 2019 noting the importance of non-water-based fire fighting activities being considered and implemented, including the engagement of heavy plant (as discussed above).¹⁰¹⁸ The NSW RFS advised that, where traditional water-intensive direct attack methods proved difficult or less likely to succeed, there was greater emphasis on indirect fire fighting strategies including falling back and backburning.¹⁰¹⁹

The NSW RFS avoided the use of drinking water for non-essential purposes and used alternative water sources where possible. A good example of innovation was the use of reclaimed water provided by Port Macquarie-Hastings Council (piped from a local recycled water plant) to suppress the Lindfield Park Road fire burning in underground peat. This involved laying 2.5 km of hose and using 30 megalitres of water to rehydrate the area over 50 days (at a rate of half a megalitre a day).¹⁰²⁰ The NSW RFS also worked with Armidale Regional Council to drill a bore rather than use town water supplies and to build water storage at Armidale Airport to minimise water wastage associated with aerial fire fighting operations.¹⁰²¹

In areas where water was available, including around Eden and Wisemans Ferry, the Inquiry was informed that FRNSW used a bulk water transfer system manufactured by Hytrans. It can be used for any operation requiring the transfer of a large volume of water, including:

- when the reticulated system is over-run
- to supply onsite static fire fighting systems
- to create a temporary ring main
- flood mitigation.

¹⁰¹⁸ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 1 May 2020*.

¹⁰¹⁹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

¹⁰²⁰ Thomas, K. (2019, 3 September). Reclaimed water used to flood underground peat fire on NSW mid-north coast, ABC. Retrieved from <https://www.abc.net.au/news/2019-09-03/plan-to-inundate-underground-fire-switched-on/11469022#:~:text=The%20Lindfield%20Park%20Road%20fire%20is%20burning%20in%20underground%20peat,a%20day%2C%20over%2050%20days>.

¹⁰²¹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

The Hytrans system contains a HS150 pump which contains approximately 1,600 metres of hose. The hose capacity is consistent with other fire service systems as used by fire services overseas (including in the UK, Netherlands and Germany). FRNSW has adopted a 152 mm diameter hose rather than other traditional smaller hoses (i.e. 127 mm or 100 mm), so the system can deliver a high volume of water over long distances.

FRNSW currently has one bulk water system in service and the portability of the system means that it can be transported anywhere in the State by a hook loader appliance. The Inquiry was informed that the unit was used to great effect in the following areas:

- Eden (Eden Woodchip Mill): as the internal ring main could not supply the quantity of water required over a protracted period of time, seawater was used to extinguish fire
- Wisemans Ferry (Spencer): the system drafted water out of the river
- Lithgow: the system was set up to supply fire fighting water if required in the town.

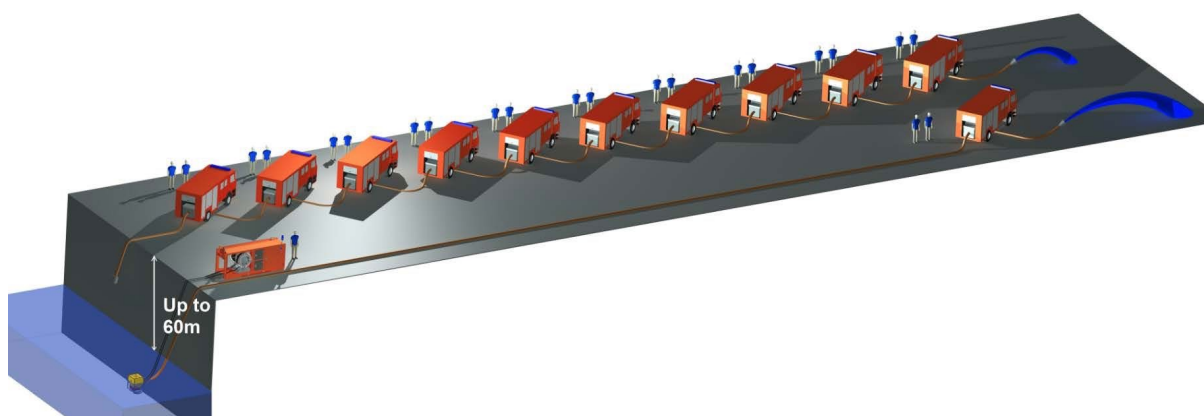


Figure 5-4: Benefits of use of the bulk water system.¹⁰²²

5.5.4.2 Catchments were protected but power outages to water infrastructure impeded fire fighting efforts

In the 2019-20 bush fires, WaterNSW and the response agencies were successful in preventing critical damage to essential water supply and electricity infrastructure. Overall, 33,355 hectares of WaterNSW land was burnt, including 90% of the Warragamba Special Area (330,000 hectares) and 62% of the Shoalhaven Special Areas (900 hectares).¹⁰²³

WaterNSW noted the NSW RFS collaborated effectively with it throughout the season and demonstrated a clear understanding of 'water quality values', which were incorporated into their decision-making where possible. WaterNSW advised that the NSW RFS made substantial efforts to keep the fire out of the metropolitan catchments, ensuring a proportion of the supply remained unaffected by fire which is important for the short and long-term management of water quality in the Greater Sydney supply.^{1024 1025}

In some communities, power outages and damage to infrastructure restricted water supply and adequate pressure for effective fire fighting. For example, Shoalhaven Water, which provides water and sewage services to 50,000 properties in the Shoalhaven Local Government Area, told the Inquiry that, while limited infrastructure was destroyed by the

¹⁰²² FRNSW (Fire and Rescue NSW). (2020). *Advice to the Inquiry provided 7 May 2020*.

¹⁰²³ WaterNSW. (2020). *Advice to the Inquiry provided 22 April 2020*.

¹⁰²⁴ Ibid.

¹⁰²⁵ Ibid.

Currowan/Tianjara fire events, maintaining a constant water supply to all areas was a challenge, mainly due to extensive power outages (to water treatment plants, pumping stations and motorised valves) and limited access to infrastructure (e.g. due to safety concerns).¹⁰²⁶ Some Conjola Park property owners experienced very low to no water pressure in the lead up to the impact of the fires.

On New Year's Eve power supply was also lost to water supply reservoirs at Fisherman's Paradise (10:40 am), Lake Conjola (11:40 am), and the critical Conjola Water Pumping Station (WPS) (11:50 am). Shoalhaven Water estimated that the Conjola reservoir was at zero capacity by around 3 pm, and due to the loss of power to Conjola WPS, Fishermans Paradise and Conjola reservoirs could not be filled. Shoalhaven Water staff, under emergency services escort, delivered a large generator to the Conjola WPS site at approximately 9 pm on New Year's Eve.

This lack of water had a big impact on the Shoalhaven community, especially those who were defending their properties.¹⁰²⁷ The Inquiry heard this created a lot of distress, with claims that the water was 'turned off'.

Shoalhaven Water has confirmed that water supply was not 'switched off' to any area in the Shoalhaven but did acknowledge the demand on the system was excessive and advised it is investigating methods to build further resilience, noting the expectations of the system in an extreme event are much greater than current design standards.¹⁰²⁸

The Inquiry heard that, in other areas that were at risk of but not yet under direct attack from the fires, demands on water supply were effectively managed through existing Energy and Utility Services Functional Area Coordinator (EUSFAC) arrangements. The EUSFAC



advised the Inquiry that Sydney Water received reports of insufficient water mains pressure from customers in Wilberforce, who were concerned there would be insufficient water for fire fighting if they were affected by the Gospers Mountain fire. Sydney Water concluded this was due to multiple NSW RFS tankers filling up in one location, which was reported to the EUSFAC who then advised the NSW RFS. Following this advice, the NSW RFS changed the location for filling tankers to alternative locations designated by Sydney Water, and water pressure returned to normal.¹⁰²⁹

Overall, while there were clearly challenges relating to water availability for fire fighting in some areas, the Inquiry considers the NSW fire authorities appropriately adapted their strategies to the resources available in very challenging circumstances.

Photo 5-4: Water resources. Source: Bruce Summerell, Submission to Inquiry.

¹⁰²⁶ Shoalhaven Water, Submission to the Inquiry.

¹⁰²⁷ Ibid.

¹⁰²⁸ Ibid.

¹⁰²⁹ EUSFAC (Energy and Utility Services Functional Area Coordinator). (2020). *Advice to the Inquiry provided 30 April 2020*.

The Inquiry received feedback from several stakeholders about the Government's stock water replacement policy, namely that the commitment to replacing all stock water used for fire fighting purposes is welcome but that elements of implementation are lacking (e.g. clarity for farmers about which agency is responsible, and how farmers' needs will be prioritised noting ongoing water scarcity). The Inquiry has not investigated this issue in detail as the stock water replacement policy (under the NSW Disaster Assistance Guidelines) is part of recovery, and therefore outside the Inquiry's Terms of Reference. It notes this is an issue for improvement in future seasons.

5.5.5 Attacking the fires from the air

Key points

- A lot of aerial resources were required during the 2019-20 season for fire fighting as well as a range of other purposes including transporting personnel and resources, surveillance and search and rescue missions.
- Helicopters, Large Air Tankers and drones were used to great effect in support of aerial intelligence and fire suppression. NSW's own resources were augmented substantially by aviation assets from other State and Territories as well as overseas. The Inquiry supports an expansion of FRNSW's drone capabilities to support real-time information gathering, which should be shared among the NSW RFS and other agencies as needed.
- Demand for larger fire fighting aircraft is increasing worldwide, which poses a risk that NSW may not be able to engage the same volume of aircraft in future seasons. The Inquiry considers the Commonwealth Government should be engaged in discussions to increase NSW's aviation surge capacity, noting the ADF's existing aviation asset base.

5.5.5.1 The National Aerial Firefighting Centre (NAFC) was well-prepared for increased demand

The State Air Desk (SAD) 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 (see Appendix Four for the full list), the SAD has access to aviation resources from other jurisdictions and private operators through contract arrangements facilitated by the National Aerial Firefighting Centre (NAFC). NAFC's national shared information system (known as ARENA) provides a common registry of aircraft available for combat agencies to use during fire and emergency operations. ARENA includes details on aircraft rates, contract service periods, aircraft location and availability, and provides real time data to the Air Desk module.

The SAD 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 the aircraft operator which confirms authorisation to fly. There is also a situation board that provides a visual display of aircraft dispatched per incident.

AFAC advised that, in anticipation of the season ahead, NAFC initially contracted 147 services for Australia-wide use during the 2019-20 bush fire season. NAFC further advised that 29 of these were engaged specifically on behalf of NSW (noting that the

Resource Management Agreement allows for surge capacity sharing between states and territories). The services were for a mixture of fixed-wing aircraft and helicopters:

- 14 helicopters, including two Type 1 (Heavy) Erickson Aircrews, and one Type 3 (light) helicopter equipped with specialist infra-red sensing and mapping equipment
- 15 fixed-wing aircraft, including 2 large airtankers.¹⁰³⁰

When the extraordinary scale of the 2019-20 season was made apparent, 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. 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.¹⁰³¹

5.5.5.2 Aviation played a crucial role in fire fighting during the 2019-20 season in NSW

Aside from human resources and land-based fire fighting techniques, aviation played a crucial role throughout the 2019-20 season. The scale of the season in NSW meant that a large contingent of aerial resources was required, not just for fire fighting 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.¹⁰³² The submission to the Inquiry from the Emergency Leaders for Climate Action notes that, while "fire fighting aircraft can be a crucial and necessary tool in the fire fighting 'toolbox' ... they are only effective when used in close coordination with ground-based fire fighting crews".¹⁰³³

In addition to NSW-owned aircraft, the NSW RFS engaged 38 aircraft through NAFC contract arrangements between July 2019 and March 2020. The NSW RFS has advised that 70 changes were made to service periods for NAFC contract aircraft to ensure appropriate levels of capability throughout the State. The 'call when needed' arrangements also provided access to tactical aircraft, aviation fuel trucks, specialist aircrew and aerial intelligence capability.¹⁰³⁴

ARENA shows that 317 aircraft were engaged for fire fighting in NSW between July 2019 and 30 January 2020 (this represents both NSW-contracted aircraft and aircraft provided under the 'call when needed' arrangements). ARENA data further shows that the highest number of non-RFS aircraft engaged on a single day in NSW was 160 on 22 December 2019.¹⁰³⁵ In addition, 73 aircraft were engaged for service under the 'call when needed' arrangements, including seven Type 1 (heavy) helicopters.

From 1 July 2019 to 12 February 2020, ARENA data shows aircraft flew some 63,000 hours in conjunction with bush fires in NSW. AFAC advised the Inquiry this figure significantly

¹⁰³⁰ Australasian Fire and Emergency Service Authorities Council (AFAC), Submission to the Inquiry.

¹⁰³¹ Ibid.

¹⁰³² SA CFS (South Australian Country Fire Service). Aerial Firefighting. Retrieved from [https://safecom-files.s3.amazonaws.com/current/docs/aerial_fire_fighting.pdf#:~:text=Large%20Air%20Tankers%20\(LATs\)%20and,Very%20Large%20Air%20Tankers%20\(VLATs\)&text=LATs%20are%20currently%20operated%20by,of%20water%20and%20fire fighting%20chemicals.](https://safecom-files.s3.amazonaws.com/current/docs/aerial_fire_fighting.pdf#:~:text=Large%20Air%20Tankers%20(LATs)%20and,Very%20Large%20Air%20Tankers%20(VLATs)&text=LATs%20are%20currently%20operated%20by,of%20water%20and%20fire fighting%20chemicals.)

¹⁰³³ Emergency Leaders for Climate Action, Submission to the Inquiry.

¹⁰³⁴ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

¹⁰³⁵ Australasian Fire and Emergency Service Authorities Council (AFAC), Submission to the Inquiry.

exceeds any previous season.¹⁰³⁶ In total, there were 2,518 aircraft taskings (some for single missions, some lasting multiple days) across the State. The NSW RFS has advised 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.¹⁰³⁷ Due to the increase in aircraft usage, the NSW RFS ordered an additional 5,000 one-tonne retardant bags from overseas because of limited stock in Australia (fire retardant is discussed further later in this Chapter).¹⁰³⁸

5.5.5.3 Helicopters were the most frequently used type of aircraft during the season

Helicopters' multifunctionality led them to being by far the most used type of aircraft during the bush fire season. Helicopters were engaged in early fire suppression, aerial intelligence and search and rescue operations resulting in the rescue of 51 people over the course of the season.¹⁰³⁹



Photo 5-5: Aerial appliances. Provided by NSW RFS 8 July 2020.

As discussed previously in this Chapter, the RART program uses two specially configured medium utility helicopters (BK117) 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. These RARTs are strategically deployed around the State during the bush fire season.

The NSW RFS advised that, while the use of RARTs and RAFTs was considered to be successful during the 2019-20 season, the number and spread of fires across the State challenged the capacity of suitable and available aircraft for these operations.¹⁰⁴⁰ While some contract aircraft can be used for this purpose, the two NSW RFS-owned BK117 helicopters are prioritised for the RART program.

¹⁰³⁶ Ibid.

¹⁰³⁷ Meeting with Glen Innes Incident Management Team on 9 March 2020.

¹⁰³⁸ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

¹⁰³⁹ Ibid.

¹⁰⁴⁰ Ibid.

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 fire fighting efforts or support other combat agencies in undertaking their emergency roles.

5.5.5.4 Single-engine helicopters have less functionality and do not meet NSW RFS safety standards

As well as NSW RFS' and NPWS' own strict operating guidelines¹⁰⁴¹ for RART and RAFT operations, helicopters must also comply with Civilian Aviation Orders set by the Civil Aviation Safety Authority on helicopter winching and rappelling activities.¹⁰⁴²

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.¹⁰⁴³ The key safety advantage of a twin-engine helicopter is that it still has fly-away capability if one of the engines is lost. The Inquiry's own research suggests that other comparable agencies which carry out winching activities also do so with twin-engine helicopters, including CareFlight¹⁰⁴⁴ and Westpac Rescue Helicopter.¹⁰⁴⁵

NPWS is the only State Government agency the Inquiry is aware of that has actively acquired single-engine helicopters in recent times. The Inquiry acknowledges the significant non-fire related work undertaken by NPWS aircraft and the suitability/functionality of these aircraft for these land management functions. The Inquiry also notes that the aircraft meet all safety standards (other than NSW RFS winching safety standards).

However, 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. For example, during the Armidale/Northern Tablelands fires, the Northern Tablelands IMT advised of instances where winch operations could have been included in fire fighting plans but, as the IMT was aware that winch aircraft were unavailable, other non-winch related operations were put in place. If the NPWS aircraft had met NSW RFS safety standards for winching operations, this would have given the IMT a greater level of flexibility and potential options for planning. Throughout September 2019, Park Air aircraft were attached to the incident; however, they were limited to firebombing and observation roles. These roles could have been filled by other aircraft should the Park Air machines have met the requisite standard for winching.

¹⁰⁴¹ RFS (NSW Rural Fire Service). (2014). OP 1.2.18 Operational Protocol for Rapid Aerial Response Teams (RART). Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0020/42284/OP-1.2.18-Rapid-Aerial-Response-Teams.pdf.

¹⁰⁴² CASA (Civil Aviation Safety Authority). Civil Aviation Order 29.11 Air Service operations – helicopter winching and rappelling operations. Retrieved from <https://www.legislation.gov.au/Details/F2015C00074>.

¹⁰⁴³ RFS (NSW Rural Fire Service). (2017). Helicopter Winching Standards, section 5.2.1. RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 17 March 2020*.

¹⁰⁴⁴ CareFlight. (2020). Helicopters. Retrieved from <https://careflight.org/about-us/our-aircraft/helicopters/>

¹⁰⁴⁵ Westpac Life Saver Rescue Helicopter. Operations. Retrieved from <http://www.heli Rescue.com.au/About/Operations>.

The Inquiry requested advice from NPWS on why it has 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.¹⁰⁴⁶ The Inquiry notes that NPWS is undertaking further research to inform future aviation business planning. The Inquiry supports the move to twin-engine helicopters for winching.

5.5.5.5 The use of Large and Very Large Air Tankers set a new record

Large Air Tankers (LATs) and Very Large Air Tankers (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 fleet. NFAC evaluations also suggest that because LATs/VLATs can be deployed relatively quickly, they are best placed to provide surge capacity where there are resource shortages or resources are fully engaged. The primary role of LATs and VLATs is firebombing using water or fire suppressant.

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, above the existing contract arrangements with NAFC. In addition, NSW received another VLAT in February 2020 due to supplementary Commonwealth Government funding. While the Inquiry understands 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.¹⁰⁴⁷

In total, the NSW RFS used two VLATs and four LATs to undertake 1,708 collective missions and drop over 24 million litres of fire suppressants, in order to support ground fire fighting personnel.¹⁰⁴⁸ This represented the largest contingent of VLATs/LATs ever used in NSW and included the NSW RFS-owned LAT (737), the *Marie Bashir*.

With the *Marie Bashir* permanently at RAAF base at Richmond, the NSW RFS has access to a LAT all year round. Four days after its commissioning on 4 August 2019, it flew its first mission and made its first ever suppressant drop on the Lindfield Park Road fire at Port Macquarie. As at 20 March 2020, it had flown 455 missions and dropped 6.825 million litres of suppressant.¹⁰⁴⁹ NSW is the only Australian state or territory with a permanent LAT. The NSW RFS advised that having the *Marie Bashir* available from the start of the season was invaluable to the RFS' fire fighting capability this season, particularly given the early start to the season when access to contract aircraft was limited due to the overlap with the northern hemisphere fire season.¹⁰⁵⁰ This issue is further discussed below.

¹⁰⁴⁶ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 8 May 2020*.

¹⁰⁴⁷ Emergency Leaders for Climate Action; AFAC, Submissions to the Inquiry.

¹⁰⁴⁸ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 6 February 2020*.

¹⁰⁴⁹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

¹⁰⁵⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 6 February 2020*.

5.5.5.6 Aerial resources were stretched across Australia and overseas during the 2019-20 season

The Inquiry acknowledges the tragic loss of life of three American fire fighting pilots, following an accident involving a Lockheed EC130Q (C-130) aircraft contracted to the NSW RFS. The crew had been tasked with a fire retardant drop over the Adaminaby Complex bush fire.¹⁰⁵¹ The Inquiry notes the Australian Transport Safety Bureau's ongoing investigation and is therefore unable to make further comment.

Much of the aerial fire fighting fleet involves shared resources across all Australian jurisdictions. Severe to extreme bush fire 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. As noted in the AFAC submission to the Inquiry, this had occurred in a way that had not been observed previously.

The intensity of the 2019-20 season resulted in unusually high rate-of-effort. Specifically, AFAC advised that "... very high number of hours flown, often for extended periods meant that aircraft reached maintenance limits that would not have previously been encountered during a bush fire season".¹⁰⁵²

AFAC further noted that pilots reached statutory flight and duty time limitations that would have not applied normally. The NSW RFS standards state that "Flight time of a pilot / aircrew must not exceed 10 hours within a 24 hour period" and "not be on duty for more than 12 hours in any consecutive 24 hours. Duty time is calculated from the time the pilot arrives at the aircraft or briefing and ceases when they return to their accommodation".¹⁰⁵³ There were also challenges in securing availability of aerial support personnel within NSW, previously discussed in Chapter 3.

International support was crucial in ensuring continuity of supply of aerial fire fighting capability. NSW, and all other jurisdictions across Australia, relies on international support through NAFC and AFAC to meet fleet requirements. The availability of the aerial fire fighting fleet sought from overseas continues to be an issue and was a consistent theme in media commentary and, in turn, in submissions received by the Inquiry. NFAC has told the Inquiry that availability of LATs and VLATs in particular has been problematic, as jurisdictions both across Australia and overseas continue to experience protracted fire seasons.

Ken Thompson ASFM, a former Deputy Commissioner of NSW Fire Brigades (now NSW Fire and Rescue), was quoted during the most recent fire season as saying "... we've got very serious concerns about the small numbers of large aircraft that are available to support firefighters and local communities".¹⁰⁵⁴

¹⁰⁵¹ ATSB (Australian Transport Safety Bureau). (2020). Aviation safety investigations & reports Collision with terrain involving Lockheed EC130Q, N134CG, 50 km north-east of Cooma-Snowy Mountains Airport (near Peak View), New South Wales, on 23 January 2020. Retrieved from https://www.atsb.gov.au/publications/investigation_reports/2020/aoir/ao-2020-007/.

¹⁰⁵² Australasian Fire and Emergency Service Authorities Council (AFAC), Submission to the Inquiry.

¹⁰⁵³ RFS (NSW Rural Fire Service). (2018). Aviation Standard Operating Procedures, section 5.2. RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 6 February 2020*.

¹⁰⁵⁴ Davis, Jess. (2019, 15 November). Are bigger water bombers the answer to Australia's bushfire woes?, ABC. Retrieved from <https://www.abc.net.au/news/2019-11-15/are-bigger-water-bombers-the-answer-to-bush-fire-woes/11705502>.

AFAC's submission to the Inquiry noted that, although aircraft sourced from the northern hemisphere meet their contractual obligations, there is an ongoing risk to these arrangements. There has been a worldwide increase in demand for these larger fire fighting assets, which has not necessarily been accompanied by a commensurate increase in supply.

This was already experienced to a certain extent in the 2019-20 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 2019-20 and for future years.

Given future fire seasons are predicted to be more protracted and extreme in both the northern and southern hemispheres, the Inquiry expects NSW to experience similar aviation surge capacity challenges if another extreme fire season occurs. This was also acknowledged by AFAC in its submission:

*In the past, the peaks of the bush fire seasons in the northern and southern hemispheres – when demand for specialised, heavy aircraft is greatest – have normally been some months apart, so the issue of competing needs tended to occur at the margins, not the peak, of the fire seasons. NAFC acknowledges the forecast trend for more serious bush fires to occur outside of the previously traditional peak times – a trend well illustrated during the 2019-20 season. NAFC will continue to work with States and Territories on appropriate resourcing strategies that do not rely on short notice acquisition of assets from overseas to meet surges in demand and requirements for aerial fire fighting at non-traditional times of the year.*¹⁰⁵⁵

While the Inquiry supports NAFC continuing to work with states and territories on strategies to ensure surge capacity can be maintained in future seasons, it also considers that the Commonwealth should be involved in augmenting this capacity given its current aviation asset base. Acknowledging the significant capital investment required to purchase aviation assets, and the efficiencies associated with multipurpose equipment, the Inquiry recommends the NSW Government request the Commonwealth to conduct a trial with NSW RFS on the feasibility of retrofitting RAAF C130 aircraft with modular airborne fire fighting systems and training to provide ADF with the capacity to augment aerial fire fighting during major disasters.¹⁰⁵⁶

5.5.5.7 The mix of aircraft in the current fleet should be reviewed to ensure it is fit-for-purpose

The Inquiry acknowledges there is no 'silver bullet' when it comes to the right type of aircraft for fire fighting, as there is a range of factors to consider (e.g. access to water sources, prevailing weather conditions, remoteness of terrain etc). In relation to air tankers, for example, there are operational limitations that should also be acknowledged, beyond cost and availability. Air tanker operations can be hampered by their ability to access suitable airfields to take off and land from, with many regional NSW facilities lacking the infrastructure to accommodate aircraft the size of a Boeing 737 or similar, if rapid refuelling is required.

¹⁰⁵⁵ Australasian Fire and Emergency Service Authorities Council (AFAC), Submission to the Inquiry.

¹⁰⁵⁶ United States Air Force. (2007). Modular Airborne Firefighting System. Retrieved from <https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104558/modular-airborne-fire-fighting-system/>.

A literature review carried out following the 2018 Camp Fire, which destroyed over 500 square kilometres of Northern California and is consistently referred to as the most expensive natural disaster of that year, concluded that expanding the CalFire fleet of airtankers would be a poor investment of taxpayer dollars, quoting studies that have found that air tankers are routinely deployed at times, places, and conditions where they are least useful or effective.¹⁰⁵⁷ The Inquiry does not suggest this is the case in NSW, where they were appropriately used as part of a well-developed mitigation strategy during an event, dropping fire retardant ahead of fire fronts and potentially creating a fire break for ground crew.

The 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 fire fighting fleet in order to maximise flexibility.*¹⁰⁵⁸

The Inquiry received a range of submissions advocating for particular models or types of aircraft to be added to the existing Australian fire fighting fleet. In light of the extreme weather conditions experienced during the 2019-20 season the Inquiry agrees that a review of the existing fleet should be undertaken to ensure NSW (and Australia) has fit-for-purpose aerial fire fighting assets that support fire fighting in a range of conditions.

Recommendation 50: That, in order to ensure Australia’s fire fighting 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 fire fighting systems to provide the Australian Defence Force with the capacity to augment aerial fire fighting during major disasters
- b) work with states and territories through the National Aerial Firefighting Centre to review the current mix of aviation assets and determine whether it is fit-for-purpose, noting the current lack of mid-sized fire fighting aircraft.

5.5.5.8 Drones were part of bush fire reconnaissance operations

NPWS, FRNSW and Forestry Corporation have Remotely Piloted Aircraft Systems (RPAS) – more commonly known as drones – capabilities that were used throughout the 2019-20 season.

FRNSW has an extensive RPAS capability. It comprises a combination of 2 platforms: Mavic 2 Enterprise dual (fixed daytime and thermal camera) & Matrice 210 V1 with XT2 (daytime and thermal camera) Z30 30 x optical zoom X5S.

¹⁰⁵⁷ Bevington, D. (2019). A New Direction for California Wildfire Policy – Working from the Home Outward. Retrieved from <https://assets.takeshape.io/1f1d0876-be74-4b33-99c8-6ac93f1d70db/dev/18cecbdc-20ad-4ac8-aab2-05b60f5ff064/LDF,%20A%20New%20Direction%20for%20California%20Wildfire%20Policy%2020190211.pdf>.

¹⁰⁵⁸ Emergency Leaders for Climate Action, Submission to the Inquiry.

FRNSW has held a remotely piloted aircraft operator's certificate (ReOC), issued by the Civil Aviation and Safety Authority (CASA), since August 2016. FRNSW also has CASA permission to operate RPAS in restricted areas. Sixty-two FRNSW personnel hold Remote Pilot Licences (RePL), so are trained and certified to operate RPAS. The FRNSW capability is based in Sydney, Batemans Bay and Jindabyne. There is scope to travel to regional areas based on operational requests and requirements, as was the case during the 2019-20 season.¹⁰⁵⁹

The RPAS capability allows reconnaissance of bush fire affected areas, which can be viewed by IMTs to assist in planning fire fighting strategies. This is especially useful when weather conditions and smoke may prevent helicopters from accessing the area. These platforms were also used to great effect in the recovery phase of operations, with mapping technology that enabled confirmation of property losses and also volume of debris for removal to waste facilities.

Fifteen RPAS owned and operated by FRNSW were made available, with six (for reasons of take-off weight, prevailing conditions and capability) used to carry out around 50 missions, made up of multiple flights. Each unit had payloads ranging from high resolution/multi-optical zoom visual cameras, high-resolution thermal (infrared) cameras and live-streaming capability. NPWS ParkAir drones were also used for a range of strategic operations including undertaking building assessments in otherwise inaccessible areas, conducting night operations with strike teams and running thermal line scans.¹⁰⁶⁰

FRNSW and NPWS RPAS were a valuable part of the aerial response over the course of the season, providing real time intelligence to incident command. When flight conditions were unsuitable for manned aircraft (mostly due to smoke), these RPAS were sometimes deployed to ensure situational awareness was maintained, with livestreaming of bush fire conditions and thermal data sent to Fire Control Centres and the NSW RFS State Operations Centre for immediate viewing.

RPAS also provided 'digital scouting' by identifying hot spots in advance of aerial fire fighting 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 control centres to assist in the deployment of available and suitable resources.¹⁰⁶¹

5.5.5.9 Expanding drone capability would improve situational awareness and provide a strong return on investment

Placing greater reliance on RPAS has been encouraged by key stakeholders and submissions received by the Inquiry have also called for further investment in remotely piloted vehicles¹⁰⁶² (noting that these submissions have a commercial vested interest in their use).¹⁰⁶³ Analysis following the wildfires in Northern California in 2018 confirmed that "the highest return on investment (ROI) technologies are autonomy, autonomous sensing over fire, and the associated data and information system".¹⁰⁶⁴

¹⁰⁵⁹ FRNSW (Fire and Rescue NSW). (2020). *Advice to the Inquiry provided 22 May 2020*.

¹⁰⁶⁰ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 5 June 2020*.

¹⁰⁶¹ FRNSW (Fire and Rescue NSW). (2020). *Advice to the Inquiry provided 22 May 2020*.

¹⁰⁶² The Ripper Group, Submission to the Inquiry.

¹⁰⁶³ Carbonix, Submission to the Inquiry.

¹⁰⁶⁴ Stavros, E. (2019) *Smoke Sky – Exploring New Frontiers of Unmanned Aerial Systems for Wildfire Science and Applications*. Retrieved from

The Inquiry notes that small and medium RPAS do 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.

RPAS have a number of limitations that affected their use during the 2019-20 season. This ranged from the size of RPAS available and extreme weather conditions (with winds above 40kph) that made their use extremely problematic. There is also a need to integrate the use of RPAS with aircraft to ensure that a safe and coordinated approach is taken.

The Inquiry shares 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. The Inquiry acknowledges that, although NPWS also has an RPAS fleet that undertakes significant work to support land management operations (not just fire), FRNSW has a more advanced capability, which should be expanded and leveraged by other agencies working with FRNSW to ensure that there is not a duplication of effort in resourcing.

Currently when flying RPAS at a major bush fire under a Section 44 declaration, FRNSW must be granted approval from the NSW RFS to conduct low level RPAS operations within that airspace. In discussions with CASA the Inquiry was informed that expanding the use of RPAS 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 RPAS operations to commence in a timely way and on a larger scale during future fire seasons.¹⁰⁶⁵

To reap the full benefits of the RPAS Program as a State-wide resource, the Inquiry would recommend these additions to the RPAS 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 can be maximised in supporting FRNSW's core services, such as structural fire fighting. Locating additional RPAS capability close to established aviation hubs would provide FRNSW with a greater ability to attract staff who hold or have the requisite qualifications to gain a RePL. To ensure equitable geographic coverage, the Inquiry suggests that regional NSW be investigated for potential additional locations. As

https://www.researchgate.net/publication/337387115_Smoke_Sky_--_Exploring_New_Frontiers_of_Unmanned_Aerial_Systems_for_Wildland_Fire_Science_and_Applications?_esc=publicationCoverPdf&el=1_x_3&enrichId=rgreq-d8060a1f113deac130fb96e0c7fe09da-XXX&enrichSource=Y292ZXJQYWdIOzMzNm4NzExNTtBUzo4MzQzMjY0NDcwMDU2OThAMTU3NTkzMzNDg5NA%3D%3D.

¹⁰⁶⁵ Meeting with CASA on 12 May 2020.

RPAS capability increases (including ensuring that data is transferrable into NSW RFS systems), the Inquiry encourages NAFC to include RPAS in the ARENA system.

Recommendation 51: That, in order to enhance NSW's ability to improve situational awareness, Government expand FRNSW's Remotely Piloted Aerial Systems (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.

5.5.5.10 Aerial fire fighting at night would provide an additional fire suppression tool

Given the extent to which fires continued to burn overnight during the 2019-20 season, it is apparent there is a need to explore other strategies that enable fire fighting to continue at night when conditions allow.

It is acknowledged that aerial fire fighting at night has the potential to enhance current fire fighting capability. It 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 fire fighting at night.¹⁰⁶⁶

The Inquiry acknowledges that the overnight extreme weather conditions experienced in the 2019-20 fire season (as discussed in Chapter 2) 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 also not conducive to aerial operations.

The NSW RFS commenced a night-time aerial operations trial during the 2016-17 fire 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 the Civil Aviation Safety Authority (CASA) requirements. The NSW RFS purchased NVD, and five NSW RFS aviation specialists were trained in their use.¹⁰⁶⁷ The NSW RFS advised the Inquiry that the results of the trial were not documented. Since that time, the NSW RFS has engaged an alternative aviation provider which includes NVD capability as part of contractual arrangements.

Emergency Management Victoria conducted a phased trial of aerial fire fighting at night in collaboration with the Civil Aviation Authority and NAFC during the 2017-18 and 2018-19 fire 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 fire fighting, 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.¹⁰⁶⁸ The NSW RFS advised the Inquiry that NSW RFS aviation personnel attended the Victorian trial and it continues to closely monitor the outcomes.

¹⁰⁶⁶ Australasian Fire and Emergency Service Authorities Council (AFAC), Submission to the Inquiry.

¹⁰⁶⁷ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 17 April 2020*.

¹⁰⁶⁸ EMV (Emergency Management Victoria). (2018). Night fire suppression back for this summer. Retrieved from <https://www.emv.vic.gov.au/news/night-fire-suppression-back-for-this-summer>.



Photo 5-6: Night fire fighting. Retrieved from <https://www.emv.vic.gov.au/news/night-fire-suppression-back-for-this-summer>.

Based on the trials conducted to date, and the need for expanded fire fighting capacity at night, the Inquiry supports a further trial of aerial fire fighting at night to ensure the NSW RFS has all available tools at its disposal where these are safe and appropriate to use. The Inquiry recommends the NSW RFS conduct a further aerial night-time fire fighting trial during the 2020/21 season, which should include:

- appropriate safety requirements (e.g. management of fatigue)
- quantifying the associated costs (e.g. the use of additional ground crews to support aerial operations)
- helicopter search and rescue (which was successfully deployed during the 2019-20 season using ADF aircraft crewed by NSW RFS personnel)
- an evaluation of trial outcomes, including a cost-benefit analysis.

The NSW RFS has advised its recent acquisition of a Bell 412 rotary wing aircraft could be used as part of this trial. Subject to the results of the trial, the Inquiry supports including night-time aerial fire fighting as a permanent fire suppression tool in future fire seasons.

Recommendation 52: That, in order to enhance NSW's fire fighting capacity, Government trial aerial fire fighting at night in the 2020-21 season with a view to full implementation if successful.

5.5.6 Fire retardant

Key points

- A record 24 million litres of fire retardant was used in the 2019-20 season and was an important part of fire fighting strategies.
- Based on the way in which fire retardant is applied by the RFS, the Inquiry found there are no significant health or environmental impacts associated with the retardants used by the RFS.
- In rare instances, the Inquiry heard that retardant was dropped on citizens and their properties, who were concerned about its impact on their personal health, or contaminated private water sources. The people affected were directed to multiple NSW Government agencies for advice on the health impacts, any mitigation action required and their eligibility for financial compensation, which proved difficult to navigate and is an area for improvement.

5.5.6.1 A significant amount of fire retardant was used during the 2019-20 season

Fire retardants are used to slow the spread or intensity of a fire. They help firefighters on the ground to control and contain a fire and may also be dropped from aircraft during fire fighting operations. Sometimes a red/pink coloured pigment, made from iron oxide, is added so that firefighters can see the area where retardant has been released. Fire retardants consist of “detergent chemicals made from a combination of wetting agents and foaming chemicals, fertilisers (ammonium and diammonium sulfate and ammonium phosphate) mixed with thickeners (guar gum) and corrosion inhibitors (for aircraft safety).”¹⁰⁶⁹ Fire retardants are mixed with water before they are used in fire fighting. After the water has completely evaporated, the remaining chemical residue prevents vegetation or other materials from igniting, until it is removed by rain or erosion. Fire retardants also work by binding to plant material (cellulose) and preventing combustion.

The NSW RFS used around 10 times the amount of retardant during the 2019-20 season than in the previous year (see table below), which is yet another indicator of the extraordinary nature of the season and the resources required. The NSW RFS advised the Inquiry that additional retardant was purchased due to the engagement of additional aircraft throughout the season; however, a large amount was unused. Fire retardant has an indefinite shelf life provided it is stored in an area where it will not be exposed to moisture, and the NSW RFS has stored the unused product for use over future seasons.

Financial year	Volume of retardant purchased (t) ¹⁰⁷⁰	Volume of retardant used (t)
2017-18	361 tonnes	266 tonnes
2018-19	340 tonnes	311 tonnes
2019-20	5,822 tonnes	3,000 tonnes

Table 5-2: Volume of fire retardant purchased and used from 2017-18 to 2019-20.¹⁰⁷¹

¹⁰⁶⁹ NSW Health. (2020). Fire retardants and private water sources. Retrieved from <https://www.health.nsw.gov.au/environment/factsheets/Factsheets/fire-retardants.pdf>.

¹⁰⁷⁰ One tonne is equivalent to approximately 8,000 litres.

¹⁰⁷¹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 22 June 2020*.



Photo 5-7: Fire retardant. Provided by NSW RFS 8 July 2020.

Retardant is currently sourced from overseas. However, given the high volume purchased by the NSW RFS and associated costs, the Inquiry considers it would be beneficial to produce fire retardant domestically if possible. The NSW RFS advised the Inquiry there is a current tender for retardant gels and foams closing later in 2020. This will provide an opportunity for Australian companies to supply retardant, and the NSW RFS advises a number of companies have expressed an interest in participating in the tender process.¹⁰⁷²

Queensland Fire and Emergency Services used large air tankers for waterbombing at Peregrine, Sarabah, Stanthorpe and Pechey in 2019 to great effect. The Inquiry understands that they did not use retardant in the 2019-20 season, and at time large air tankers were unavailable due to their use in NSW and Victoria. There were some instances where the LAT was bound for Queensland but was recalled to NSW. Earlier this year the Queensland Government secured its own large air tanker to ensure the availability of this asset during next season.¹⁰⁷³

5.5.6.2 No major environmental or health impacts of fire retardants were found

The only retardants endorsed for use in Australia by the National Aerial Firefighting Centre (NAFC) are those that have been tested and approved by the United States Department of Agriculture Forest Service (USDAFS) Wildland Fire Chemical System. The NSW RFS uses the USDAFS Specification 5100-304C *Long Term Retardant, Wildland Fire fighting* as a fire-retardant certification, and the specific retardant must be listed on the USDAFS Qualified Products List in order for the NSW RFS to purchase it.¹⁰⁷⁴ In addition, the NSW RFS advised it works with WaterNSW to ensure suppressants meet with its approval.¹⁰⁷⁵

The NSW RFS advised that its intention is to avoid dropping retardant within 100 metres of dams, creeks and rivers; however, this may be affected by wind or movement of the

¹⁰⁷² Ibid.

¹⁰⁷³ Queensland Government. (2020). Large Air Tanker secured to battle Queensland bushfires. Retrieved from <http://statements.qld.gov.au/Statement/2020/2/20/large-air-tanker-secured-to-battle-queensland-bushfires>.

¹⁰⁷⁴ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 22 June 2020*.

¹⁰⁷⁵ Ibid.

aircraft.¹⁰⁷⁶ On the impact of fire retardant on safe drinking water supply during the 2019-20 season, WaterNSW advised that:

*the RFS ensured the application of all fire fighting chemicals was tracked and recorded spatially. These records were shared with WaterNSW following the bush fires to enable it to manage any residual risks associated with these chemicals. While there were some minor issues receiving and using this data, this process was generally considered a success.*¹⁰⁷⁷

On the impact on human health, NSW Health advises that the fire retardants currently used in Australia are of low toxicity: "Testing shows these chemicals can produce minor irritant effects before they are mixed with water".¹⁰⁷⁸ The concentrated powder can cause minor respiratory irritation and the gels can irritate eyes and skin. When handling the powder, all workers are required to wear protective equipment including gloves, goggles and dust masks. However, NSW Health advises that "Risk assessments carried out in the United States and in Victoria demonstrated that the risk of health effects was very low, even to people who are accidentally exposed to the fire retardants during their application".¹⁰⁷⁹ NSW Health also advises that if fire retardant contaminates drinking water (e.g. if it enters a water tank), the water should not be used for drinking or food preparation.

At the request of the Inquiry, the NSW Environment Protection Authority (EPA) recently commissioned a rapid environmental assessment of fire-retardant products used by the NSW RFS (Phos-Check MVP-FX, Blazetamer 380 and Phos-Chek WD881A).¹⁰⁸⁰ The assessment found that:

- MVP-FX is similar to fertiliser, and the nutrients can have adverse or beneficial effects on soil or in water depending on the situation; the product also contains a range of metals/elements which were not predicted to be in soil at levels likely to result in environmental impacts, particularly at the expected application rates used by the NSW RFS
- Blazetamer contains hydrocarbon solvent and total nitrogen at levels that could result in concentrations in soil or water above guidelines; however, it is not expected that this product would have environmental effects
- WD881 was not expected to have significant environmental effects.

¹⁰⁷⁶ Ibid.

¹⁰⁷⁷ WaterNSW (2020). *Advice to the Inquiry provided 22 April 2020*.

¹⁰⁷⁸ NSW Health. (2020). Fire retardants and private water sources. Retrieved from <https://www.health.nsw.gov.au/environment/factsheets/Factsheets/fire-retardants.pdf>.

¹⁰⁷⁹ Ibid.

¹⁰⁸⁰ DPIE (Department of Planning, Industry and Environment). (2020). *Advice to the Inquiry provided 26 May 2020*.



Photo 5-8: Fire retardant. Source: Nick Moir, *The Sydney Morning Herald*.

Overall, the assessment commissioned by the EPA showed that, while some fire retardant products could have detrimental environmental impacts, these were only likely to occur if the application rates were a lot higher than those used by the NSW RFS (and which were considered to be unrealistic by the environmental risk analysts).

5.5.6.3 Clearer information is needed for people whose properties have been affected by retardant

The NSW RFS advised that the location and potential effect of retardants on farms, environmentally sensitive areas and nearby waterways are considered when aerial retardants are used. Where possible, retardants are only used as a last resort in these areas if there is no other suitable location. However, in some cases there were instances where farms and private properties were affected. The Inquiry was made aware of an organic garlic farm in Tenterfield which had fire retardant dropped directly on one of the property owners, as well as the property itself. The property owners subsequently dealt with a range of NSW government agencies in order to understand and access the range of assistance measures available.

The Inquiry reviewed a range of public-facing information about how people whose drinking water supplies and/or properties have been affected by fire retardant can understand the impacts of retardant and access assistance if needed. This information sits across at least three different government websites (Department of Primary Industries, Resilience NSW and NSW Health) and directs people to call different phone numbers for assistance.

The Inquiry understands the Bushfire Customer Care Service has now been established as a 'one-stop shop' for people requiring assistance (including those who have been affected by fire retardant), which is a positive step. However, this should also be supported by a similar repository of information online to provide clear written guidance on the support available and the associated eligibility criteria. In addition, clear information should be provided to

NSW RFS personnel on avenues for support to ensure correct and timely advice is provided to people affected by fire retardant, as the NSW RFS is often their first point of call.

The NSW RFS would also benefit from clearer information on where organic farms are located across NSW. The Inquiry suggests that the Department of Primary Industries (DPI) develops a data layer with this information and provides it to the NSW RFS for integration into NSW RFS mapping.

5.5.7 Access for wildlife care and rescue

This season saw an extremely high level of community interest in bush fire impacts on wildlife that created a ground swell of desire to help.¹⁰⁸¹



Photo 5-9: Injured wildlife. Provided by NSW RFS 8 July 2020; Anonymous, Submission to the Inquiry; Christina Grant McNaught, Submission to the Inquiry.

5.5.7.1 Training

The NSW RFS recommends that any non-fire fighting personnel who need access to an active fireground in the course of their duties should take the NSW RFS' 6-hour Bush Fire Awareness (BFA) Training course. This course is available to landowners, government agency staff, heavy plant operators, media representatives and essential services staff, as well as to animal welfare and rescue organisation personnel.

The BFA training is a base-level competency that provides people with sufficient knowledge to undertake their duties safely on a fireground. Once a person is assessed as BFA-competent, a credential is issued which is valid for a three-year period. Even if a person has the credential, the Incident Controller is ultimately in control of determining whether, when and where they may enter a fireground. The BFA course is currently not mandatory.

Key elements of the Bush Fire Awareness training include:¹⁰⁸²

- an appreciation of the key risks and related precautions on a fireground to improve the individual's understanding of instructions or directions given by fire fighting personnel
- improved understanding of the permission required to enter a fireground
- improved understanding of command and control on a fireground
- understanding of fireground communication
- training in safety on the fireground, protective clothing and equipment, survival techniques and fireground hazards.

¹⁰⁸¹ Australian Wildlife Society, Submission to the Inquiry.

¹⁰⁸² RFS (NSW Rural Fire Service). Bush Fire Awareness Training. Retrieved from https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0003/8805/Bush-Fire-Awareness-Brochure.pdf.

The Department of Planning, Industry and Environment (DPIE), which includes the NPWS, provides a variety of training, including an Animal Welfare Course, to its staff. The NSW RFS Bush Fire Awareness training is currently not part of that training program. The Inquiry recommends that DPIE works with the NSW RFS to incorporate the appropriate components of the BFA program into the existing Animal Welfare Course. This would benefit DPIE staff in fireground access.

5.5.7.2 NPWS licensing for national parks access to volunteers

Most animal welfare activities occur in national parks, and require NPWS permission to access as well as the Incident Controller's. Although it is possible for an individual person's entry to a fireground to be facilitated through the presentation of the BFA (accreditation) card, usually access to firegrounds for animal welfare volunteers in national parks is controlled by way of licensing of native wildlife rescue and rehabilitation organisations by the NPWS. The licences set out agreed protocols established with that organisation (e.g. the NSW Wildlife Rescue and Information Service, WIRES). Licensed organisations are responsible for the management of all their own personnel, including ensuring that they are suitably accredited to undertake the work and that the fireground safety requirements (protective clothing and equipment)¹⁰⁸³ are met prior to entry.¹⁰⁸⁴

The Inquiry was told that, before the 2019-20 fire season, the NPWS wrote to all licensed care/rescue groups advising of the protocols for access to firegrounds.¹⁰⁸⁵

5.5.7.3 Involvement of volunteers in hazard reduction

Licensed animal welfare organisations and individuals can become involved in hazard reduction in a variety of ways:

- undertaking rescue and care of wildlife that are found to be injured or in need of aid post a planned hazard reduction
- input of local knowledge at the local level about the location of specific animals prior to a hazard reduction, so that measures can be adopted to minimise harm to wildlife in consultation with the regulatory authority
- facilitating the assistance of veterinarians (if required) listed on the native animal vet directory maintained by the National Parks and Wildlife Service.¹⁰⁸⁶

Volunteers or wildlife carers require the consent of the landowner/manager to enter their land for hazard reduction. It is incumbent upon the welfare/rescue organisation to advise landholders about matters that will inform the giving of consent by the landholder, for example, activities to be carried out on the land, liabilities, privacy, record keeping and the release of any rehabilitated animals.

The Bush Fire Management Committees (BFMCs) also provides forums for key stakeholders to cooperate and resolve any issues about bush fire preparation and management. BFMC representation includes NPWS representatives.

¹⁰⁸³ Ibid.

¹⁰⁸⁴ Friends of the Koalas Inc., Submission to the Inquiry.

¹⁰⁸⁵ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 26 May 2020*.

¹⁰⁸⁶ Department of Planning, Industry and Environment. (2020). Help a sick or injured animal.

Retrieved from <https://www.environment.nsw.gov.au/topics/animals-and-plants/native-animals/sick-or-injured-animals>.

5.5.7.4 Involvement of volunteers during the bush fires

Despite the training and licensing regimes, the management of injured wildlife does not have a specific place within the Emergency Management Framework as it currently stands.

The Inquiry established that two temporary wildlife coordinator positions were established during the fire season at NPWS to work with combat agencies, Department of Primary Industries, Local Land Services and the sector to establish a framework for rescue and recovery of wildlife in emergency events covering all-natural disasters.¹⁰⁸⁷ There is also a significant investment by wildlife organisations in protective clothing, equipment and training to enable volunteers to perform a broad suite of rehabilitation work.

The Inquiry was also informed that a wildlife coordinator was included in the planning cell for an Incident Management Team on the South Coast and that a NPWS staff member was added to the Animal and Agriculture Services Functional Area (AASFA) State-wide coordination unit in Orange.¹⁰⁸⁸

Access to firegrounds (once safe) is controlled by Incident Management Teams. While there was an expectation that access would be facilitated for wildlife carers who are associated with authorised licensed animal welfare and rescue organisations, this did not always occur. This lack of agreed procedures within Incident Management Teams meant that at times access was clunky, poorly communicated and caused delays. The Inquiry was also provided with examples where access was facilitated well by NSW RFS and Forestry Corporation staff.¹⁰⁸⁹

The opportunity also exists for the development of a training package for firefighters on the management of wildlife in emergencies.

5.5.7.5 Use of paid vets

The Inquiry understands that each state has different arrangements in place for the paid deployment of vets in bush fires. Existing national guidelines for engagement of private vets cover emergency animal disease and not natural disasters. In natural disasters DPIE uses Local Land Service vets and has procedures in place to directly engage local vets, who have appropriate local connections to support immediate and longer-term recovery. Payment is made under the Agricultural and Animal Services Functional Area (AASFA) state agreement.

5.5.7.6 Vets Beyond Border (volunteers)

In 2016, Vets Beyond Borders (VBB) established a database (AVERT) to record the names of veterinary staff (vets/vet nurses) prepared to volunteer in a natural disaster. By 2020 it had grown to about 200 members. Because it had not actually been used since its establishment, when DPIE contacted VBB in January 2020 to request the assistance of volunteers, the active status of members was largely unknown. During the same period, VBB was overwhelmed by vets wishing to volunteer and the database grew to over 900 volunteers.¹⁰⁹⁰

The Inquiry recognises that Vets Beyond Borders has made changes since the fires to improve its database to ensure contact details are up to date and each volunteer has a

¹⁰⁸⁷ NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 26 May 2020*.

¹⁰⁸⁸ Ibid.

¹⁰⁸⁹ Friends of the Koalas Inc., Submission to the Inquiry.

¹⁰⁹⁰ Vets Beyond Borders. *Advice to the Inquiry provided 10 July 2020*.

checked list of skills-based qualifications (including insurance details, firearms licence, treatment and euthanasia of livestock and vaccinations). The database also has the functionality to sort according to categories. VBB has now established protocols for working with wildlife groups through the introduction of a task request form to allow a systematic and recordable approach to deploying volunteers. VBB also developed a darting protocol for volunteers and darters that has been approved by NPWS and the Vet Practitioners Board NSW.¹⁰⁹¹

The current NSW *Disaster Assistance Guidelines* enable the provision of emergency veterinary treatment for the care and safe keeping of pets and companion animals (including non-production animals such as horses) as well as for the humane care of animals.¹⁰⁹² However, there is a lack of detail as to what is included and excluded, and the document is silent on timeframes. For example, vets may be required to provide assistance to animals experiencing burns for an extended period, but there is a lack of clarity about the length of time the cost of that assistance would be met by government agencies.

Recommendation 53: That Government develop and implement a policy on injured wildlife response, rescue and rehabilitation including:

- a) a framework for the co-ordination and interaction with emergency management structures
- b) guidelines for Incident Management Plans to include wildlife rescue and rehabilitation as a consideration
- c) a requirement for all vets and wildlife rescue volunteers to obtain the Bush Fire Awareness accreditation
- d) guidance for firefighters on handling injured wildlife.

5.6 IMPACT ON CRITICAL INFRASTRUCTURE

Key points

- The Energy and Utility Services Functional Area Coordinator played a critical role during the season, coordinating communications between emergency response agencies and energy providers to reduce the impact of fires on power assets.
- Despite these actions, electricity networks were extensively affected by the fires, resulting in tens of thousands of people without power.
- The biggest consequence of power outages was the loss of communications, as communications towers lost power supply and appropriate backup systems were not in place. Lack of communications affected the community's ability to receive critical warnings and meant community members couldn't contact family and friends, which added to their distress.
- Limited access to real-time information from energy and telecommunications providers made it difficult for the NSW RFS to know where critical sites were located, and limited the NSW Telco Authority's ability to understand the status of network damage and outages.

¹⁰⁹¹ Ibid.

¹⁰⁹² Resilience NSW. (2015). NSW Disaster Assistance Guidelines, p 7. Retrieved from <https://www.emergency.nsw.gov.au/Documents/publications/guidelines/Guideline-NSW-Disaster-Assistance.pdf>.

The role of the Energy and Utility Services Functional Area Coordinator (EUSFAC) covers electricity supply, natural gas, liquid fuels, water supply and waste management. The team consists of four subject matter experts in the areas of electricity, gas, liquid fuels and water industries. The 2019-20 bush fire season stretched these resources.

The Telecommunications Services Functional Area (TELCOFA) is led by the Telecommunications Emergency Management Unit (TEMU) within the NSW Telco Authority. The TELCOFA “coordinates the response to significant and widespread telecommunications outages which may endanger the safety of the public or emergency responders”.¹⁰⁹³ The TEMU is co-located in the State Emergency Operations Centre and acts as a link between telecommunications carriers and emergency service organisations. It provides information on hazards to telecommunications carriers, and assists them to access critical infrastructure, for example by arranging air transport or NSW police, State Emergency Service or NSW RFS (or, under appropriate protocols, Australian Defence Force) escorts. Carriers, in turn, assist the TEMU with the deployment of emergency communication services and information on network outages caused by natural hazards.¹⁰⁹⁴

5.6.1.1 EUSFAC played a critical role during the 2019-20 season

The EUSFAC coordinated meetings between electricity distributors and emergency response agencies to increase situational awareness of all parties in areas such as:

- increases to Asset Protection Zones (APZs) (where possible)
- strategic backburning
- retardant drops (where possible)
- location of coal stockpiles (Mt Piper generator)
- coordinated protection of critical infrastructure.

These actions considerably reduced the impact of fire damage to the Upper Tumut Switching Station, Mt Piper and Murray power stations, TransGrid switching stations and other power assets.¹⁰⁹⁵

On 12 November 2019, Essential Energy informed the EUSFAC of the importance of the wood power pole supplier at Coffs Harbour. All three electricity distributors source their wood poles from this one source. With the Liberation Trail fire burning in the Coffs Harbour area, EUSFAC ensured priority was given to the protection of this site. As the fire season progressed, Endeavour Energy advised that the industry had initiated a NSW and Queensland stocktake of poles across Transgrid, Essential Energy, Ausgrid and Energy Qld to gain a collective view of availability, sizes, materials and need. This stocktake was then expanded nationally.¹⁰⁹⁶

Operational guidelines had been previously developed between the NSW RFS, EUSFAC, TransGrid, Ausgrid, Endeavour Energy and Essential Energy for energising/de-energising of power lines. These guidelines create a uniform procedure to assist operational decision making of all parties involved. The Inquiry was informed the Liberation Trail fire on

¹⁰⁹³ NSW State Telecommunications Services Functional Area. (2018). NSW Telecommunications Services Functional Area Supporting Plan (2018). Retrieved from <https://www.emergency.nsw.gov.au/Documents/plans/supporting-plans/Supporting-Plan-Telecommunications.PDF>.

¹⁰⁹⁴ NSW Telco Authority. (2020). *Advice to the Inquiry provided 16 April 2020*.

¹⁰⁹⁵ EUSFAC (Energy and Utility Services Functional Area Coordinator). (2020). *Advice to the Inquiry provided 30 April 2020*.

¹⁰⁹⁶ Endeavour Energy, Submission to the Inquiry.

16 November 2019 provided one of the first examples of successful use of the operational guidelines to de-energise the lines to undertake a backburn. Whilst there were initial challenges in ensuring that all involved understood the processes, as parties became more familiar with the guidelines, they became more efficient in the guidelines' use. Ultimately, they were used multiple times for transmission line outages over the 2019-20 season.

5.6.1.2 Electricity networks were extensively affected

The Inquiry heard that fires burned across more than 45% of Endeavour Energy's network supply area, and bush fires interrupted electricity supply to 54,000 of its customers between December and January, with 20,000 people left without power at the fire's peak over the New Year period, mainly on the South Coast.¹⁰⁹⁷ In the worst-affected areas, some customers were without power for up to 10 days. Essential Energy reported that over 104,000 of its customers were affected (including 4,700 life support customers) and over 3,200 power poles and 4,500 cross arm poles were damaged or destroyed.¹⁰⁹⁸

Energy providers on the whole responded quickly and en masse to remove and replace damaged equipment along their extensive networks. These efforts were recognised by local councils and the community as the following submissions to the Inquiry indicate:

*Essential Energy is to be commended for the speed of their response working long hours in hot, dusty, dirty and smoky conditions.*¹⁰⁹⁹

*Our local electricity distributor, Essential Energy capably responded to the natural disaster via the rapid deployment of crews who replaced hundreds of burnt poles and re-established electricity supplies within a relatively short period of time.*¹¹⁰⁰

The fire caused extensive damage to wooden power poles. Endeavour Energy reported to the Inquiry that 800 power poles were damaged or destroyed,¹¹⁰¹ and that its standing practice is to replace burned wooden poles with concrete or steel poles. However, due to the significant damage caused and the three-week lead time to order (due to concrete curing), supplies of certain sizes of concrete/steel poles were exhausted in some areas. To expedite prompt restoration of services, Endeavour Energy replaced only 40% of its wooden poles with steel or concrete poles, with the remainder replaced by wood. Essential Energy, as stated above, had over 3,200 power poles and 4,500 cross arm poles damaged or destroyed. Essential Energy is reviewing its use of composite poles;¹¹⁰² however, these are a lot more expensive.

The Inquiry heard that along the Queensland-NSW interconnector (QNI) a number of power poles are timber. Whilst a number of these were threatened during the 2019-20 bush fire season, no major damage was caused. The QNI is a vital asset and should be made more resilient through the replacement of the timber poles with suitable alternatives that are more fire resistant.

¹⁰⁹⁷ Ibid.

¹⁰⁹⁸ Essential Energy, Submission to the Inquiry.

¹⁰⁹⁹ Greater Hume Council, Submission to the Inquiry.

¹¹⁰⁰ Nambucca Valley Council, Submission to the Inquiry.

¹¹⁰¹ Endeavour Energy, Submission to the Inquiry.

¹¹⁰² The composite power pole is constructed from Epoxy Vinyl Ester Resin giving it resistance to Caustic Alkalis, Hypochlorite Bleaching Chemicals and high temperatures and termites.

Disruption to electricity transmission and distribution networks was caused by more than damage to power poles. Serious damage was also caused to pole-mounted substation sites, and hundreds of kilometres of overhead high voltage powerlines affecting thousands of customers throughout the bush fire season.

5.6.1.3 Power outages led to loss of communications

As discussed in Chapter 4, the biggest consequence of power outages was the loss of communications, as most telecommunication towers are connected to electricity by transmission lines.

NSW had 818 telecommunication facilities affected by the bush fires. Facilities included mobile and fixed-wireless base-stations, nodes, exchanges, equipment shelters, and copper and optical fibre cables. Of these facilities:

- 514 had outages of four hours or more
- 169 facilities had outages of less than four hours (noting information on this indicator was only received from three of the four carriers)
- 108 facilities had no outages.¹¹⁰³

The Australian Communications and Media Authority noted that the affected facilities with no outages were supported by backup power until the mains power was restored.¹¹⁰⁴ The peak of outages greater than four hours in NSW occurred over New Year from the impact of the Currowan and Green Valley bush fires.¹¹⁰⁵

Across Australia there was a total of 908 outage incidents of four hours or more during the review period of 19 December 2019 to 31 January 2020. NSW had the highest number of outage incidents for both mobile and fixed-line facilities, with 434 fixed line outages (85% of all fixed-line outages) and 214 mobile outages (66% of all fixed-line outages).¹¹⁰⁶

¹¹⁰³ ACMA (Australian Communications and Media Authority). (2020). Impacts of the 2019–20 bushfires on the telecommunications network: Report for the Minister for Communications, Cyber Safety and the Arts. Retrieved from <https://www.acma.gov.au/publications/2020-04/report/impacts-2019-20-bushfires-telecommunications-network>.

¹¹⁰⁴ Ibid.

¹¹⁰⁵ Ibid.

¹¹⁰⁶ Ibid.

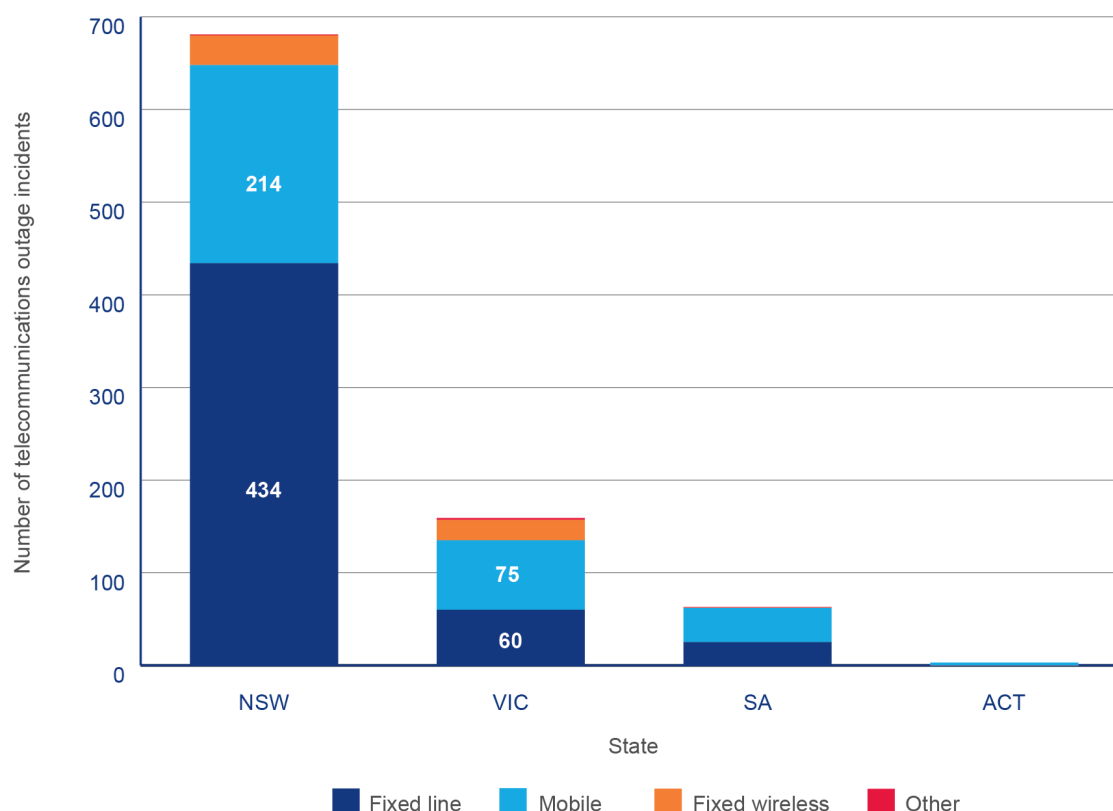


Figure 5-5: Number of telecommunication outage incidents, by state and network type.¹¹⁰⁷

In its submission to the Inquiry, Telstra stated a number of fixed line and mobile network facilities experienced outages of greater than four hours between 19 December 2019 and 31 January 2020:

Network Type			
State	Fixed line	Mobile	Total
NSW	171	65	236
SA	23	11	34
VIC	39	65	74
Total	233	111	344

Table 5-3: Telstra Network facilities that experienced one or more fire-related outages of greater than 4 hours between 19 Dec 2019 and 31 Jan 2020.¹¹⁰⁸

Power loss was responsible for over 85% of Telstra network facility outages, and fire damage caused 1.4% of Telstra network outages. While Telstra stated that 21,800 fixed line customers were affected by the outages, it was not possible for it reliably to determine coverage loss for mobile customers.¹¹⁰⁹ Optus, Vodafone and the NBN did not make submissions to the Inquiry on this issue.

¹¹⁰⁷ Ibid.

¹¹⁰⁸ Telstra, Submission to the Inquiry.

¹¹⁰⁹ Ibid.

The fires also meant that road and facility access was often restricted or limited due to continued fire activities and the threat of fallen trees. Without access roads, telecommunications carriers are unable to assess damage, undertake necessary remediation or restoration activities, or deploy temporary facilities. Carriers worked with emergency service organisations to gain access as soon as it was safe to do so.

The Inquiry received numerous examples of backup systems not being in place, and people in bush fire zones being left without critical services for unacceptable periods of time.

*It is recognised that Telstra were unable to restore fixed line telephones until electricity was restored to Exchanges however this left the community very vulnerable. No electricity, no fixed or mobile phones, internet connectivity and very limited radio coverage. The community was disappointed with the response times from Telstra and whilst a key mobile phone base station has been rebuilt it is providing a significantly reduced service and coverage four months after the fire was contained.*¹¹¹⁰

*The break down in power and telecommunications systems created huge stress and uncertainty for the community and in turn placed undue responsibility and stress on a very small volunteer brigade already dealing with a multitude of issue.*¹¹¹¹

*The loss of power and telecommunications (phone, ABC radio and television) resulted in difficulty communicating with segments of the community for specific periods of time. It is evident that the general population is now dependent on these forms of communication.*¹¹¹²

In the telecommunications domain, good examples of backup that worked were when carriers provided generators (93%) and deployed temporary facilities such as Satellite Cells on Wheels (SATCOWs), Cells on Wheels (COWs) (2.5%)¹¹¹³ and 4G small cells.¹¹¹⁴ NBN Co deployed some fixed satellite services on a temporary and semi-permanent basis across NSW bush fire affected areas. Specifically, for the South Coast, NBN Co deployed satellite trucks (known as the NBN Road Muster trucks) to Batemans Bay on 2 January 2020, which provided service for the recovery and evacuation centres. For areas such as Cobargo and Malua Bay, NBN Co worked with the local emergency response coordinators to provide and install satellite dishes at evacuation and relief centres to provide free Wi-Fi.¹¹¹⁵ The Inquiry heard feedback from the community that the provision of backup communications by the telecommunications carriers was greatly appreciated.

¹¹¹⁰ Greater Hume Council, Submission to the Inquiry.

¹¹¹¹ Tilba District Chamber of Commerce Inc., Submission to the Inquiry.

¹¹¹² Eurobodalla Shire Council, Submission to the Inquiry.

¹¹¹³ ACMA (Australian Communications and Media Authority). (2020). Impacts of the 2019–20 bushfires on the telecommunications network: Report for the Minister for Communications, Cyber Safety and the Arts. Retrieved from <https://www.acma.gov.au/publications/2020-04/report/impacts-2019-20-bushfires-telecommunications-network>.

¹¹¹⁴ Telstra, Submission to the Inquiry; ACMA (Australian Communications and Media Authority). (2020). Impacts of the 2019–20 bushfires on the telecommunications network: Report for the Minister for Communications, Cyber Safety and the Arts. Retrieved from <https://www.acma.gov.au/publications/2020-04/report/impacts-2019-20-bushfires-telecommunications-network>.

¹¹¹⁵ Meeting with NBN on 2 June 2020.

5.6.1.4 Access to real-time information from energy and telco providers was an issue

The Inquiry was informed that the EUSFAC was not supplied with the details/maps of areas affected, timeframes without power, numbers/timeframes for reconnection and data on reconnection for the 2019-20 season. This highlights discussion previously in Chapter 4 about the importance of access to information on critical infrastructure. As a result, EUSFAC developed its own mapping website (via publicly available information) but it lacked the level of detail required for distribution networks for electricity, water and gas.

Access to information about telecommunications and other critical infrastructures sites is an ongoing issue which again presented in the recent bush fires. The Inquiry heard that information about telco carrier sites was not provided quickly enough to the State Operations Centre and to TEMU, and the TEMU struggled to gain accurate and timely information about outages and damage from the telco carriers to support the response and recovery efforts. This is despite telco carriers reporting continual network monitoring through use of manual and automated diagnostic systems.¹¹¹⁶ As discussed in Chapter 4, under NSW legislation there is no power to compel or direct telco carriers to provide outage data. The NSW Telco Authority reported TEMU was required manually to plot carrier critical infrastructure but did not have the resources to map the widespread outages and damage of these services.¹¹¹⁷ At the time of writing, the NSW Telco Authority indicated to the Inquiry that it had not received the data requested from the carriers, including information on their priority sites.¹¹¹⁸

The TEMU model for delivery of service during the fires proved invaluable to the support and protection of telecommunications infrastructure. There were no representatives of telecommunications carriers present at the State Operations Centre, nor does the Inquiry support them being present. The TEMU is the conduit for the carriers into the State Operations Centre and it is a model that works well under the legislation. This is supported by a statement from the Communications Alliance and the Australian Mobile Telecommunications Association:¹¹¹⁹

Most service providers found that the model of interaction with NSW stakeholders was effective. The Telecommunication Emergency Management Unit (TEMU) is a section within the NSW Telco Authority. The TEMU maintains a professional relationship with all key stakeholders and provides operational updates to the carriers during emergency situations. The TEMU also facilitates and coordinates site access for carriers by way of RFS escorts.

The Telecommunication Emergency Management Unit model should be considered Australia wide to increase consistency in all states and territories through the introduction of standards, guidelines and an operating model that is led by the Commonwealth.

5.6.1.5 Mobile generators are critical to resilience but there are supply challenges

The Inquiry heard that mobile generators, typically powered by diesel engines, have been long identified as a critical component for business resilience during power outages. The

¹¹¹⁶ Telstra, Submission to the Inquiry.

¹¹¹⁷ NSW Telco Authority. (2020). *Advice to the Inquiry provided 16 April 2020*.

¹¹¹⁸ NSW Telco Authority. (2020) *Advice to the Inquiry provided 17 July 2020*.

¹¹¹⁹ Communications Alliance and the Australian Mobile Telecommunications Association. (2020). Joint Submission to the Royal Commission into National Natural Disaster Arrangements. Retrieved from https://www.commsalliance.com.au/_data/assets/pdf_file/0009/69687/200417_CA-AMTA-submission_Royal-Comm.-National-Natural-Disaster-Arrangements_SUBMITTED.pdf.

2019-20 bush fire season identified the following matters which affected the emergency deployment of generators:

- appropriate sizing of the alternate power source and equipment, rated in accordance with anticipated load
- safe ongoing availability of access for delivery and refuelling to sites
- the need for technical support to install generators.

The 2019-20 bush fire season saw a high number of both commercial and government agency requests for mobile generators. There is a limited supply of generators available via commercial means and a limited number readily available from electricity network businesses. Mobile generators are coordinated by the Engineering Services Functional Area (ESFA) using private suppliers. The State-level exercise undertaken by the State Emergency Management Committee in 2018 resulted in the ESFA being provided with a list of all commercial suppliers of generators.

The Inquiry noted there is a challenge in supplying generators, with competing priorities, for the purposes of business continuity, network service providers restoring power to customers, and the role of government in providing backup power to private businesses. The Telco Authority informed the Inquiry of similar issues with generators, backup power supply and refuelling generators, noting that support from the Australian Defence Force became invaluable for refuelling generators and related activities.¹¹²⁰ The Inquiry found that there was limited coordination and establishment of a priority process for deployment and ongoing support.

A State-wide mobile asset inventory and deployment strategy would allow for faster response to loss of coverage in an economically efficient manner across the whole telecommunications industry. This could include generators, mobile cells and prebuilt shelters. This will help identify the gap in mobile assets required considering that the telecommunications network within NSW will be growing through programs such as the Critical Communications Enhancement Program (CCEP) and the Mobile Black Spot Program discussed later in this Chapter.

Recommendation 54: That, to ensure mobile generators are sourced and distributed on a priority basis during natural disasters, the EUSFAC work with the NSW Telco Authority, relevant NSW government agencies and commercial stakeholders to develop a mobile asset deployment strategy. The strategy should reduce duplication in purchasing, maintaining and housing mobile generators and improve agility in deployment.

5.6.1.6 Liquid fuel supply was restricted in some areas

The oil companies across NSW operate independently and rely on their own supply chain. EUSFAC worked closely with fuel companies to ensure fuel supply to bush fire affected areas (North Coast, South Coast, Snowy regions of NSW and Mallacoota in Victoria). The impact of tourists on the South Coast meant that, during evacuation, fuel was difficult to source as power was out and service stations had limited ability to pump fuel to the bowser. The EUSFAC coordinated delivery of a generator (and installation technician) to the Caltex service station in North Batemans Bay to ensure enough fuel was available for departing tourists. The 2018 State-level exercise identified this as a major issue should power be lost,

¹¹²⁰ NSW Telco Authority. (2020). *Advice to the Inquiry provided 16 April 2020*.

and made a number of recommendations about generators (for fuel and EFTPOS) and designated petrol stations for emergency services vehicles.

Road closures in many areas did result in some products running low, some petrol stations being unable to supply fuel due to power outages, and some sites voluntarily reserving fuel for emergency service vehicles until restocking occurred. Volume limits were also placed on customers to ensure that everyone had access to fuel. Overall, the Inquiry found that fuel companies have a good awareness of stock levels, re-stocking options and emergency services requirements. While it is possible for the NSW Government to declare a State liquid fuel emergency if there is an actual or likely fuel shortage with State implications,¹¹²¹ this was not required during the 2019-20 season.

5.6.1.7 Some Public Safety Network (PSN) sites were affected

Radio communication sites under the PSN are governed by a NSW Telco Authority bush fire risk management framework. This framework includes a broad review of risk assessment and treatments during the planning, design and operational phases. In the 2019-20 bush fires, 15 PSN sites and around 40 emergency services organisations and NPWS sites were damaged.¹¹²² Strengthening government telecommunications sites' resistance to extreme conditions and consideration of site designs will be particularly important with the planned increase in PSN sites under the Critical Communications Enhancement Program (CCEP – discussed later in this Chapter). The telecommunications sites' resistance to extreme conditions is increased through site modifications such as increased Asset Protection Zones, power autonomy and backup, as discussed in Chapter 4.

5.6.1.8 There were limited impacts on water infrastructure

During the bush fires, some water infrastructure was affected. As a result a number of regional water supply schemes issued boil water notices due to power loss or the addition of untreated water to the networks to maintain fire fighting supply.

In January, residents of Eden and Boydtown were advised to boil water for a few days due to power loss to chlorination facilities for Ben Boyd Dam. Residents of Bemboka, Quaama, Cobargo, Bermagui, Beauty Point, Fairhaven, Wallaga Lake, Wallaga Lake Heights, Wallaga Lake Koori Village and Akolele were also advised to boil water due to fire impacts to water treatment infrastructure.¹¹²³

Particular impacts on water infrastructure included:

- Ben Boyd Dam (Bega Valley): A bush fire fighting helicopter force-landed in the dam, one of the supply dams for the Bega Valley Shire Council's Tantawangalo-Kiah supply system. The pilot was uninjured; however, the fuel tank was full, causing council to isolate the dam to prevent it being used to supply the system. Localised booms were put in place until the helicopter was removed.
- water reservoir failure (Cooma): The Snowy 1 reservoir suffered a catastrophic failure on 4 January 2020, with 0.5 ML of water lost, resulting in serious water damage to one property and minor damage to others. The concrete reservoir had been decommissioned several years previously, but was being recommissioned temporarily to provide additional storage for anticipated extreme water demands.

¹¹²¹ Section 26, *Energy and Utilities Administration Act 1987*.

¹¹²² NSW Telco Authority. (2020). *Advice to the Inquiry provided 16 April 2020*.

¹¹²³ Bega Valley Shire Council (2019). Boil water notice - Brogo Bermagui supply. Retrieved from https://begavalley.nsw.gov.au/cp_themes/default/page.asp?p=DOC-ZDJ-77-62-43.

- private rainwater tanks: The bush fires resulted in a lot of ash and debris in private rainwater tanks. These 'contaminants' were considered unlikely to cause a health risk, but did affect water appearance and taste. As a result, NSW Health provided factsheets on rainwater tanks and bush fires to affected households.¹¹²⁴

Overall, water treatment infrastructure across the State fared well given the extent and severity of the fires. This was due to a combination of preparation efforts and most water assets being located in one spot, either next to a town or water storage.

5.6.1.9 Sewage treatment works

In the 2019-20 fires the Environment Protection Authority (EPA) identified 11 sewage treatment plants that were directly within a fire affected area (Boydton, Cobargo, Batemans Bay, Tomakin, Conjola, Cabramurra, Batlow, Talbingo, Tumbarumba, Adelong and Bundanoon) and an additional four sewage treatment plants which were very close to fire (Braidwood, Sussex Inlet, Adaminaby and Tumut).

Interrupted power supply on the South Coast resulted in minor discharges from several pumping stations. The EPA advised the Inquiry that council operators were proactive in positioning mobile generators to ensure pumping and treatment continued wherever possible to prevent overflows. The EPA also noted that, while detailed information was limited due to power outages affecting telemetry systems, any impacts were very likely to have been minor or negligible.¹¹²⁵

Additionally, on the South Coast for example, the inflows to sewage treatment plants were significantly reduced due to the number of tourists who followed evacuation orders. As a result, any water quality impacts of uncontrolled sewage overflows from power outages were minimal.

While some sewage treatment plants suffered damage – e.g. Conjola Regional Sewage Scheme had two sewage pumping stations burned and its electrical system damaged but this was quickly repaired – overall, all licensed sewage treatment plants remained operational during the bush fires.

¹¹²⁴ NSW Health. (2020). Rainwater and bushfires. Retrieved from <https://www.health.nsw.gov.au/environment/water/Pages/rainwater-bushfires.aspx>.

¹¹²⁵ EPA (Environment Protection Authority). (2020). *Advice to the Inquiry provided 8 July 2020*.

5.7 ENABLING SYSTEMS AND INFRASTRUCTURE

5.7.1 Communication systems

Key points

- Fire authorities had trouble communicating with each other on the fireground, as current systems across NSW fire authorities are not as interoperable as they should be. Different agencies had different levels of intelligence as data was unable to be easily shared across systems, and there were challenges tracking equipment across the fireground.
- In the short term, the Inquiry recommends the Government ensure all NSW fire authorities can access and use the Public Safety Network (PSN), including the RFS' Private Mobile Radio network in areas where the PSN isn't available, and prioritise expanding PSN coverage across the state.
- There were also difficulties in fireground communication across borders, which highlighted the need for agreed protocols that are clearly communicated and understood by NSW and inter-state crews.
- The 2019-20 season highlighted the importance of a Public Safety Mobile Broadband network to enable real time sharing of visual and location data. This would enhance response time and capability, and support cross-border cooperation during future bush fire events.

5.7.1.1 Telecommunications services are critical for emergency services

Telecommunications services are critical for emergency services organisations to be able to deliver effective and well-coordinated response activities, in addition to being critical for the community's needs during a bush fire, further discussed later in this Chapter.

The 2019-2020 bush fires placed exceptional demands on emergency service organisations and highlighted the importance of technological capability for managing large-scale, multi-agency and cross-border emergency incidents, in addition to planned events and business-as-usual operations.

In NSW the Telco Authority is responsible for leading sector-wide reforms and identifying, developing, procuring and delivering government operational communication services.¹¹²⁶ This includes management of the NSW Public Safety Network (PSN) that provides radio communications for emergency services and government agencies.

5.7.1.2 Gaps in access and coverage of the Public Safety Network hampered communications

The main interagency communications platform used by NSW emergency service organisations (ESOs) for operations is the Public Safety Network (PSN), formally known as the NSW Government Radio Network (GRN).¹¹²⁷ The PSN provides a 'mission critical' grade mobile radio platform availability for five ESOs and 48 other government, utility and emergency purpose clients.¹¹²⁸ This equates to approximately 50,000 radio users. Currently,

¹¹²⁶ NSW Telco Authority. About Us. Retrieved from <https://www.telco.nsw.gov.au/content/about-us>.

¹¹²⁷ NSW Telco Authority. (2020). *Advice to the Inquiry provided 16 April 2020*.

¹¹²⁸ NSW Telco Authority. Critical Communications Enhancement Program (CCEP). Retrieved from <https://www.telco.nsw.gov.au/ccep/ccep-home>.

the PSN covers around one-third of NSW, including the Sydney Basin and adjacent areas, and approximately 80% of the NSW population.¹¹²⁹

The PSN allows for interoperability between ESOs via the use of shared radio channels known as 'Emergency Service Organisation' or 'Government Liaison' programmed into FRNSW, NSW RFS, State Emergency Service and NSW Ambulance radios. Some NSW Police Force and Forestry Corporation of NSW radios also have these shared channels fitted. These channels can only be used in areas where there is PSN coverage.¹¹³⁰ PSN is typically used for upper level command and control purposes.

The Inquiry found there are several issues with PSN in the bush fire context, including:

- in areas not covered by the PSN, agencies rely on their own Private Mobile Radio (PMR) networks for wide area communications and there are limited capabilities for wide area shared radio channels to be established between agencies
- although radio communication systems are mature and reliable, they do not support heavy data traffic and web-based applications, including visual/data streaming
- despite work to provide connectivity between the PSN and the Queensland Government Wireless Network, there is no multi-state interoperability for wide area communications, and NSW radio must be physically fitted to interstate metropolitan fire fighting vehicles when they arrive in NSW¹¹³¹
- prior to the commencement of the Critical Communications Enhancement Program (CCEP), it was estimated that 65% of existing NSW government radio communication assets would reach, or would be nearing, their end of life by 2020.¹¹³²

The Inquiry heard there were PSN coverage issues on the North Coast as interim 'fixes' were put in place, the network was partially activated and agencies had to largely rely on their individual PMR networks. A lack of deployable equipment and the vast and mountainous geography of the areas involved meant it was not always possible to establish effective communications networks. This meant that fire agencies deployed communication specialists to use deployable radio repeater equipment to attempt to create 'on the run' interoperability networks to allow for tactical communications between agencies. In areas where interoperable networks could not be established, some emergency service organisation units were relying on mobile phones and satellite telephones, which was often ineffective.¹¹³³

Recommendation 55: That, in order to improve fireground communications between NSW agencies and interstate personnel:

- a) Government ensure all NSW fire authority personnel and vehicles can access and utilise the Public Safety Network (PSN). This should include access to NSW RFS Private Mobile Radio networks where PSN coverage is not yet available.
- b) the NSW Telco Authority review cross-border communications availability and planning and advise NSW fire authorities on next steps to enable multi-state interoperability for wide area communications.

¹¹²⁹ NSW Telco Authority. Government Radio Network. Retrieved from <https://www.telco.nsw.gov.au/content/government-radio-network-grn>.

¹¹³⁰ FRNSW (Fire and Rescue NSW). (2020). *Advice to the Inquiry provided 7 May 2020*.

¹¹³¹ Ibid.

¹¹³² NSW Telco Authority. Critical Communications Enhancement Program (CCEP). Retrieved from <https://www.telco.nsw.gov.au/ccep/ccep-home>.

¹¹³³ FRNSW (Fire and Rescue NSW). (2020). *Advice to the Inquiry provided 7 May 2020*.

5.7.1.3 The SEOC currently relies on other organisations for access to the PSN

The State Emergency Operations Centre (SEOC) currently does not have its own independent PSN capability due to a lack of technical hardware (handsets, base stations etc.) and no assigned talk groups or service subscriptions. If necessary, the SEOC can be supported by the ESOs or functional areas which have this capability, but this does not provide access to the PSN or any centralised State-level talk groups for operational communication coordination across the functional areas. If carrier communication services become unavailable, the Inquiry does not consider it sustainable for the SEOC to rely on another facility or organisation to provide radio comms support. It should maintain its own access to the PSN.

The report of Exercise Lumen Tenebris, a joint State Emergency Management Committee/(then) Department of Planning and Environment exercise conducted in 2018, made recommendations about the SEOC and PSN ability. The Inquiry understands that Resilience NSW is trialling radio handsets on the PSN while the NSW Telco Authority facilitates its adoption of PSN services.

Recommendation 56: That, in order to ensure the State Emergency Operations Centre (SEOC) can maintain communications during emergencies, the Government provide the SEOC with independent Public Safety Network functionality.

5.7.1.4 The Inquiry supports expanding PSN as a priority

The Critical Communications Enhancement Program (CCEP) under the NSW Telco Authority is expanding the PSN to increase land coverage from less than 35% to 85% of NSW, and to cover 98% of the NSW population.¹¹³⁴ The expansion will allow emergency service organisations to migrate from their separate radio networks onto a single, interoperable radio network for both mission critical and day-to-day operational communications.¹¹³⁵

In addition to reducing duplication of radio infrastructure and operating costs, the expanded PSN will enable contiguous coverage along and within large geographic areas and roads, and larger, cross-agency and coordinated responses to localised emergency events. CCEP will enable a single network, allowing ESOs to communicate with each other through specific talk groups. The Inquiry heard that in the recent fire season the expansion enabled a small number of new radio sites to be brought online in time (ahead of the CCEP schedule) to provide radio coverage in some of the fire areas, for example, in Glen Innes and surrounds.¹¹³⁶

Agencies advised the Inquiry they have implemented supplementary strategies to improve access to PSN. For example, the NSW Telco Authority deployed a small number of Mobile Radio Assets (also known as PSN Cells on Wheels, or CoWs) which provided infill PSN radio coverage in areas where the network did not provide coverage. The authority has also been working with fire agencies to trial equipment enabling access to the PSN from outside normal coverage areas via mobile telephone and satellite networks. During the 2019-20 fire season a number of fire agency vehicles on the NSW North and South Coast used satellite

¹¹³⁴ NSW Telco Authority. (2020). *Advice to the Inquiry provided 16 April 2020*.

¹¹³⁵ NSW Telco Authority. Critical Communications Enhancement Program (CCEP). Retrieved from <https://www.telco.nsw.gov.au/ccep/ccep-home>.

¹¹³⁶ FRNSW (Fire and Rescue NSW). (2020). *Advice to the Inquiry provided 7 May 2020*.

radio equipment to communicate back to FRNSW communication centres in areas where PSN was not yet established. The 2019-20 fire season also saw the PSN network affected in 15 areas (50% through the loss of power).

In March 2020 the NSW Government committed additional capital funding of \$217 million in 2021-22 to enable the fastest and most cost-effective completion of the next stage of the CCEP.¹¹³⁷ Completion of the full State CCEP will be subject to a final business case to be developed during 2020-21.

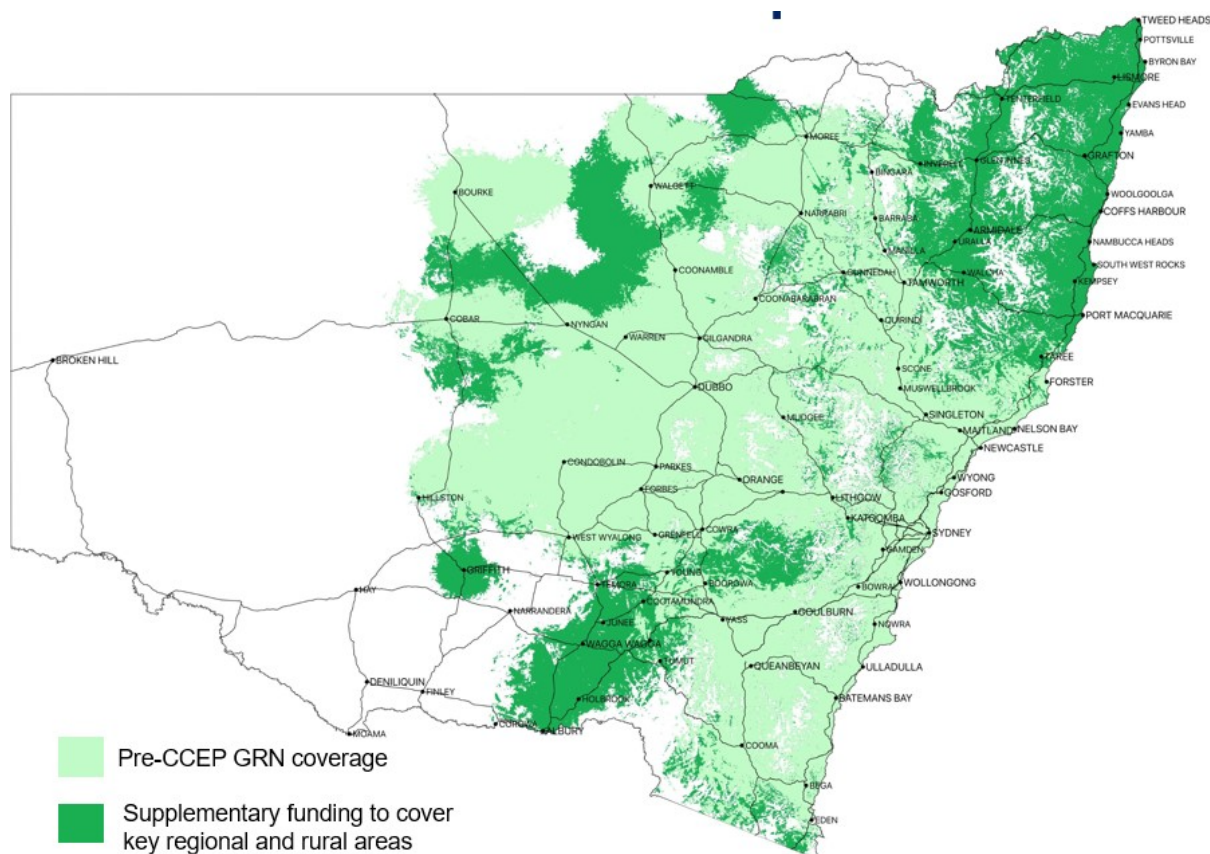


Figure 5-6: NSW Public Safety Network coverage map, pre- and post- the Critical Communications Enhancement Program.¹¹³⁸

The Inquiry endorses the continued funding and completion of the CCEP as an immediate priority to enable an effective operational response by ESOs and, pending development and implementation of Public Safety Mobile Broadband, a more sophisticated mission-critical data transfer and communications system that will promote interoperability for NSW agencies and across borders.

5.7.1.5 Public Safety Mobile Broadband (PSMB) would provide a robust and sophisticated solution

A 2015 Research Report by the Productivity Commission found that:

¹¹³⁷ NSW Telco Authority. (2020). \$217 million funding boost for emergency communications. Retrieved from <https://www.telco.nsw.gov.au/content/217-million-funding-boost-emergency-communications>.

¹¹³⁸ NSW Telco Authority. (2020). *Advice to the Inquiry provided 16 April 2020*.

*the land mobile radio networks used by Public Safety Agencies are reliable and have extensive geographic coverage (for voice only). However, they only support low-speed data applications, and they lack technical interoperability. This can prevent PSAs from communicating with one another and means that radio equipment does not work upon crossing jurisdictional borders (Finding 2.1).*¹¹³⁹

The Commission also noted “mobile broadband use has been modest due to concerns that the quality of commercial services is insufficient to support ‘mission critical’ operations”.¹¹⁴⁰ This view was supported by NSW government agencies, which noted that heavy reliance on commercial spectrum in the recent bush fire season could have been ineffective and potentially put lives and property at risk, given that commercial network infrastructure was impacted or destroyed in some areas.¹¹⁴¹

A dedicated Public Safety Mobile Broadband (PSMB) network would greatly improve agencies’ data transfer and communications capability in future disasters, and reduce their exposure to extreme congestion and network failure on consumer-grade commercial mobile broadband networks. Unlike the PSN, which communicates voice data only, PSMB also would enable the ‘real time’, reliable and secure transfer of visual and location data and greatly expand the options for communication. Images and video of people, places and incidents could be streamed live to and from the field, enhancing response time and capability. Achieving an interoperable PSMB capability will support cross-border cooperation between public safety agencies during large-scale cross-border disaster and bring Australia in line with international jurisdictions such as the US and UK, which already have this capability.¹¹⁴²

Through the auspices of (the then) Council of Australian Governments (COAG), all Australian jurisdictions agreed in 2018 to participate in the development of a national PSMB capability, led by a multi-jurisdictional PSMB Senior Officials Committee. A national project to develop PSMB is awaiting the outcome of a proof of concept request for proposal. The PSMB National Project Management Office (NPMO), which has been hosted by NSW and is responsible for delivering workstreams under the national PSMB Strategic Roadmap, is in transition to centralised coordination under the Commonwealth. The Inquiry understands that funding arrangements for the NPMO and the proof of concept are not resolved between the jurisdictions, and that this is required for the national PSMB program to proceed. As a national capability, states and territories believe the Commonwealth should make a significant financial investment to enable the urgent delivery of the program. States and territories are in ongoing negotiations with the Commonwealth Government on the allocation of dedicated spectrum for PSMB. The Commonwealth has set aside 5 + 5 MHz of spectrum for PSMB and offered this allocation to states and territories at below market value.

However, NSW agencies advised the Inquiry that this allocation is only sufficient for business-as-usual public safety activities and would require heavy reliance on

¹¹³⁹ Productivity Commission. (2015). Public Safety Mobile Broadband, Research Report, p 33. Retrieved from <https://www.pc.gov.au/inquiries/completed/public-safety-mobile-broadband/report/public-safety-mobile-broadband.pdf>.

¹¹⁴⁰ Ibid.

¹¹⁴¹ NSW Telco Authority. (2020). *Advice to the Inquiry provided 16 April 2020*.

¹¹⁴² COAG (Council of Australian Governments). (2018). Public Safety Mobile Broadband Strategic Roadmap. Retrieved from <https://www.coag.gov.au/sites/default/files/communique/public-safety-mobile-broadband-strategic-roadmap.pdf>.

supplementation from commercial spectrum. NSW agencies support provision of 10 + 10 MHz of dedicated spectrum to reduce reliance on carrier spectrum and allow for streaming of real-time data from multiple, concurrent sources.¹¹⁴³ In addition, given that the PSMB is solely for communications that support community protection and safety, the dedicated spectrum should be provided at no cost to states and territories. This would align with the Commonwealth's greater responsibility for leading national PSMB development, including its agencies' future use of the PSMB capability in each state and territory, and establishing the capability as soon as is practicable.

Recommendation 57: That, in order to ensure emergency response agencies can communicate across state and territory borders, the Commonwealth Government allocate 10 + 10 MHz as a dedicated spectrum for Public Safety Mobile Broadband (PSMB) at no cost to states and territories.

5.7.1.6 Further clarity on inter-agency and cross-border fireground communications is needed

In addition to the PSN and PMR area communications networks discussed above, fire agencies use local point-to-point radio communications known as 'fireground' radio. Fireground radio is relatively short range and relies on direct messages from radio to radio rather than via a network.

Emergency service agencies use different radio systems for strategic and tactical fireground communications. Whilst NSW RFS, the NSW Police Force, NPWS and Forests Corporation NSW use Very High Frequency (VHF) radio terminals on the fireground (tactical), until recently FRNSW only used Ultra High Frequency (UHF) radio terminals. The use of differing radio systems is often desirable, due to the differing performance of radio spectrum frequencies in different conditions, and the need to maintain separation between control and tactical teams and to minimise radio traffic.^{1144 1145 1146 1147 1148}

However, for the 2019-20 bush fire season it also meant in some cases direct fireground communications between NSW RFS and FRNSW were only possible where NSW RFS had sufficient UHF radios available, or where a forward command post was established with both agencies in attendance. The Inquiry recommends that Incident Management Teams ensure that communication channels should be allocated for each individual incident where an IMT takes charge. These should be recorded in the Incident Action Plan in a way that is easy to understand and implement and, where multiple agencies are involved in the response, the plan needs to allow for all agencies to communicate with the control point.

Given the number of fires that crossed borders and the reliance on inter-jurisdictional fire agencies to provide surge capacity for NSW during the 2019-20 season, it is important to ensure clear protocols are in place to enable cross-jurisdictional fireground communications.

¹¹⁴³ NSW Telco Authority. (2020). *Advice to the Inquiry provided 16 April 2020*.

¹¹⁴⁴ Meeting with Cooma Incident Management Team on 27 April 2020. Presentation noted control used PMR (UHF) radio network but tactical channel used both UHF or VHF to ensure separation. Also noted half the district was on the PMR network and the other half used GRN to try to minimise radio traffic.

¹¹⁴⁵ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 3 April 2020*.

¹¹⁴⁶ Unions NSW, Submission to the Inquiry.

¹¹⁴⁷ Hamish MacKenzie, Submission to the Inquiry.

¹¹⁴⁸ Public Service Association (PSA), Submission to the Inquiry.

While MoUs are in place (as discussed in Chapter 3), there are differing levels of compatibility between fire agencies. The Inquiry heard that:

- ACT RFS vehicles have the NSW RFS code plug allowing for all NSW channels to be available to ACT RFS appliances. This applied to both portable and fireground vehicle radios.¹¹⁴⁹
- the Victorian Country Fire Authority has incompatible primary fire agency vehicle and portable radios (however, tactical channels do exist). The Inquiry noted that default communication plans are provided for in the MoU between agencies and local communication plans as part of the Mutual Aid Agreements covering cross-border operations;¹¹⁵⁰ however, these didn't always appear to work in practice
- Queensland and NSW operate different radio communication systems that are not directly compatible. The Queensland Fire and Emergency Services' (QFES) Government Wireless Network has liaison channels for all emergency service agencies in Queensland, NSW and the ACT that utilise a similar system. However, neither state has the full capability of each other's digital network. QFES does not have a specific fireground radio network. As such, QFES has no compatibility with NSW RFS fireground radios.¹¹⁵¹

Generally speaking, communications protocols are established at the Incident Controller level, which is considered to be too ad hoc. The Inquiry recommends that all Memoranda of Understanding between agencies should include a section specifically dedicated to how agencies will communicate across borders during incidents.

Recommendation 58: That, in order to ensure all agencies have a clear understanding of cross-border communication channels during bush fires, all MoUs between state or territory agencies include an agreed protocol about how agencies will communicate across borders and that these are reflected in Incident Action Plans.

5.7.1.7 An integrated dispatch system and ability to track all NSW RFS vehicles would improve response times

All Triple Zero calls for fires in NSW are directed to the FRNSW Communication Centre. On receipt of a call, FRNSW dispatches either FRNSW or NSW RFS resources to the call depending on the fire district the incident occurs in.

FRNSW resources are dispatched via the Emergency Services Computer Aided Dispatch (ESCAD) system, which is a call taking and dispatch system. NSW RFS resources are dispatched through either:

- a telephone call to the NSW RFS Operations Communications Centre (OCC), for the rural fire districts centrally managed at NSW RFS HQ, or
- a telephone call to the relevant Fire Control Centre (FCC) for all other rural fire districts.

A key weakness in the current arrangement is the lack of connectivity between FRNSW's call and dispatch system (ESCAD) and other agency resource deployment and management systems (ICEMS). The NSW RFS dispatch (as it currently stands) is time consuming and has the potential in some instances to cause a delay in responding to an incident. The

¹¹⁴⁹ ACT Emergency Services Agency. (2020). *Advice to the Inquiry provided 15 May 2020*.

¹¹⁵⁰ Victorian Country Fire Authority. (2020). *Advice to the Inquiry provided 19 May 2020*.

¹¹⁵¹ Queensland Fire and Emergency Services. (2020). *Advice to the Inquiry provided 25 May 2020*.

current system can result in double handling of a call by the FRNSW Communication Centre and the NSW RFS Operations Communications Centre personnel.

The Bega Valley Fires Independent Review (2018)¹¹⁵² found that, when resource deployment and situational awareness are not available to the FRNSW Communications Centre, the communications centre effectively ‘flies blind’ taking multiple Triple Zero calls for assistance. To address this the Review recommended a fully integrated call and dispatch centre for all NSW operations. The Inquiry supports this recommendation. This was also supported by a number of submissions to the Inquiry.^{1153 1154} During the 2019-20 fire season a NSW RFS liaison officer was placed at the FRNSW Communication Centre to overcome any duplication of effort and there were no reported communication issues.

In May 2020, the NSW RFS Commissioner announced the roll-out of an integrated dispatch system to NSW RFS that integrates with other fire agencies and pushes data across NSW RFS internal support systems. The implementation of this integrated dispatch system will provide an automated inter-operability between agencies through ICEMS and consolidate multiple NSW RFS internal dispatch systems, providing system efficiencies through centralised dispatch.¹¹⁵⁵ While the NSW RFS has described the roll-out as a ‘real and pressing’ priority, there are no firm timeframes for its completion.

Automatic Vehicle Location (AVL) devices are a means for automatically determining and transmitting the geographic location of a vehicle. The importance of AVL capability was raised in submissions to the Inquiry, with one submission noting:

*One of the imperatives of logistics management is having what you need where you need it at the right time. You need to know when to redeploy assets. Are the drivers passing fatigue limits do the crews need feeding? Are the trucks damaged? Can we get parts to the truck?*¹¹⁵⁶

Currently the FRNSW has AVL fitted to all vehicles, which allows them to have improved situational awareness and the ability to allocate a task to the closest resource to an incident. The rollout of the AVL capability to the NSW RFS is being undertaken in partnership with the NSW Telco Authority. All NSW RFS vehicles, including the recently announced 120 new vehicles, will be AVL capable. The AVL, however, is reliant on the Critical Communications Enhancement Program (CCEP) being available as discussed above.

Recommendation 59: That, in order to improve response times to Triple Zero calls, the NSW RFS implements the integrated dispatch system before the 2020-21 fire season commences.

¹¹⁵² Keelty, M. (2018). Bega Valley Fires Independent Review. Retrieved from <https://www.emergency.nsw.gov.au/Documents/publications/Bega-Valley-Fire-Independent-Review.PDF>.

¹¹⁵³ Sean O'Brien, Submission to the Inquiry.

¹¹⁵⁴ Fire Brigade Employees Union (FBEU, Submission to the Inquiry.

¹¹⁵⁵ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

¹¹⁵⁶ Greg Cole, Submission to the Inquiry.

5.7.2 Invoicing

Key points

- The current NSW RFS system was not suited to processing the very large number of invoices (58,843) for goods and services procured throughout the 2019-20 fire season.
- Invoice processing and payment delays negatively affected supplier relationships, which must be addressed to ensure continuity of supply in future fire seasons.

5.7.2.1 While enhancements were made to support increased supplier activity, this was insufficient

Under existing protocols, emergency logistics staff work at the State Operations Centre and at the Incident Management Teams (IMT) to ensure that all logistical needs are captured, recorded and processed. The 2019-20 fire season also saw the establishment of a Major Incident Logistics Support Unit at State level to provide more support to anticipate the fluctuating operational needs. In addition, the Inquiry established that a team from Deloitte was engaged during the fire season further to support the payment process.

Despite this additional capacity, the Inquiry was informed through community consultation and submissions that problems were encountered in processing invoices for catering and heavy plant during the fire season 2019-20. For the financial year as at 28 May 2020, the NSW RFS had received 58,843 invoices with 2,530 remaining unpaid.¹¹⁵⁷

While business-as-usual invoicing is processed electronically, emergency logistics processes are manual – goods receipts are captured manually from an IMT and matched against a logistical order. Emergency logistical processing accounted for 28,454 invoices of the overall total for the 2019-20 season. While the NSW RFS uses invoice scanning software, the system remains overly manual and involves double handling, and there are sometimes challenges in accurately matching documents.

It is clear to the Inquiry that the current system was unable to cope with the high volume of contracted goods and services during the season, based on feedback from NSW RFS personnel and business owners:

*RFS/FCCs must prioritise payments to small businesses. The Tyringham store supplied fuel 24 hours a day to RFS trucks for the duration of the fires, but then waited months for those fuel invoices to be paid in full.*¹¹⁵⁸

*Logistics Officers struggle to keep a record of our fire fighting assets, fire crews and their locations. Timeliness of payments was a major issue throughout the fire season. Some suppliers were not paid for months after providing invoices.*¹¹⁵⁹

The Inquiry also heard from the Glen Innes IMT that the delay in paying heavy plant operators negatively affected supplier relationships, with some threatening not to take on work in future fire seasons as a result. It is clear that while these issues are administrative in nature, if left unaddressed they may constrain fire fighting capacity and continuity of supply in future seasons if suppliers refuse to engage with the NSW RFS.

¹¹⁵⁷ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 29 May 2020*.

¹¹⁵⁸ Tyringham Rural Fire Brigade, Submission to the Inquiry.

¹¹⁵⁹ Public Service Association (PSA), Submission to the Inquiry.

In response to these concerns, the Inquiry was informed by the NSW RFS that it has established an 'Emergency Logistics Project'¹¹⁶⁰ to address shortfalls and review options available. The objective of the project is to deliver:

- real-time procurement and resource allocation capability for field and IMT operators with integration to core NSW RFS systems (SAP) and incident management (ICON)
- automated workflows with business rules integration, and
- analytics, dashboards and reporting functionality.

Recommendation 60: That, in order to ensure timely payment and maintain positive ongoing supplier relationships during large-scale bush fires, the NSW RFS implements an automated logistics solution, informed by the outcomes of the Emergency Logistics Project.

5.7.3 Fire Control and Emergency Operations Centres

Key points

- Co-located Fire Control Centres (FCCs) and Emergency Operations Centres (EOCs) demonstrated marked benefits including improved information and communication flows and coordinated operations.
- Some FCCs and EOCs experienced challenges if they were not co-located and/or were not operating from purpose-built facilities, including communication difficulties and providing suitable liaison officers in the context of stretched resources.
- Further work is needed to identify FCCs that could be upgraded and accommodate co-located EOCs in future bush fire incidents.

5.7.3.1 Purpose-built Fire Control Centres provided clear advantages during the season

Fire Control Centres (FCC) act as the primary local command centre through which the operations of rural fire districts are conducted. They also accommodate administration, training delivery and other emergency management facilities. There are 107 FCCs across NSW, and each of the 45 NSW RFS Management areas has a primary FCC site.

FCCs are the command centres for IMTs during a Section 44 bush fire incident. During discussions with IMTs across the State, the Inquiry heard there were clear advantages when an IMT was operating from a purpose-built FCC compared to those housed in legacy buildings. The Glen Innes IMT noted the Glen Innes FCC's modern facilities greatly assisted in supporting situational awareness, as well as enabling IMT members to easily communicate with each other (e.g. fit-for-purpose meeting rooms, and the intuitive layout assisted ease of access within the building).¹¹⁶¹ The Inquiry heard similar reflections from the IMT based at the Nowra FCC.¹¹⁶² This greatly contrasted with the Hawkesbury IMT's experience, which was operating from a much older FCC. The IMT noted the building's layout is confusing to navigate and does not facilitate ease of access between areas, which is often essential during an emergency situation when information-sharing and decision-making needs to happen quickly and efficiently.¹¹⁶³

¹¹⁶⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 4 May 2020*.

¹¹⁶¹ Meeting with Glen Innes Incident Management Team on 9 March 2020.

¹¹⁶² Meeting Far South Coast Incident Management Team on 7 April 2020.

¹¹⁶³ Meeting with Hawkesbury Incident Management Team on 24 February 2020.

5.7.3.2 Co-locating FCCs and Emergency Operations Centres (EOCs) is best practice

An Emergency Operations Centre (EOC) is the established centre from which an Emergency Operations Controller either controls an emergency operation, or coordinates support to the Combat Agency or Functional Area. An EOC can be established at a state, regional, or local level under the SERM Act. EOC facilities may be:

- **separate** and operating independently in a specific geographic location
- **co-located**, operating from adjacent or in close proximity to Combat Agency facilities
- **integrated** into a Combat Agency's operations facility
- **mobile**, with its functions supported by moveable equipment and resources that can be located and set up according to operational requirements, and/or
- **virtual**, conducted using a coordinated network of personnel and electronic systems.

Depending on how FCCs are set up, they often have the capacity also to act as an EOC during a bush fire incident and have the advantage of being able to be used for any type of event.

There are two tiers of facilities:

- **Tier 1:** Regional level facilities to manage larger scale operations, being a single primary co-located EOC in each emergency management Region, as well as a redundancy option/s. All identified Regional EOCs must be co-located with an emergency service organisation or within an emergency service precinct.
- **Tier 2:** Local facilities to manage local operations and which may act as redundancies for Tier 1 facilities, being an EOC identified in each regional local council area. Wherever possible, EOCs should be co-located with an ESO/within an emergency service precinct.

A strategic review of EOCs¹¹⁶⁴ was finalised in 2016 following a request of the State Emergency Management Committee (SEMC), which was concerned that the then arrangements were becoming increasingly unsustainable. The review's aim was to deliver a suite of recommendations to enhance multi-agency EOC arrangements within NSW, provide a clear understanding of the resources available and the resources required, and develop a best practice model which is sustainable into the future.

The review ultimately determined that "the provision of Emergency Service Organisation facilities and the proposed Emergency Operations Centre facility model is to be orientated towards multi-emergency service facility co-location".¹¹⁶⁵

Key findings and recommendations of the review included:

- EOC facilities need to ensure appropriate communication and support to affected communities during emergency events
- there are stark differences in the metropolitan and regional/rural operating environments
- a move towards emergency service organisations and EOCs co-located in multi-emergency service facilities
- Memoranda of Understanding should be executed between combat agencies at a State level, committing to the provision and ongoing support of co-located EOC workspaces within new and upgraded combat agency facilities
- EOC workspaces must provide all essential requirements as identified in the relevant policy according to an agreed enhancement plan

¹¹⁶⁴ SEMC (State Emergency Management Committee). (2016). Strategic Review of Emergency Operations Centres.

¹¹⁶⁵ Ibid.

- a funding model should be considered that provides incentives for EOC co-location and consolidation of emergency service organisation facilities
- introduction of a revised quality assurance model and process to ensure the suitability, functionality and preparedness of identified EOC facilities with independent monitoring and evaluation.

In response to the SEMC review, the Board of Commissioners has agreed that Resilience NSW and the NSW Police Force should lead a strategic facility review of EOCs in NSW. The review will investigate arrangements to enable sustainable, interconnected interoperability and, where possible, modernised operations and funding of EOCs, to ensure they are combat-ready for emergencies. The ultimate goal will be to ensure that NSW has appropriately staffed, equipped and located EOCs to address disaster response and recovery operations, as well as a plan and processes to ensure the quality of EOCs is maintained over time.

The Inquiry, following consultations with key stakeholders and frontline personnel, concurs with the SEMC review findings in that, during an event, EOCs operate best when co-located in a multi-agency facility. As previously discussed, the inclusive set up of the SEOC in the State Operations Centre at Sydney Olympic Park provides a best practice example – albeit on a more macro level – of how co-location between partner agencies places a greater emphasis on collaboration and situational awareness.

Transport for NSW, for example, advocated for the concept of ‘joined up decision making’ and, based on the experience of its staff, recommended to the Inquiry that:

consideration of RFS Fire Control Centres be co-located with EOCs where possible – EOC decision making was improved where Fire Control Centres were co-located, this allowed for greater collaboration with RFS.

In the Blue Mountains, the IMT reflected that the co-location of the EOC and FCC was considered essential as it allowed quicker and deeper conversations than if they were operating from separate locations.¹¹⁶⁶

The Inquiry heard of various communications issues in EOCs when not co-located in a Fire Control Centre – including with dissemination of vital information and the lack of suitable NSW RFS liaison personnel into the EOC.

In light of the benefits of co-locating FCCs and EOCs, and the related issue of some FCCs not being modern, fit-for-purpose facilities (which not only impeded IMT operations but also meant they were unable to serve as EOCs), the Inquiry recommends the NSW RFS review FCCs that are not purpose-built facilities in areas that were heavily affected by fire. The results of this review should be combined with the EOC Facilities Review to identify areas that would benefit from a purpose-built FCC, enabling co-location with the EOC.

Recommendation 61: That, in order to improve cross-agency communication and coordination during bush fires, the NSW RFS review Fire Control Centres (FCCs) in areas that were heavily affected by fire. The results should be combined with the Emergency Operations Centre (EOC) Facilities Review to identify areas that would benefit from a purpose-built FCC, enabling co-location with the EOC.

¹¹⁶⁶ Meeting with Blue Mountains Incident Management Team on 25 February 2020.

5.7.4 State Operations and State Emergency Control Centres

Key points

- The state-of-the-art facilities at the NSW RFS State Operations Centre at Sydney Olympic Park enabled a new level of cross-agency collaboration.
- Co-location of the State Emergency Operations Centre (SEOC) and the NSW RFS State Operations Centre facilitated whole-of-government cooperation and should continue for future major fire incidents.

5.7.4.1 The State Operations Centre enabled a high level of cross-agency coordination and collaboration

The NSW RFS headquarters at Sydney Olympic Park houses the State Operations Centre (OpsCen), as well as the State Air Desk (SAD) and the Operational Communications Centre (OCC). The new \$21.5 million facility replaced the former headquarters at Lidcombe and was officially opened in late November 2018. The OpsCen has adopted world's best practice in as far as it promotes interoperability of systems and portability of information through the design layout and seating arrangements for agencies.

This facility serves as the sole State-level operations and information centre for bush and grass fires. The OpsCen operates continuously 24 hours a day, with staffing levels determined by conditions. It has the capacity to accommodate more than 200 multi-agency personnel. Using lessons learned at Lidcombe, the OpsCen at Sydney Olympic Park was designed to enhance collaboration between the agency representatives on site.

Previously the OpsCen was set out so that the prime location was occupied by NSW RFS personnel, with other agency staff at the peripheries. The new OpsCen, however, provides permanent workstations for representatives from all key agencies at the centre of the room in an effort to promote and facilitate situational awareness. In addition, those workstations are set up with technology and access to systems as they would be at those representatives' home agencies. As it was put it to the Inquiry during consultation, an officer from RMS can sit at their computer and access traffic camera feeds, just as they would be able to at the Transport Management Centre.

Partner agencies maintain a permanent presence in the OpsCen. FRNSW has personnel within a dedicated area known as the Bush Fire Incident Co-ordination Centre (BICC). FRNSW staffing is increased when significant bush fire activity is forecast or occurring. Personnel from NPWS and Forestry Corporation of NSW are also represented in the OpsCen during these times.

The OpsCen has workspaces allocated for a number of other emergency service organisations and functional areas for use in the event of major bush fire conditions. These agencies include, amongst others, the Bureau of Meteorology, NSW Police Force, NSW Ambulance, the different elements of Resilience NSW and representatives of the Australian Defence Force.

These agencies work alongside the NSW RFS to assist with consequence management and planning activities such as evacuation, traffic diversions and school/hospital closures. Their presence at this single centre allows for greater co-ordination to occur across all agencies and for the timely provision of information and decision making.



Photo 5-10: State OpsCen during 2019-20 season. Provided by NSW RFS 8 July 2020.

The Inquiry heard from numerous stakeholders about the level of cross-agency coordination and collaboration that the OpsCen enabled. While it was recognised that establishing the facility represented a significant capital outlay, there was a substantial return on investment as it enabled a level of collaboration that had not been seen in previous significant fire seasons.

The recent COVID-19 outbreak has demonstrated the OpsCen is not just a NSW RFS resource, but a State resource: a one-of-a-kind facility that can be easily adapted for non-fire related events, with whole-of-government coordination and the execution of the NSW government emergency responses within one central, purpose-built location.

5.7.4.2 Co-locating the SEOC at Sydney Olympic Park enabled real-time situational awareness

The State Emergency Operations Centre (SEOC) is established under section 20 of the *State Emergency and Rescue Management Act 1989* and is under the control of the State Emergency Operations Controller (SEOCN), supported by staff from Resilience NSW. The primary function of the SEOC during an emergency operation is to:

- support the SEOCN to control or support the emergency operation
- facilitate planning for the ongoing emergency operation
- acquire and allocate resources
- support the development of a coordinated public information strategy.

The SEOC is a 24/7 facility usually located in Surry Hills. However, from 1 October 2019 the SEOC functions and staff were co-located at the NSW RFS OpsCen and remained there for the duration of the 2019-20 season. Before 1 October, SEOC staff had been present at the NSW RFS State Operations Centre on days when Total Fire Bans were in place.

The co-location of the SEOC and OpsCen ensured SEOC personnel were able to maintain excellent real-time situational awareness without relying on Liaison Officers having to

communicate from one location to another. This was essential given the scale and fast-paced nature of the fires throughout the season, which often required immediate and coordinated responses from a number of different agencies.

In addition to facilitating cross-agency communication and collaboration, the systems interoperability and functional space at the OpsCen is of a far higher standard than the capability of the SEOC in Surry Hills, which has been in its current location since 1992 and has not had any improvement works since an upgrade and reconfiguration in 2007. While the co-location of the SEOC and OpsCen worked well, there are no formal arrangements in place to guarantee this would occur in future disasters. The Inquiry recommends the current SEOC arrangements and location be reviewed to ensure inter-operability during all natural disasters.

Recommendation 62: That, in order to ensure State Emergency Operations Centre (SEOC) interoperability during all natural disasters, Resilience NSW review the current SEOC arrangements and location including responsibilities for ongoing resourcing and maintenance.

5.8 THE COMMONWEALTH GOVERNMENT'S ROLE

5.8.1 Role of the Australian Defence Force

Key points

- The ADF does not have a defined role as a fire-fighting combat agency. Existing ADF civil defence capabilities (e.g. logistics/sustainment, transport and engineering) complement State capabilities, and there was little to no stakeholder support for the ADF capabilities to be expanded to fire fighting.
- Stakeholder and agency feedback clearly showed ADF personnel and reservists worked exceptionally well with NSW combat agencies on the ground, often in very difficult circumstances.
- The established arrangements to facilitate the NSW Government requesting Defence Assistance to the Civil Community (DACC) can be cumbersome and slow to implement, and there are opportunities for improvement. These include streamlining approvals, providing better visibility to the State on available ADF resources/capabilities, and reviewing the need for the State to exhaust its capabilities before requesting ADF assistance.

5.8.1.1 ADF assistance complemented NSW's emergency response capability

The Australian Defence Force (ADF) does not have a defined role as a fire fighting combat agency. Requests from NSW to the ADF are made under Defence Assistance to the Civil Community (DACC) arrangements. The ADF, via the SEOC as the NSW jurisdictional authorised officer, receives requests for assistance where the natural disaster exceeds or exhausts the State's capabilities or where the resources cannot be mobilised in sufficient time. These requests are through Emergency Management Australia (EMA) within the Department of Home Affairs, which is responsible for planning and coordination through the COMDISPLAN. There are two types of DACC requests: local emergency assistance requests (category 1) and significant emergency assistance requests (category 2).

Local emergency assistance requests (DACC category 1) commenced in September 2019 and the ADF commenced providing Joint Operations Support Staff (JOSS) to the NSW RFS

OpsCen from 31 October 2019.¹¹⁶⁷ NSW technicians integrated and worked onboard ADF aircraft as part of the DACC requests, significantly enhancing capability across the State. The JOSS personnel worked closely with EMA liaison officers who also maintained a presence in the OpsCen during heightened levels of activity. Thirty-two requests for emergency assistance under the DACC framework were made over the course of the 2019-20 bush fire season. These requests are fully outlined in Appendix Thirteen.

Most DACC requests fell within category 2 (significant emergency assistance). The nature of the requests ranged from aviation support or the provision of accommodation and logistic support for fire fighting crews, to the establishment and renewal of joint taskforce arrangements. Assistance from the ADF included:

- accommodation for over 3,000 emergency workers at a variety of defence bases
- involvement of ADF Search and Rescue aircraft in rescuing 51 people from risk of fire impact, who were subsequently provided emergency accommodation
- retrieval of a helicopter, with FRNSW, from the Ben Boyd Reservoir where it had crashed on 9 January 2020
- on 23 January 2020, provision of an Air Force rotary wing aircraft, in concert with NSW authorities, to insert a recovery team at the crash site of the Coulson Aviation C-130 Hercules under very difficult operating conditions, and later assistance in the transfer of family and company members to the site.

The SEOCN's comment sums up the effort of the ADF:

*Some of the more significant tasks and activities were deploying to remote communities from the coast providing first aid, food and water and recognisance. They built structures, plumbed public toilets, operated machinery and the list goes on. It would be fair to say that they provided hope to many people who would not have seen or had contact with traditional agencies for some time.*¹¹⁶⁸

International defence forces from New Zealand, Singapore, Japan, Papua New Guinea, Fiji, the United States of America, Indonesia and Canada also deployed personnel, fire fighting supplies and equipment, and logistical support over the course of the operation.

5.8.1.2 The ADF also assisted in initial recovery operations for the first time

Following a unilateral decision by the Commonwealth Government, Operation Bushfire Assist 2019-20 formally commenced on 31 December 2019 and ran to 26 March 2020, creating an overarching support agreement, with a Joint Taskforce established in NSW (formalised by DACC request of 3 January 2020) to deal with all future NSW requests for ADF assistance as well as the extension of any existing request¹¹⁶⁹.

More than 6,500 ADF members, including around 3,000 Reserve forces, provided support to emergency relief, response and recovery operations across NSW, Victoria, Queensland, the ACT, South Australia and Tasmania.¹¹⁷⁰ It speaks to the scale of the impact of the 2019-20 bush fire season that for the first time in Australia's history, the Governor-General approved

¹¹⁶⁷ Department of Defence, Submission to the Inquiry.

¹¹⁶⁸ SEOCN (State Emergency Operations Controller). (2020). *Advice to the Inquiry provided 13 April 2020*.

¹¹⁶⁹ Department of Defence, Submission to the Inquiry.

¹¹⁷⁰ Minister for Defence and Prime Minister of Australia. (2020). Operation Bushfire Assist concludes. Retrieved from <https://www.minister.defence.gov.au/minister/lreynolds/media-releases/operation-bush-fire-assist-concludes>.

the Call Out of Australian Army Reservists on 4 January 2020 to provide additional support to state and local authorities to assist fire affected areas.¹¹⁷¹

In cooperation with NSW authorities, Defence provided approximately 2,600¹¹⁷² personnel to regional areas of NSW affected by the bush fires including:

- engineering personnel and assets assisting with access to critical infrastructure through the clearance of roads and fire trails
- clearing of roads, railway lines and properties
- installing an Army water purification system as a temporary measure to support water production to the Bega Valley Shire Council – the system produced approximately 6.1 million litres for the community
- providing emergency relief, medical provisions and assistance with the management of donated goods
- delivering generators, fuel, food, fodder and potable water to isolated towns and affected communities
- providing veterinary services, wildlife rescue and support to animal welfare agencies¹¹⁷³
- dispatching HMAS Adelaide to an area of the South Coast on 5 January 2020 to provide support to local communities if required.

5.8.1.3 The Inquiry does not support expanding the ADF's role to fire fighting

There was much debate in the media during the 2019-20 fire season about the ongoing role of the ADF and calls for this to be expanded beyond the current arrangements; essentially for the ADF to have a dedicated fire fighting capability to support civilian services.

The Inquiry does not support the proposal to have the ADF establish a fire fighting capability. As noted in submissions received during consultation, ADF personnel are not suitably trained to fight fires. Even if they were, personnel would need to focus solely on fire fighting activities to maintain basic competencies.

The Chief of Army, Lieutenant General Rick Burr, has publicly stated:

*It is not Defence's primary mission. At this time, we're not looking at doing fire fighting. We've been able to value-add by helping behind the scene, but there is no focus on fire fighting ... Our principal job is to prepare for war. Our resources are tied up in doing that.*¹¹⁷⁴

This is supported in the submission by the ADF that states:

*In supporting Emergency Services NSW and communities, Defence saw the greatest value in providing capabilities that complement state capabilities in particular transport, engineers, aviation, medical support and logistics/sustainment capabilities.*¹¹⁷⁵

¹¹⁷¹ Order to Call Out the Australian Defence Force Reserves, 4 January 2020. Retrieved from <https://www.legislation.gov.au/Details/F2020N00001>.

¹¹⁷² Department of Defence, Submission to the Inquiry.

¹¹⁷³ Ibid.

¹¹⁷⁴ Levick, Ewen. (2020, 21 February). ADF chiefs weigh in on submarine and bushfire debates, *Australian Defence Magazine*. Retrieved from <https://www.australiandefence.com.au/events/event-reporting/adf-chiefs-weigh-in-on-submarine-and-bush-fire-debates>.

¹¹⁷⁵ Department of Defence, Submission to the Inquiry.

5.8.1.4 There was strong collaboration between NSW and ADF personnel

Stakeholder and agency feedback during the Inquiry's consultations was overwhelming in noting that ADF personnel and reservists and NSW combat agencies personnel worked exceptionally well together on the ground in what proved to be, at times, very trying and difficult circumstances.

There is long-standing collaboration between the ADF and the NSW Government and in particular the Office of Emergency Management (now Resilience NSW). Historically the ADF has always had a presence on the SEMC, Regional Emergency Management Committees and Local Emergency Management Committees. Joint Operations Support Staff are members of the SEMC who provide additional advice and regular liaison. NSW RFS personnel have also attended the JOSS Liaison Officers Professional Development course each year since 2015 to enhance relationships and exchange information. The Inquiry would encourage these collaborative learning opportunities to continue between agencies.

There is general agreement that once the Joint Taskforce was established and fully integrated into the State Operations Centre, the process for requesting ADF support was far easier. It allowed the NSW RFS to enter into direct negotiations and discussions with ADF personnel at a suitably senior rank to authorise and approve requests, and meant assistance was provided in a timelier manner. However, the NSW RFS was not aware that the formation of a Joint Taskforce was being considered by the Commonwealth, which created some initial issues including (but not limited to) integration into the State response arrangements as well as extant logistical implications.¹¹⁷⁶ The Inquiry would encourage open communication between the Commonwealth and NSW Governments ahead of similar decisions being made in future fire seasons, to ensure adequate arrangements can be put in place to optimise the ADF's involvement.

5.8.1.5 The process for requesting ADF assistance can be improved

DACC request mechanisms have worked sufficiently in 'normal' emergency management situations. In this event, the focus of ADF support to NSW transitioned from liaison, through to emergency assistance and the safety of life and property, to span response and initial recovery operations, while always working in support of NSW State authorities.¹¹⁷⁷

However, the Inquiry has been made aware of concerns about perceived delays in responding to DACC requests during the 2019-20 season. Most of the cases brought to the Inquiry's attention relate to what is perceived to be an overly bureaucratic or overly hierarchical process within the ADF – particularly when specific requests for assistance went beyond those normally made during an emergency event. An example given was DACC request No. 001 relating to contingency air transport for operational firefighters, which required transporting large groups with commercial seating. The request was considered over several days by Emergency Management Australia and the ADF before final approval was given.¹¹⁷⁸ In the context of emergency events such as bush fires, the Inquiry considers that inflexible approval processes are not conducive to providing agile and time-critical responses. ADF Officers located at IMTs need to have authority to determine if they can complete a task at that level.

¹¹⁷⁶ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 15 April 2020*.

¹¹⁷⁷ Department of Defence, Submission to the Inquiry.

¹¹⁷⁸ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 15 April 2020*.

In addition, the ADF does not provide states and territories with a comprehensive list of capabilities and available resources that could provide support during emergencies. Instead, NSW makes a request to the ADF and is advised whether or not it can be met. While the Inquiry understands there is a need to protect certain types of information relating to defence capabilities, in light of the types of assistance requested (accommodation, transport, etc.) it does not seem unreasonable for states and territories to have greater visibility over the type of support available. This would enable states and territories to align requests to the available resources and capabilities and reduce response times during time-critical emergency events.

The current arrangements also require states and territories to exhaust their own resources before a request for ADF assistance is made. In practice, this means that even if NSW knows State resources will be constrained and exhausted based on projected demands, and ADF assistance will be required, assistance is unable to be requested until the threshold is actually met. Combined with inflexible ADF approval processes, this means there is usually a gap between the time at which assistance is needed and when it is received. Given the fast-moving nature of bush fires, the Inquiry considers early requests for ADF assistance should be facilitated.

Recommendation 63: That, in order to ensure the guiding principles and approval processes are contemporary, streamlined and more flexible, the NSW and Commonwealth Governments review the Defence Assistance to the Civil Community (DACC) arrangements. This review should include the circumstances in which the State can request Commonwealth assistance, and the level of information provided by the ADF to the State on available resources and capabilities.

5.9 PUBLIC WARNING SYSTEMS

Key points

- There was extensive community reliance on ABC radio for emergency warning updates, particularly when telecommunications towers were lost.
- People living in areas without reliable mobile phone coverage felt very vulnerable, particularly when landlines went down, as they had no means of calling Triple Zero for help or receiving emergency alerts.

5.9.1 Public messages were coordinated across NSW Ministers and combat agencies

In Chapter 3 the Inquiry provided an overview of the public warning systems, including the background and development of a national system. In this section it considers the effectiveness of the warning systems and whether they operated as intended.

The effective communication of public information and warnings is a critical element of emergency management. Public information and warnings play an important role in community safety by empowering people to make informed and timely decisions, thereby taking protective action.¹¹⁷⁹

¹¹⁷⁹ Australasian Fire and Emergency Service Authorities Council (AFAC), Submission to the Inquiry.

Media plays a vital role in the communication of events as they happen. In delivering this message it is important that media personnel are safe and appropriately dressed in personal protective clothing. Bush fire safety training is conducted annually across NSW and is offered to media personnel such as journalists, photographers, presenters and producers.¹¹⁸⁰ The two-hour program covers basic fire awareness, safety and survival information. There is a theory-based assessment, and successful participants are issued with a NSW RFS Media Accreditation Card that must be worn and shown to enter a NSW RFS-controlled fireground. Media must also wear PPC that consists of a Proban-treated yellow jacket, pants, helmet clearly marked as 'Media', gloves, goggles, face mask and sturdy footwear.

The NSW RFS 2018-19 Annual Report¹¹⁸¹ stated that “almost 400 members of the media undertook bush fire safety training in order to be accredited to report on incidents in NSW and assist in the dissemination of important fire information to the community”. The NSW RFS informed the Inquiry that in the 2019-20 season, due to the huge increase in media attention, three additional weeks of media training was conducted, with two weeks based regionally and one week in Sydney. A total of 220 media personnel undertook the training in January 2020 alone.

Public messaging and briefings were disseminated from the NSW RFS Operations Centre, with a rhythm that provided “*clear, timely, accurate, persistent and shared messages from government and lead agencies*”, as noted by Deputy Commissioner (and SEOCON) Gary Worboys from the NSW Police Force.

The NSW RFS Commissioner and Deputy Commissioner and staff of the State Public Information Unit of NSW RFS made themselves available to share information, issue warnings and provide details of fire activity, with the NSW RFS estimating that 20,000 interviews were given over the course of the 2019-20 season. These interviews were conducted with morning and evening news and current affairs programs, television and radio, plus regular media briefings that were captured by multiple television, radio and news agencies.

The media briefings were regularly conducted with senior NSW RFS personnel alongside the Premier, key Ministers, and Commissioners from FRNSW and Ambulance Service of NSW, and Deputy Commissioner Worboys, with each agency head ready to brief the media on the responses of their portfolios. This supported cooperative and transparent information flow between agencies. Media were able to base themselves at the NSW RFS site, and a schedule of briefings was maintained that became an accepted daily media rhythm.¹¹⁸²

The presence of the Premier with the Commissioners of the different agencies reflected a united approach to the combatting of the fires, and visually reinforced that the NSW agencies were working together. This aligned with a recommendation of the Bega Valley Fires Independent Review, which noted the value of agency representation at major

¹¹⁸⁰ RFS (NSW Rural Fire Service). Media training. Retrieved from <https://www.rfs.nsw.gov.au/news-and-media/information-for-the-media/media-training>.

¹¹⁸¹ RFS (NSW Rural Fire Service). (2019). Annual Report 2018-19. Retrieved from <https://www.rfs.nsw.gov.au/resources/publications/annual-reports>.

¹¹⁸² SEOCON (State Emergency Operations Controller). (2020). *Advice to the Inquiry provided 13 April 2020*.

briefings or press conferences “to reinforce successful integrated collaborative efforts rather than individual agency achievements”.¹¹⁸³

5.9.1.1 There is a need for additional personnel to support the PIFAC during protected events

Under the State Bush Fire Plan, the NSW RFS provides the ‘single source’ of bush/grass fire information across the State through the NSW RFS public website and social media platforms.¹¹⁸⁴ The NSW RFS was supported in its media operations by the Public Information Functional Area Coordinator (PIFAC), who is:

*responsible for the coordination of public information during an emergency which is under the control of an emergency operations controller, and the development of media and public information strategies, plans and materials in support of the State Disaster Plan and agencies when required.*¹¹⁸⁵

The role of the PIFAC is outlined in the *NSW Public Information Services Functional Area Supporting Plan*.¹¹⁸⁶ The Plan states that all agencies are entitled to release information without the express approval of the PIFAC; however, when agencies need to ensure that their agency-specific messages do not conflict with PIFAC messages, agencies may need to consult the PIFAC before the release of any information.

Traditionally the PIFAC role has been held by an individual within the NSW Police Force (Police Media Unit) who is trained in handling and coordinating a large volume of information. The increase in the use of technology and social media to distribute information and warnings has seen the PIFAC’s workload increase well beyond that of a single person. The SEOCON has advised that:

*the need for a well-resourced and supported PIFAC was evident in the bush fire event and ... the role has now been boosted within NSWPF with an additional Deputy PIFAC role and supported in part by NSW Police Media officers.*¹¹⁸⁷

The SEOCON also informed the Inquiry that long protracted events require a full team of trained and competent people to level the [work] load, which is not evident in each organisation at this time. The team could be multi-agency, utilising the trained media officers found across NSW agencies involved in emergency operations. This option was recommended following Exercise Deerubbin held in mid-2019, an exercise of catastrophic flooding in the Hawkesbury-Nepean Floodplain.

¹¹⁸³ Keelty, M. (2018). Bega Valley Fires Independent Review, page 24. Retrieved from <https://www.emergency.nsw.gov.au/Documents/publications/Bega-Valley-Fire-Independent-Review.PDF>.

¹¹⁸⁴ SEMC (State Emergency Management Committee). (2017). State Bush Fire Plan, page 14. Retrieved from <https://www.emergency.nsw.gov.au/Documents/plans/sub-plans/state-bush-fire-plan.pdf>.

¹¹⁸⁵ SEMC (State Emergency Management Committee). (2018). NSW State Emergency Management Plan (EMPLAN) page 78. Retrieved from <https://www.emergency.nsw.gov.au/Documents/publications/20181207-NSW-state-emergency-management-plan.pdf>.

¹¹⁸⁶ NSW Police Force. (2019). Public Information Services Functional Area Supporting Plan. Retrieved from <https://www.emergency.nsw.gov.au/Documents/plans/supporting-plans/Supporting-Plan-Public-Information.pdf>.

¹¹⁸⁷ SEOCON (State Emergency Operations Controller). (2020). *Advice to the Inquiry provided 13 April 2020*.

In light of the significant increase in workload for the PIFAC as a result of social media and the 24-hour news cycle, coupled with the intense demands of coordinating and disseminating accurate information over the 2019-20 season, the Inquiry supports an expanded team of trained media officers to ensure the PIFAC is well-supported during future protracted events.

Recommendation 64: That, in order to expand the pool of trained personnel able to undertake the Public Information Functional Area Coordinator (PIFAC) role, Resilience NSW and the NSW Police Media Unit (PIFAC) develop and deliver a training package for Emergency Management Media Liaison Officers.

5.9.1.2 There were strong levels of public engagement with information issued by the NSW RFS

The Inquiry understands that the safety of people in bush fire affected communities is influenced by their awareness, preparedness, responses and decision making, and, critically, by public warning systems. To that extent, public information about an early start to the fire season was available from mid-2019, including via media releases issued by the NSW RFS,¹¹⁸⁸ and was reported by a variety of media outlets.^{1189 1190 1191} From 1 July 2019 to 20 February 2020, the NSW RFS Media phone received 15,445 enquiries.¹¹⁹² This figure does not account for the additional enquiries NSW RFS Media Officers received to their individual mobile phones.

Once fires commenced, the NSW RFS used existing messaging systems to disseminate information and warnings. Over the course of the season the NSW RFS published 2,326 tweets and issued 2,418 Facebook posts from the official NSW RFS Facebook page. Importantly, there were high rates of engagement with information issued via social media, particularly those issued via Facebook. The NSW RFS advised that tweets were liked or shared 609,951 times, and Facebook posts were liked or shared 6.45 million times. The NSW RFS also gained over 260,000 new Facebook followers.¹¹⁹³

In addition, there were 430 Emergency Alert campaigns issued via 340,603 voice messages and 2.14 million text messages, and the Fires Near Me smartphone app was also highly relied upon as a source of information (further discussed later in this Chapter).

The information and messages that were shared were blunt, with the NSW RFS Commissioner and Deputy Commissioner advising:

¹¹⁸⁸ RFS (NSW Rural Fire Service). (2019). NSW RFS declares start of Bush Fire Danger Period. Retrieved from <https://www.rfs.nsw.gov.au/news-and-media/media-releases/nsw-rfs-declares-start-of-bush-fire-danger-period>.

¹¹⁸⁹ Ingall, Jennifer. (2019, 1 August). Drought-stricken NSW braces for an early bushfire season with not enough water to take them on, ABC. Retrieved from <https://www.abc.net.au/news/2019-08-01/nsw-braces-for-early-bush-fires-season-and-lack-of-water/11371540>.

¹¹⁹⁰ Noyes, Jenny. (2019, 1 August). It's still winter, but parts of NSW are now officially in bushfire season, *Sydney Morning Herald*. Retrieved from <https://www.smh.com.au/environment/weather/it-s-still-winter-but-parts-of-nsw-are-now-officially-in-bush-fire-season-20190801-p52cum.html>.

¹¹⁹¹ Wheeler, Faye. (2019, 30 July). Drought conditions concerning: NSW Rural Fire Service Acting Commissioner Rob Rogers, *The Land*. Retrieved from <https://www.theland.com.au/story/6299966/rfs-makes-this-undertaking-to-landowners-as-drought-continues/>.

¹¹⁹² RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 17 March 2020*.

¹¹⁹³ Ibid.

*Don't expect a fire truck, don't expect a plane, don't wait for a warning.*¹¹⁹⁴

The bluntness of the communications was such that former Commissioner Shane Fitzsimmons was described in a UK article as having:

*... become renowned for delivering warnings and key developments – often bad news – in a straight-talking, informative way.*¹¹⁹⁵

This style of messaging ensured that the public had access to information that was understandable, directive and clear as to the response and resourcing of that response.

Submissions to the Inquiry acknowledged the efficacy of public messaging compared to previous fire seasons:

*the public warnings, Fires Near me, the Commissioners and other public messages were all huge improvements. If this season occurred 10 years ago, there would have been many more deaths.*¹¹⁹⁶

There has been a notable shift in recent years in how the community access information, and the community are proactively seeking information through apps, social media, websites as well as more traditional channels such as TV and radio.¹¹⁹⁷ NSW RFS research commissioned to assess the effectiveness of their fire preparedness communications campaign from 2018 to 2020 found that there has been a significant increase in individual sense of responsibility to heed warnings and take action to leave early or prepare the home ahead of a bush fire.¹¹⁹⁸

The NSW RFS itself estimated that fires of this size and scale could have resulted in the loss of approximately 150 lives. This estimate was based on the *Life and House Loss Database Description and Analysis: Final Report* (CSIRO, 2012)¹¹⁹⁹ that analysed bush fire related life loss in Australia between 1901 and 2011 to produce a dataset that is used to predict potential losses.

5.9.1.3 Some people expected to receive personalised warnings

The need for nationally consistent warnings is discussed in Chapter 3. The Inquiry received a number of submissions about the public information and warnings issued throughout the bush fires. Opinions were divided as to their benefits, with a number of respondents finding that the information was too generalised to be of use for their specific circumstances.

¹¹⁹⁴ Seo, Bo and Evans, Simon. (2019, 20 December). Fires engulf Australia as temperatures soar, *Australian Financial Review*. Retrieved from <https://www.afr.com/politics/federal/change-your-holiday-plans-rfs-20191220-p53lr#~:text=Most%20major%20cities%20were%20forecast,in%20Brisbane%2C%20Canberra%20and%20Sydney>.

¹¹⁹⁵ Mao, Frances. (2020, 30 January). Shane Fitzsimmons: 'Tireless' fire chief steering Australians through disaster, *BBC*. Retrieved from www.bbc.com/news/world-australia-51230844.

¹¹⁹⁶ Justin Williams, Submission to the Inquiry.

¹¹⁹⁷ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 6 May 2020*.

¹¹⁹⁸ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 4 May 2020*.

¹¹⁹⁹ Blanchi, R, Leonard, J, Haynes, K, Opie, K, James, M, Kilinc, M, Dimer de Oliveira, F & van den Honert, R. (2012). *Life and House Loss Database Description and Analysis*. CSIRO, Bushfire CRC report to the Attorney-General's Department.

*I live in the Bay & Basin region (Shoalhaven). During NYE & the Saturday following when the Currowan Fire was at its worst, we found that it was impossible to get any specific information regarding where local fires were breaking out.*¹²⁰⁰

The Inquiry heard that some people expected a personalised message before taking action. This expectation is backed up by survey results conducted by Newgate Research on behalf of Infrastructure NSW. In relation to flooding in the Hawkesbury Nepean, likely affected residents were asked how they would respond after hearing an evacuation order on the radio. In response, 17% indicated that they would wait for another warning, such as a call or door knock.¹²⁰¹ This view was supported by the NSW Greens Party Room submission to the Inquiry, which stated:

*[There was a] false belief that a fire crew will evacuate you ... We were asking people to evacuate or what their plan was given the proximity to the fire and the extreme warnings. I was shocked at the cavalier approach of so many we spoke to ... [In one case] the husband was reluctant to leave and said that 'the fireys will evacuate us if things get bad'. We explained that given there was only one road in to their property and the multiple sites of fire in the area that there was not going to be a fire team coming up to their property to evacuate them.*¹²⁰²

Other research undertaken by Dr Ken Strahan in Victoria indicates that several factors influence someone's decision to evacuate, including their personal perception of risk as well as the receipt of official warnings, and that 30-50% of people 'wait and see'.¹²⁰³ This demonstrates that while consistent and clear messaging is important, people will have different reactions to receiving the same information.

5.9.1.4 The NSW RFS issued extensive Emergency Alert campaigns throughout the 2019-20 season

Emergency Alert is the national telephone warning system used by emergency services to send voice messages to landlines and text messages to mobile phones within a defined area about likely or actual emergencies.¹²⁰⁴ The system was initiated by COAG as an immediate response to the 2009 Black Saturday Bush fires in Victoria, to enable states and territories to notify the public of emergency events.¹²⁰⁵

Emergency Alert is delivered through three separate (but integrated) services:

1. Core – the infrastructure which processes and manages telephony alert messages to fixed landlines & mobile phones
2. Location Based Service (LBS) – the infrastructure which transmits alert messages from the Core to Telstra, Optus and Vodafone mobile customers

¹²⁰⁰ Name withheld, Submission to the Inquiry.

¹²⁰¹ Newgate Research. (2014). Social Research on Floods in the Hawkesbury Nepean Valley; Quantitative Research Report, page 38. Retrieved from <http://www.infrastructure.nsw.gov.au/media/1734/ngr-1407004-project-flood-quant-report-f2.pdf>.

¹²⁰² NSW Greens Party Room, Submission to the Inquiry.

¹²⁰³ Strahan, K, Whittaker, J & Handmer, J. (2018). Self-evacuation archetypes in Australian bushfire. International Journal of Disaster Risk Reduction, 27 307-316.

¹²⁰⁴ Emergency Alert. You May Receive Emergency Warnings on Your Phone. Retrieved from <http://www.emergencyalert.gov.au/>.

¹²⁰⁵ COAG (Council of Australian Governments). (2009). Meeting Communiqué, 30 April. Retrieved from: <https://www.coag.gov.au/meeting-outcomes/coag-meeting-communiqu%C3%A9-30-april-2009>.

3. Location Based Number Service (LBNS) – the infrastructure which transmits alert messages from the Core to fixed base addresses.

During the period of active bush fires, the NSW RFS successfully sent 340,603 voice messages and 2.14 million text messages.¹²⁰⁶ These messages were sent as part of 430 separate campaigns, commencing on 10 September 2019 with a message about the Crescent Head area, and ending with the final message sent on 3 February 2020.¹²⁰⁷ The peak days of activity were 31 December 2019 (52 alerts), 8 November 2019 (41 alerts), 21 December 2019 (32 alerts) and 4 January 2020 (28 alerts).¹²⁰⁸ The alerts issued on 21 December 2019 and 4 January 2020 coincided with periods of State of Emergency.

Alerts are tailored depending on the proximity of the fire and the action people need to take in response. Examples of Emergency Alert messages sent during the 2019-20 season are:

*Voice message re Bees Nest fire sent on 6 September 2019: New South Wales Rural Fire Service emergency bush fire warning. There is a bush fire in the Guy Fawkes National Park area. If you are not prepared or your plan is to leave, leave now before conditions become too dangerous. Put your Bush Fire Survival Plan into action. Stay up to date. Check the R F S website at www.rfs.nsw.gov.au or contact the bush fire information line on one eight hundred 6 7 9 7 3 7.*¹²⁰⁹

*SMS re Hillville Rd fire sent on 8 November 2019: NSW RFS EMERGENCY BUSH FIRE WARNING - Possums Brush, Rainbow Flat residents safest option to leave now if path clear to Tuncurry. www.rfs.nsw.gov.au or 1800679737.*¹²¹⁰

Submissions to the Inquiry indicated that once people received the Emergency Alert, they generally took the required action.

*I was up from 6am after receiving the emergency alert, and spent hours making my place safe and finalising my evacuation gear.*¹²¹¹

*We had been told to if we were going to evacuate we had to do this by 8am and go to the centre at the Moruya Show Ground. Seemed everyone took notice of the warning on the emergency alert on their mobile phones.*¹²¹²

*RFS communication systems helped save many lives through improved notices include “leave now” advice.*¹²¹³

*I woke just after 6 am on the 31/12 and read a text message sent at 6:02 from emergency services to say there was a bushfire at Mogo and to evacuate toward the beach. I got up, my parents were already up and had also received a recorded phone call with a similar message. We realised that we needed to put the initial part of our bushfire plan into action...*¹²¹⁴

¹²⁰⁶ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 17 March 2020.*

¹²⁰⁷ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 9 April 2020.*

¹²⁰⁸ Ibid.

¹²⁰⁹ Ibid.

¹²¹⁰ Ibid.

¹²¹¹ Ruth Horsfall, Submission to the Inquiry.

¹²¹² Jennifer Butt OAM, Submission to the Inquiry.

¹²¹³ John Benson, Submission to the Inquiry.

¹²¹⁴ Renae Kelly, Submission to the Inquiry.

*We very much appreciated our early morning robo call on our landline on 31 December 2019 advising that there was a fire in the area and to evacuate immediately which we did.*¹²¹⁵

5.9.1.5 Emergency Alerts were hampered by power and telecommunications failuresⁱ

Not all Emergency Alert messages issued reach the intended recipients. The SMS location-based messages were 81.31% successful; of SMS address-based messages, the success rate was 69.68%; and of the voice messages, the success rate was 69.54%.¹²¹⁶ The Inquiry was advised that reasons for individuals not receiving a message on the landline may include:

- the landline was engaged
- the individual didn't hear/answer the phone
- there was a power outage and the recipient has a cordless landline phone
- the landline telephone was outside the warning area
- the individual did not have a standard landline telephone
- the telephone is not registered to the correct address.

Reasons an intended recipient may not receive a text message include:

- text message inbox was full
- the mobile telephone was switched off or was not in a mobile telephone coverage area
- the last known location of the mobile handset was not within the warning area at the time of the emergency
- the individual has not updated their registered service address
- the individual travelled into a warning area after a message was issued
- the individual was in a mobile telephone blackspot.¹²¹⁷

While the NSW RFS is unable to advise the extent to which each of the above factors affected failure rates for Emergency Alerts during the 2019-20 season, the Inquiry received a lot of feedback through written submissions and at community meetings about the impact of power outages and associated loss of communications towers. Community members at the Lithgow meeting said that in areas of no mobile reception, such as Wolgan Valley (NBN landline only), once landlines went out due to power outages they could not receive emergency warnings.¹²¹⁸ The 2019-20 season demonstrated that resilient power and telecommunications networks are essential to ensuring community safety, as discussed in Chapter 4. The failure to receive warnings caused considerable community distress, as people felt there was no effort made to inform them of impending danger.

*Very quickly, the helicopter began dumping closer and closer to us, we could now easily see water being released from the buckets even through the treacherous smokey conditions. ... At this point, we had not received any warning to alert us of a fire heading directly towards Conjola Park. Our worst fears were about to become a reality.*¹²¹⁹

¹²¹⁵ Pamela Davis, Submission to the Inquiry.

¹²¹⁶ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 9 April 2020*.

¹²¹⁷ Ibid.

¹²¹⁸ Lithgow Community meeting on 25 February 2020.

¹²¹⁹ Christopher Price, Submission to the Inquiry.

*For us the real issue was on New Years eve when in fact fire did come to Bewong. Again some people left but if I recall correctly this time there were no phone messages because I think both mobile and landline phones were out.*¹²²⁰

The Inquiry is aware that Emergency Management Australia, in the Commonwealth Department of Home Affairs, has commenced a strategic review of the efficacy of new and emerging telephony-based emergency warning technologies with the aim of identifying options for future emergency warning systems.¹²²¹ The Inquiry supports this review.

5.9.1.6 ABC media was an essential source of information during the 2019-20 season

The ABC works across Australia with emergency services agencies to deliver warnings, alerts, information and news about disasters and emergencies on TV, radio, online and on mobile. Local stations strive to deliver timely, accurate and relevant information to affected communities, and will share information provided by community members who are invited to share their experiences, once they are safe.¹²²²

The ABC has committed to broadcasting warnings on the radio, social media and online as soon as possible after being told of a threat being posed to the community. During the summer, at peak emergency times, the ABC provided rolling broadcasts of the fire updates, interrupting regular programming to do so. To support its response, the ABC redirected resources to boost its emergency broadcasting and coverage. Staff were recalled from leave and teams and equipment were deployed interstate to support local teams in affected areas.¹²²³

Submissions received to the Inquiry highlighted the reliance on the ABC throughout the season:

*The ABC (and particularly ABC radio) should be commended for its coverage and information regarding the bush fires. We had our local ABC Radio on all the time.*¹²²⁴

*The ABC was our lifeline for 3 days. There was no one else keeping us up to date with what was going on in our local area.*¹²²⁵

Independent research commissioned by the ABC, which has been submitted to the Royal Commission into National Natural Disaster Arrangements, supported the views submitted to the Inquiry. Noting the figures apply to Australia, not just NSW, the research (based on a qualitative survey of more than 1,600 people and quantitative results from almost 400 more) found:

*60% of people in bush fire-affected areas said information from the ABC helped ensure their safety ... 81% of people were aware of the ABC as an information source and one in two used it as their main source of information during the summer crisis.*¹²²⁶

¹²²⁰ Vaughan Hirschausen, Submission to the Inquiry.

¹²²¹ Department of Home Affairs. (2019). Strategic Review of the Efficacy of new and Emerging Telephony-Based Emergency Warning Technologies: Terms of Reference.

¹²²² ABC Emergency. About ABC Emergency. Retrieved from www.abc.net.au/news/emergency/about/.

¹²²³ ABC, Submission to the Inquiry.

¹²²⁴ Heather Smith, Submission to the Inquiry.

¹²²⁵ Ian Cruickshank, Submission to the Inquiry.

¹²²⁶ Meade, Amanda. (2020, 2 June). Australians say ABC saved lives during summer bushfires, royal commission told, *The Guardian*. Retrieved from

While the ABC was clearly an essential source of information for people in bush fire affected areas, the Inquiry acknowledges that the constant media coverage of the bush fires more generally (not just the ABC) was also traumatising for some. A submission to the Inquiry stated that the continuous coverage by the ABC, including updates on where the fires were and who needed to evacuate was stressful,¹²²⁷ and another submission found the reporting by the ABC and commercial media served only to magnify the sense of threat and the accompanying stress.¹²²⁸

In its submission to the Inquiry, the ABC recommends increased collaboration between state and regional emergency authorities and senior ABC staff for emergency preparation, response and recovery purposes. In other states and territories, an ABC manager has been embedded in the State Operations Centre to coordinate the flow of information. In NSW, the ABC could be included in groups or committees coordinated by the Public Information Functional Area Coordinator.¹²²⁹ As the ABC is the national broadcaster, the Inquiry considers integrating a non-journalist from the ABC into the NSW public information arrangements would benefit communities in NSW, particularly when other sources of information are inaccessible due to power outages.

ABC radio can be people's only source of information in the event of power outages and communications tower failures. Currently, NSW RFS warnings advise the public to "listen to your local radio station", but understandably the NSW RFS is unable to be more specific about the radio station frequency in each area. The ABC recommends the inclusion of relevant local frequencies on signage boards to assist both the local community and travellers unfamiliar with the ABC Local Radio serving an affected area.¹²³⁰ The Inquiry supports this recommendation, particularly as the 2019-2020 bush fires occurred in towns that experience high visitor numbers during the summer holiday period.

Recommendation 65: That, in order to improve information flows and increase public awareness of ABC emergency broadcasts, Government:

- a) include an ABC Manager in the Public Information Functional Area Coordinator (PIFAC) team within the State Operations Centre
- b) strategically place roadside signage with local/regional ABC station frequency band throughout the State.

5.9.1.7 Tailored messages were given to tourists in areas under threat

The NSW RFS declared Leave Zones and Tourist Leave Zones for five areas in Southern NSW on 3 January 2020 in the lead up to the expected severe fire conditions on 4 January 2020. This was the first time this had been done and shows another way that practices evolved during the course of the season in response to the need to provide clear and unequivocal direction to the community – in this case, tourists holidaying on the South and Far South Coasts.¹²³¹

<https://www.theguardian.com/media/2020/jun/02/australians-say-abc-saved-lives-during-summer-bush-fires-royal-commission-told>.

¹²²⁷ Gabriele Curwood, Submission to the Inquiry.

¹²²⁸ Ian Bowie, Submission to the Inquiry.

¹²²⁹ ABC, Submission to the Inquiry.

¹²³⁰ Ibid.

¹²³¹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 12 May 2020*.

5.9.1.8 Doorknocking was also used to advise people to evacuate

In addition to Emergency Alerts and public information provided via the media, doorknocking is also a means of advising people to evacuate. Doorknocking during the 2019-20 season was undertaken by NSW RFS members supported by NSW State Emergency Service (SES) and NSW Police Force.

The Inquiry was advised that the NSW SES uses Collector, an app linked to a mapping and analytics platform (ARCGIS). This enables the SES to collect survey style information in the field and to capture spatial data at the same time. The ARCGIS platform then allows this information to be viewed spatially in real-time through reports and dashboards (provided data connectivity is strong). The Collector app was used in some locations (i.e. where doorknocking was conducted by SES personnel who were trained in using the app), and the data collected was reported to the NSW RFS and a record made. Where it was used, the app enabled rapid collection and reporting of doorknocking information.¹²³² There are clear public safety benefits associated with this approach, as it allows agencies to know which areas have been doorknocked in real time and the responses from households. NSW RFS uses the Collector app for building impact assessment. The Inquiry recommends that the NSW RFS and NSW SES work together to integrate both phases of the operation and use the same platform (Collector app) for the collection of data.

The NSW SES has advised the Inquiry that the Collector app is a free application that could be used by other NSW agencies, assuming they also have the capability to integrate the data from the app into agency operational systems. Given that a number of agencies are involved in doorknocking during emergencies (not just bush fires), a shared data gateway would be required to extract information from multiple agencies and present a consolidated view to decision-makers (e.g. Incident Management Teams).¹²³³ In light of the clear public safety benefits the Inquiry recommends NSW agencies work together to explore a shared data gateway to enable real-time information on evacuation doorknocking during emergency events.

Recommendation 66: That, in order to provide real-time information on evacuation doorknocking during emergency events, Government explore a shared data gateway for NSW agencies based on the NSW State Emergency Service Collector app and a common mapping and analytics platform.

5.9.1.9 Improvements are underway to improve cross-border information on road closures

Collaboration occurred between Transport for NSW and Queensland Transport and Main Roads to ensure consistent information was displayed on each jurisdiction's customer channels (NSW Live Traffic and QLDTraffic) across the neighbouring border. Although NSW Live Traffic and QLDTraffic are coordinated with third party apps (i.e. Google Maps, Apple Maps, Waze) and inter-jurisdictional platforms (i.e. VicTraffic), these did not display the same data as the state customer channels. This created confusion for travellers and evacuees.

¹²³² SES (NSW State Emergency Service). (2020). *Advice to the Inquiry provided 13 March 2020*.

¹²³³ Ibid.

The Inquiry was informed that the data specifications for Waze and Google mapping apps did not provide for real-time removal of incident data from NSW Live Traffic from their platform. A manual work around was put in place to ensure road openings were reflected where possible during this period. Upgrades with third party platforms are now occurring, and Transport for NSW is also working with VIC Roads to establish the same data sharing capabilities to ensure consistency of public messaging across NSW Live Traffic and VIC Traffic.¹²³⁴

5.9.2 Fires Near Me app

Key points

- The community relied heavily on the Fires Near Me NSW app as a source of information during the 2019-20 fire season. Feedback was mixed – while some found it incredibly useful, others noted limitations.
- Several areas for improvement were identified, the most critical being the need to integrate information about fires bordering NSW in other states and territories. Other suggested improvements included predicting where and when fires may spread, and including related data from other apps (e.g. road closures, local weather) to provide a consolidated source of information.
- While Fires Near Me is an important source of information, it should not be relied upon as the ‘single source of truth’, particularly when fires are spreading quickly. Emergency alerts, public warnings and evacuation orders should be heeded, regardless of whether these align with Fires Near Me.

5.9.2.1 The community relied heavily on the Fires Near Me app during the 2019-20 season

The Fires Near Me NSW smartphone application (app) provides information on bush and grass fires across NSW, including incidents managed by the NSW RFS, Fire and Rescue NSW, NPWS and Forestry Corporation of NSW. It also includes links to emergency and preparation information, as well as fire danger ratings. Users are able to establish watch zones on their device and receive notifications when a new incident starts or moves into their watch zone, when there is a total fire ban declared, when the alert level increases or if a Major Fire Update is released. Users are also able to share information about fires with other users (e.g. via text message).¹²³⁵

¹²³⁴ TfNSW (Transport for NSW). (2020). *Advice to the Inquiry provided 15 May 2020*.

¹²³⁵ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 17 March 2020*.

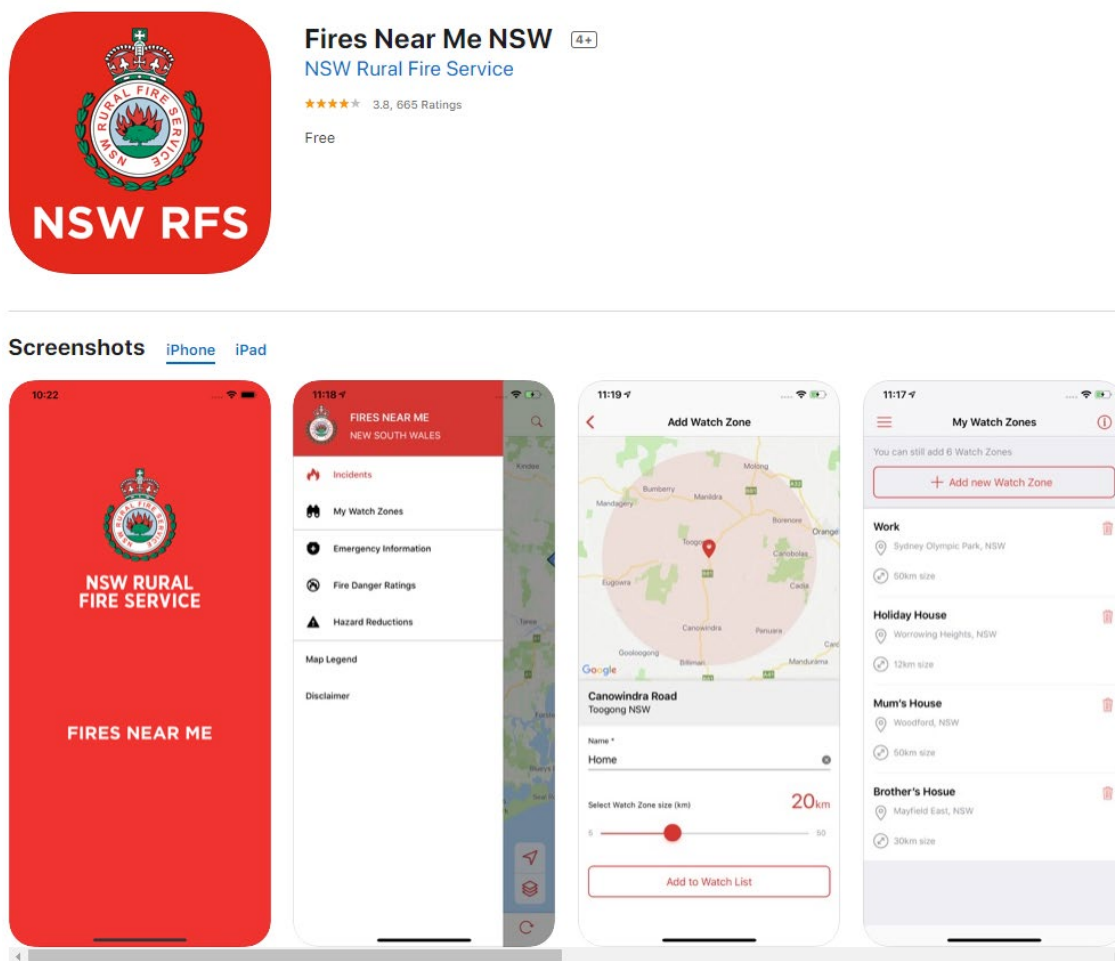


Figure 5-7: Fires Near Me NSW app screenshot.¹²³⁶

ARQ Group owns the intellectual property for the app. NSW RFS has an unlimited licence that allows it to use, modify and provide the app to others. ARQ Group retains the ability to commercialise the app. The app has been provided to a number of other states and jurisdictions to develop their own applications (e.g. South Australia). The Inquiry understands that ARQ Group is in the process of selling parts of its business, and the NSW RFS has received assurances that the sale will not impact on Fires Near Me NSW. The app and its middleware are hosted on Amazon Web Services, which provides a scalable solution as capacity can be increased automatically based on demand.

Fires Near Me had very high levels of uptake during the 2019-20 fire season. There were 2.74 million new downloads of the app between 1 July 2019 and 23 February 2020,¹²³⁷ and 'fires near me' was the most searched term on Google (Australia) in 2019.¹²³⁸ The NSW RFS advised that, in November alone, the app was used more than 30 million times to access fire information, with 5 million of those searches in one day (12 November 2019,

¹²³⁶ Apple. App Store Preview. Retrieved from <https://apps.apple.com/au/app/fires-near-me-nsw/id370891827>.

¹²³⁷ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 17 March 2020*.

¹²³⁸ Moustafa, Abi. (2019, 11 December). 'Fires near me' tops Google Australia's most searched words in 2019, 7 News. Retrieved from <https://7news.com.au/technology/google/fires-near-me-tops-google-australias-most-searched-words-in-2019-c-598365>.

when catastrophic fire danger was predicted for Greater Sydney, Greater Hunter and Illawarra/Shoalhaven). This level of engagement illustrates the community's increasing reliance on the app as a source of accurate information, a trend which the Inquiry expects to continue into the future. It is therefore essential that Fires Near Me is optimised to the greatest extent possible, and that clear guidance is given to users on any limitations to ensure they heed relevant public warnings – even if these don't align with the information provided on the app.

In submissions to the Inquiry, many people commented on how useful the Fires Near Me app was during the 2019-20 fire season. However, the Inquiry also received a range of submissions highlighting the need for improvements to the app.

*I tracked the fire's progress on the 'Fires Near Me' app and evacuated my property on 6/9/2019 at 1600hrs within 50 minutes of the 'watch and wait' notification changing to 'evacuate'. The official evacuation order was issued by the RFS later that evening.*¹²³⁹

I think the Fires Near Me app is ingenious. This really helped people to have direct and immediate information of what was happening. Helpful improvements would be to shade the back burns different to wildfire and to have burn lines shaded red where active fire was as compared to burnt areas from previous days.

*We were glued to the 'Fires Near Me' app. I thought it coped really well considering. At the time we knew it was not up to date with the extent of the fires. Knowing what we do now – there was no way it could have kept up, the fire moved so fast & who could have ever imagined it?*¹²⁴⁰

*The "Fires Near Me" App was invaluable in linking local residents to updates regarding the local bushfire situation, but it has been acknowledged by the NSW RFS that "real time" maps and information was delayed and did not give accurate information in emergencies.*¹²⁴¹

*... the RFS information and mapping system performed very well in issuing warnings and the projected spread of the fires. The RFS App "Fires Near Me" is particularly useful as it gives distances to fires, is updated frequently and has accompanying text information.*¹²⁴²

The NSW RFS advised the Inquiry that the following improvements to the app are in the final stages of development:

- a push notification inbox – currently if a user receives a push notification (e.g. fire weather outlooks) and taps on it, the notification cannot be seen again; the inbox will allow users to see notifications sent in the past 48 hours
- user profiles – currently a user must establish their 'watch zones' separately on each device; user profiles will enable users to login on multiple devices and have the same experience, without needing to update watch zones on individual devices.
- updates to user experience in relation to mapping – current map display is based on internal NSW RFS technology for operational purposes. NSW RFS and ARQ Group are exploring potential improvements to display the active edge of fires.

¹²³⁹ Cheryl Hook, Submission to the Inquiry.

¹²⁴⁰ Jane Lawler, Submission to the Inquiry.

¹²⁴¹ Helen Mower, Submission to the Inquiry.

¹²⁴² Baden Cameron, Submission to the Inquiry.

- opportunities for cross-border mapping, including the possibility to expand across state borders. This is additional to enhancements to cross-border alert warnings, which is in the early stages of development.
- the feasibility of displaying 'warning areas' as shaded areas on a map, predicted path of incidents and information about likely impacts.
- including tailored information based on a user's pre-filled bush fire survival plan and crowd sourced information such as photographs and videos.¹²⁴³

The Inquiry supports the improvements already underway. The Inquiry understands the NSW RFS is investigating a continuous improvement model with the app provider, including a roadmap of future improvements. This roadmap should be guided by the Inquiry's recommendations to ensure these improvements reflect user needs.

5.9.2.2 It is essential that Fires Near Me incorporates information on cross-border fires

As the 2019-20 fire season demonstrated, bush fires do not respect state borders. Fires Near Me already includes bush and grass fires in the ACT,¹²⁴⁴ but does not include information from Victoria and Queensland. The Inquiry found that the lack of information on cross-border fires made it difficult for people living near the Victorian and Queensland borders to get an accurate picture of what was happening in their local area and make an informed decision about how they should respond. Rather than being able to see cross-border fires on Fires Near Me, people needed to switch between other jurisdictional apps (e.g. VicEmergency) which was time-consuming and stressful in an emergency situation.

*NSW has a really great user friendly web site for the latest information on bushfires. However, that information does not include areas in the NSW/QLD border area. The bushfires were in the border areas upwind of where we live. So if you looked at the NSW Fires Near Me app/web site you would not see that there is a serious bushfire coming down from the QLD side of the border. This can create a false sense of security.*¹²⁴⁵

*Lack of coordination was a problem, especially matching Victorian info and NSW apps, and other web-based information re the progress of the fire across the Border. Generally information was not updated frequently enough.*¹²⁴⁶

*The issuing of incident information via website, apps, radio and other mediums to the community must not be restricted by state or organisational borders. There is a need to enhance the NSW community emergency / bush fire app and website that can provide incident information and warnings to communities on state and territory borders (ACT, Queensland, Victoria and South Australia). The design will need to provide transparency between agencies and jurisdictions.*¹²⁴⁷

The NSW RFS has advised there is a national version of the app, called Fires Near Me Australia, which is managed by the NSW RFS and includes data feeds from the following jurisdictions and agencies:

- NSW – NSW Rural Fire Service (including feed from ACT Emergency Services Agency)

¹²⁴³ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 1 June 2020*.

¹²⁴⁴ Ibid.

¹²⁴⁵ Patrick Deprez, Submission to the Inquiry.

¹²⁴⁶ Eden Community Access Centre, Submission to the Inquiry.

¹²⁴⁷ Craig Lapsley, Submission to the Inquiry.

- Queensland – Queensland Fire and Emergency Services
- Victoria – Emergency Management Victoria
- Tasmania – Tasmania Fire Service
- South Australia – Country Fire Service
- Western Australia – Department of Fire and Emergency Services
- Northern Territory – Police Fire and Emergency Services

The NSW RFS advised the Inquiry the national app was introduced around a decade ago, and since then all jurisdictions have developed bespoke apps (or websites) including products which cover more hazards than bush fires.¹²⁴⁸ For example, the VicEmergency app covers all types of emergencies in Victoria, and the ACT Emergency Services Agency has advised it is building a new app to deliver an all-hazards approach to emergency information.¹²⁴⁹ The national app does not provide the same level of functionality as the NSW version, most notably not providing watch zone or push notifications.

Separate to the national app, there are also differences in the way incidents in each jurisdiction are displayed to users, as agencies communicate information differently (e.g. Victoria assigns warnings to communities/geographic areas, whereas NSW assigns warnings to fire incidents). The proposed Australian Warning System covering bush fire, flood, cyclone, severe weather and extreme heat events being developed by the AFAC Warnings Group seeks to resolve these jurisdictional differences. As discussed in Chapter 3, the Inquiry recommends this work be prioritised.

While the NSW RFS maintains the national app as a service to the community, it is no longer actively promoted and has much less uptake than the NSW version (362,587 downloads in 2019-20 to date, compared to 2.74 million downloads of Fires Near Me NSW).¹²⁵⁰ The Inquiry considers there is potential in the longer term for a national app reflecting the outcomes of the Australian Warning System currently underway. However, given the importance of cross-border information to community safety and the high uptake of Fires Near Me NSW over the last season, in the short-term the NSW RFS should incorporate information on Victorian and Queensland border fires into Fires Near Me NSW.

While the Inquiry understands there are inconsistencies between datasets that would need to be resolved in order to display fire information from multiple jurisdictions on a single app (e.g. attaching warnings to geographic areas vs. fire incidents), these issues are surmountable and can be worked through. There don't appear to be any privacy or other legislative restrictions that are impeding data-sharing across jurisdictions, as evidenced by the inclusion of ACT fire information in Fires Near Me NSW.

Recommendation 67: That, in order to ensure people can access clear information on cross-border fires, the NSW RFS:

- a) incorporate information on fires in neighbouring states and territories into Fires Near Me NSW
- b) collaborate with other states and territories to develop a national app as part of the Australian Warning System being developed through the AFAC Warnings Group.

¹²⁴⁸ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 1 June 2020*.

¹²⁴⁹ ACT Emergency Services Agency. (2020). *Advice to the Inquiry provided 15 May 2020*.

¹²⁵⁰ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 1 June 2020*.

5.9.2.3 Future improvements should focus on an inclusive user experience and be clear on limitations

The Inquiry heard that visually impaired users had difficulty accessing Fires Near Me information as current functionality does not allow text to be enlarged and maps are not accessible.¹²⁵¹

*I downloaded the Fires Near Me app, as constantly instructed. My children set up my watch zones, as this part of the app was inaccessible to me. I received regular notification of activity in my watch zones. Clicking on these notifications took me only to a map, which tells me nothing.*¹²⁵²

*Australian Communications Consumer Action Network (ACCAN) advises against an over-reliance on radio and other mainstream services or applications for the provision of emergency information for consumers. For example, maps apps showing maps of areas affected by fires or power outages are not always accessible, and media reporting that relies on or refers exclusively to these maps may leave people who are blind or have vision impairment with limited information about where bushfires are currently located or what actions they should take.*¹²⁵³

In order to provide an inclusive experience for all NSW citizens, the Inquiry recommends the NSW RFS include a text enlargement functionality in the future improvements roadmap as a priority area for action.

The Bushfire and Natural Hazards CRC has noted that ‘when the community perceives that ... environmental cues, such as the weather outside, are in conflict [with] the formal instructions agencies are issuing, it creates uncertainty about the right action to take and the perceived urgency of when to do it’.¹²⁵⁴ The Inquiry also heard that the information presented on Fires Near Me did not always reflect emergency warnings issued by text messages, or people’s own observations of fires, which created confusion about what they should do. In some cases, the Inquiry heard that people could see the fire approaching or smell smoke, but Fires Near Me did not reflect the actual proximity of the fire. While the Inquiry understands there are technological limitations that sometimes affected the accuracy of Fires Near Me (discussed further below), the community’s reliance on Fires Near Me requires a clear statement of these limitations to ensure people heed public warnings and trust their own observations when making decisions, rather than solely relying on the app as the ‘single source of truth’.

The Australian Communications Consumer Action Network (ACCAN) was of the view that consumers came to realise that they could not rely exclusively on the app for up to date information about the active fires in their area, and instead turned to other sources of local information.¹²⁵⁵ However, it was clear from the community’s feedback to the Inquiry that this was not the case across the board. A clear statement about the app’s limitations and the importance of other information sources should therefore also be included as a priority in the

¹²⁵¹ Meeting with The Hon Gareth Ward MP, Minister for Family and Community Services on 13 May 2020.

¹²⁵² Fiona Woods, Submission to the Inquiry.

¹²⁵³ Australian Communications Consumer Action Network (ACCAN), Submission to the Inquiry.

¹²⁵⁴ Bushfire and Natural Hazards CRC. (2020). Addressing Conflicting Cues During Natural Hazards: Lessons From Emergency Agencies, Hazard Note, Issue 72. Retrieved from <https://www.bnhcrc.com.au/hazardnotes/72>.

¹²⁵⁵ Australian Communications Consumer Action Network (ACCAN), Submission to the Inquiry.

future improvements' roadmap. This statement should also appear as a 'push notification' for people who are within the vicinity of a fast-moving fire, so it is clear the app can be inaccurate in these circumstances and should not be relied upon as the sole source of information.

5.9.2.4 Fire spread prediction maps and traffic/weather conditions could also be included

The 2019-20 season was the first time the NSW RFS routinely published fire spread prediction maps to the public. These maps were published on days when dry conditions and dangerous fire weather were expected to result in significant and dangerous fire runs. The maps were provided on the NSW RFS website due to the size and detail of the maps (sometimes up to 10 MB). Community members noted the usefulness of these fire spread prediction maps, and suggested they be incorporated into Fires Near Me. The NSW RFS has advised this would require the maps to be digitised and would need to be tested with users to ensure the user experience meets community needs and expectations.¹²⁵⁶ The Inquiry notes that appropriate caution is needed when relying on fire spread prediction maps, as they are a forecast based on what is known at the time rather than a guaranteed prediction of what will occur.

The Inquiry received mixed feedback about the breadth of information covered by the app. Some community members commented on the need to switch between multiple apps to understand fire danger (Fires Near Me NSW app), local traffic conditions and road closures (Live Traffic NSW app) and weather conditions (BOM Weather app), and that this could be improved by incorporating this information into a single app. However, other community members noted the app's simplicity made it easy to use compared to other more complex apps (e.g. VicEmergency app), and that additional information would negatively affect its functionality.

The Inquiry considers the current focus on fire information is appropriate, and that separate apps for other types of information should remain.

The Inquiry recommends the immediate priorities should be to be clear about the app's limitations as this is essential to community safety, include information on cross-border fires, and improve the user experience for people with visual impairments.

5.9.2.5 Technological limitations sometimes affected the app's relevance

Another major area for improvement in the app, identified by both the community and fire authorities, was the need for up-to-date information. At times some fires were not updated on the app even though the fire was continuing to spread.

*There was definitely frustration with the RFS Fires Near Me app not being updated regularly. When you can't see for the smoke, but you know the fire is still burning that app is your only source of information*¹²⁵⁷

In discussions with the NSW RFS and IMTs, it was clear that fire authorities knew the level of reliance being placed on the app and kept it updated to the best of their ability. For example, the Glen Innes IMT was aware the community relied heavily on the app during the

¹²⁵⁶ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 1 June 2020*.

¹²⁵⁷ Dianne Williams, Submission to the Inquiry.

February 2019 fires, and made a conscious effort to get information out as quickly as possible.¹²⁵⁸

A number of constraining factors sometimes limited the NSW RFS' ability to update the app in real-time, including:

- the significant size of some fires made data uploads difficult due to the sheer volume of data – for example, the Hawkesbury IMT advised that the Gospers Mountain fire was so large the map needed to be 'cut' into 10 different areas to enable it to be uploaded to the app, which resulted in delays
- smoke and weather conditions (primarily wind) often affected an IMT's ability to conduct regular aerial line scans, which fire authorities rely on to track the size and spread of fires – in these circumstances, ground intelligence from local brigades was used as a source of information; however, this had its own limitations in very large fires with long perimeters.

As noted in Chapter 2, the Inquiry has been advised that the NSW RFS expects two Cessna Citation aircraft with Overwatch TK-9 Imaging System to be ready for the 2020-21 season,¹²⁵⁹ which will greatly improve the RFS' ability to detect and track the spread of fires and should improve fire authorities' ability to update the Fires Near Me app more regularly.

Recommendation 68: That the NSW RFS include the following priorities in the Fires Near Me improvements roadmap:

- a) text enlargement functionality
- b) a clear statement about the app's limitations and the importance of heeding public warnings and relying on personal observations
- c) fire spread prediction maps on extreme/catastrophic days
- d) update fire map information as technology improves.

5.10 EVACUATION

Key points

- There was a record number of evacuation centres during the 2019-20 season, and a record number of centres that were operating at the same time. There are arrangements in place to provide a trained 'surge capacity' to support evacuation centres. However, these weren't sufficient to cope with the level of demand and in some cases resulted in untrained staff managing evacuation centres.
- There is currently no requirement that Local Emergency Management Committees (LEMCs) identify alternate power sources for potential evacuation centres in the event that power is lost, which meant some evacuation centre sites were not fit-for-purpose once power outages occurred.
- There wasn't a centralised system in place that enabled people at evacuation centres to tell their story once only, and instead people were asked to provide the same information multiple times which added to their trauma. The same information was requested by local councils, State government agencies, Commonwealth government agencies and NGOs, and there was no mechanism for people to allow their information to be shared.

¹²⁵⁸ Meeting with Glen Innes Incident Management Team on 9 March 2020.

¹²⁵⁹ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 22 June 2020*.

- In some cases, aged care facilities did not have appropriate evacuation plans in place and/or their plans did not comply with evacuation guidelines. This led to vulnerable people being left without support in evacuation centres, and formal complaints that they breached their duty of care.
- While the Inquiry acknowledges that some vulnerable people left in evacuation centres should have been better supported by their carers (e.g. people from aged care facilities), there was also evidence that support for vulnerable people needs to be improved more broadly, including better guidance to evacuation centre staff.
- The large number of people who evacuated with animals required the establishment of additional sites, called 'Animal Safe Places'. However, there was a lack of clarity about how to ensure people received the same level of welfare support if they attended an Animal Safe Place, as opposed to an evacuation centre.

5.10.1.1 One evacuation order was made during the 2019-20 season

Evacuation in NSW is a multi-agency arrangement, with the decision to evacuate made by the combat agency for the hazard. Decisions to undertake planned evacuations are made by the Incident Controller and, where possible, in consultation with the NSW Police Force and/or relevant Local Emergency Operations Controller (LEOCON). The actual activity is coordinated by the NSWPF and/or LEOCON. As part of the decision-making process when considering an evacuation order, the NSW RFS Commissioner and/or Incident Controller refers to the *State Bush Fire Plan*, the Bush Fire Coordinating Committee *Community Safety and Coordinated Evacuations Policy* and the *Evacuation Management Guidelines*.

Irrespective of this, the NSW Police Force always has discretion to undertake emergency evacuations at any time if considered necessary (pursuant to section 60L of the *State Emergency and Rescue Management Act 1989*). The Inquiry considers that the current arrangements are sufficient, and notes that neither the NSW Police Force nor the emergency service organisations have sought increased powers to enforce evacuations.

Specific evacuation arrangements are developed and recorded within Local Emergency Management Plans (EMPLANs) prepared by Local Emergency Management Committees (LEMCs). These plans cover assessment of the circumstances potentially triggering evacuations, the operational arrangements for managing these, evacuation routes and evacuation centres. However, the guidelines do not specifically mention the need to plan for changes to the population demographic caused by holiday makers, or other seasonal changes that should be taken into account. The South Coast of NSW has a seasonal surge of tourism during the Christmas holidays, and LEMCs should be required to factor such considerations into their planning.

The Inquiry notes that the decision to evacuate is complex and requires careful consideration to ensure residents are not placed at greater risk. The safest option during a bush fire is leaving early (as discussed previously in this Chapter). However, it is noted that residents may choose to shelter (or stay and defend) in a well-prepared property. The NSW RFS advised that late evacuation can be dangerous, exposing people to dangers such as fire, smoke, heat and congested roads. As such, though it may be desirable to evacuate people from areas affected by bush fire, it could be potentially safer to leave them in place. Throughout the 2019-20 bush fire season, the NSW RFS used community messaging and various technology platforms (i.e. social media, NSW RFS website, Emergency Alert as discussed previously in this Chapter) to encourage residents to leave early or shelter in place in some instances.

One evacuation order was made by a NSW RFS officer for the Jingellic township (Greater Hume LGA) on 4 January 2020. This order was made using powers prescribed under section 37 of the *State Emergency and Rescue Management Act 1989*, noting a State of Emergency declaration was in place at the time. The decision to issue the evacuation order was based on:

- predicted weather and associated fire behaviour
- advice from local landholders
- advice from fire fighting personnel
- consultation with the State level personnel, and
- consultation with LEMC members and Victorian liaison officers.

5.10.1.2 The scale of evacuations during the 2019-20 season has not been seen before in NSW

Evacuation centres are established to meet the immediate needs of disaster-affected people including accommodation, food and water. While best endeavours are made to support evacuated people, it is also important to remember that the arrangements are in place to keep people safe during an understandably difficult time.

The scale of evacuation required throughout 2019-2020 has not been seen in NSW before. The Welfare Services Functional Area (WSFA – a business unit in Resilience NSW) advises that evacuation centres were operating at 88 sites for over 100 days, with the first opening at Yamba on 6 September 2019 and the last centres closing in Bega, Narooma and Moruya on 4 February 2020.¹²⁶⁰ Welfare Services opened evacuation centres on more than 100 occasions, registered approximately 30,000 evacuees and were able to accommodate at least 8,000 people.¹²⁶¹

Welfare Services was required to scale up quickly to respond to demand, increasing from four centres on 7 November to 13 centres the following day. Welfare Services managed over 10 centres in different locations in Northern NSW, with a peak of 21 and 23 centres on 11 and 12 November 2019.¹²⁶² Fires continued in the north of the state, but from December the evacuation and welfare response focus shifted to the south when evacuation centres opened in Batemans Bay and Ulladulla.

Safe access by road was essential to ensuring people could access supplies, evacuate their properties and return home afterwards, which has been previously discussed in Chapter 4. The following sections examine the other elements of people's experiences during evacuation.

5.10.1.3 More evacuation centre staff should be trained well before an event occurs

In NSW, the overall coordination of evacuation centres is managed by Welfare Services and staffed by Department of Communities and Justice (DCJ) employees. DCJ staff are supported in evacuation centres by volunteers from:

- the Australian Red Cross which provides personal support including the reception and registration of disaster-affected people
- Anglicare, which supports Red Cross and will also source and deliver basic material aid

¹²⁶⁰ Resilience NSW. (2020). *Advice to the Inquiry provided 13 May*.

¹²⁶¹ WELFAC (Welfare Services Functional Area Coordinator). (2020). *Advice to the Inquiry provided 17 March*.

¹²⁶² Resilience NSW. (2020). *Advice to the Inquiry provided 13 May*.

- Salvation Army, which provides catering services
- the Uniting Church in Australia NSW/ACT Synod, which coordinates the Disaster Recovery Chaplaincy Network.

Welfare Services Functional Area has also developed a team of 46 alumni staff to support disaster operations. These are retired staff who have previously worked in welfare operations and reside throughout the State. The team facilitates swift deployment into disaster-affected areas, frequently for extended periods at short notice.¹²⁶³

The evacuation centres frequently opened with little notice, and experienced an immediate overwhelming demand for services, with one submission noting that there was an hour and a half wait to register when evacuating from the Currowan Fire.¹²⁶⁴ The Inquiry understands that the need to evacuate is inherently stressful. One woman's submission described leaving her property. She and her 15-year-old son were in one car, and her husband behind them in the second car:

*My husband had difficulty getting out due to flames in the grass, but he managed to stamp on them and then drive through. My son ran back to me in the car running over/around the grassfire ... I wasn't thinking straight and realised I was driving with the handbrake on.*¹²⁶⁵

This illustrates how disaster-affected people arrive at evacuation centres under great stress, and the need for them to be met by trained staff prepared to provide assistance. Unfortunately, the duration and widespread nature of the bush fires limited Welfare Services' ability to always respond with trained and experienced staff, and necessitated the mobilisation of more staff than usual, particularly over the Christmas/New Year period.

In an effort to respond to the potential demand, an expression of interest was issued in early December to non-frontline service staff in the DCJ, and additional staff were placed on standby to enable personnel to operationalise every evacuation centre. This largely occurred, except staff could not be sent to Bermagui due to the timing of the request to establish the evacuation centre, and the fire then causing the evacuation centre to become isolated.¹²⁶⁶ Welfare Services also needed to navigate road closures due to fires when moving staff to needed locations. On the south coast, both the Princes Highway and Kings Highway were affected by both active fire and the associated smoke, and by fire affected hazardous trees and other infrastructure damage.¹²⁶⁷

Comments made during the Mid North Coast Community Consultation on 23 April 2020, and in the submission from Eurobodalla Council, identified limited staffing resources from DCJ. In the instance of Eurobodalla Council, it was referring to the response on New Year's Eve, which resulted in council staff volunteering to supplement the resources at short notice and enabling the opening of three evacuation centres to the community.¹²⁶⁸

The experience of one staff member is outlined in Box 5-1.

¹²⁶³ Resilience NSW. (2020). *Advice to the Inquiry provided 13 May*.

¹²⁶⁴ Laurita Jones, Submission to the Inquiry.

¹²⁶⁵ Sara Eastway, Submission to the Inquiry.

¹²⁶⁶ WELFAC (Welfare Services Functional Area Coordinator). (2020). *Advice to the Inquiry provided 17 March*.

¹²⁶⁷ Eurobodalla Shire Council, Submission to the Inquiry.

¹²⁶⁸ Ibid.

Box 5-1 A DCJ staff member experience of evacuation support

In early December 2019 Joanne, an Acting Senior Policy Officer in a policy team in DCJ, responded to an internal email requesting interested DCJ staff to register for deployment to an evacuation centre.

Jo flew from Sydney on 1 January 2020 and was at the Eden Evacuation Centre from 1-4 January 2020, generally operating with one other welfare person from DCJ. Neither of them had any experience in emergency operations, and Jo had only received the links to the online FACS course, *Disaster Welfare Registration and Immediate Assistance*, at about 8pm the night before when she was on her way out the door for a New Year's Eve party. The request that she deploy had come in a few hours earlier that day. Due to the timing of receiving the online information, coupled with her prior commitments, Jo did not complete the online training.

At the Eden Evacuation Centre Jo and her colleague worked 7am-7pm shifts, when they were replaced by two night staff. On the evening of 4 January 2020, when there were about 200-250 evacuees in attendance, they were required to evacuate from Eden.

At about 6pm, the Welfare Services Functional Area Coordinator (WelFAC) advised there was a chance that the fires would come through Eden (predicted to occur at about midnight, if at all), and that they should be prepared to evacuate the evacuation centre – but to not say anything until transport could be arranged. After speaking to the WelFAC, Jo and her partner discussed the situation with two police officers and a paramedic who had recently arrived.

Once they had confirmation that buses were coming, evacuees were notified and asked to queue in order of priority (i.e. elderly first). Some people left in their own vehicles for Bega/Merimbula, and others self-evacuated to the Eden wharf. Extra police arrived with the buses to help crowd control and load bedding material. Jo believes that they evacuated approximately 150 people to three different evacuation centres: the Bega Civic Centre (set up that night), Merimbula Sapphire Club (an already established evacuation centre) and the Tura Beach Country Club (set up that night). By the time the buses started to leave Eden, it was approximately 8pm.

The evacuation was managed by the police officers, who were supported by Jo and her colleague, the two-night shift Welfare staff members, and the paramedic.

The police managed the flow of people onto the buses and directed the buses to where they needed to go. Jo and her partner filled their rental van with food and supplies for the evacuation centre (and were assisted by some NSW RFS Volunteers who had arrived). Jo and her partner left after the buses had gone, and initially didn't know where they were going, but after catching up with the police escorted buses, they arrived at the Bega Civic Centre to assist in establishing the evacuees there. The two other Welfare staff (the night shift) went to the Merimbula Sapphire Club and assisted there.

The next day, Jo and her partner did the day shift at the Tura Beach Country Club.

Jo's experience is an example of the difficult operating environment that staff worked in during the 2019-20 bush fire season. The Inquiry noted that Jo did not receive any training information until the night before her deployment, and the Inquiry considers that this could have been provided to her when she first indicated her willingness to be deployed. Such a practice would give untrained staff a greater amount of time to develop a base level of understanding of the expectations on DCJ staff working in evacuation centres.

The staffing arrangements by DCJ personnel are voluntary, and it can be difficult to ensure staff are appropriately located throughout the State, particularly when the emergency is affecting a widespread geographical area, thus creating a simultaneous need in multiple communities. The Inquiry recommends that Welfare Services look to expand the cohort of personnel able to assist in the initial establishment of evacuation centres, which often needs to be done on short notice. This should include providing training to council and NSW

regional staff throughout NSW and may reduce instances of staff not being able to reach evacuation centres due to road closures caused by the hazard itself.

In addition, the Inquiry heard from evacuation centre staff that there was significant willingness from community members to assist at evacuation centres, either in general duties or to volunteer in particular skilled areas (e.g. GPs). The Inquiry recommends interested community members should also have access to training to build community resilience and provide an opportunity for people to actively participate in responding to a disaster, which has been shown to help process trauma. The Inquiry suggests the NSW Volunteering online portal be used to enable people to register their interest.

Recommendation 69: That, in order to ensure evacuation arrangements can be scaled up when needed, Resilience NSW:

- a) ensure staff who are willing to be deployed to evacuation centres are trained as soon as possible to bolster evacuation centre staff surge capacity
- b) train council and NSW government regional staff in evacuation centre establishment and management, supported by a one-page 'start up sheet' for opening an evacuation centre
- c) enable interested community members to be trained to assist in evacuation centre establishment and management and provide an avenue for skilled volunteers to register their interest
- d) develop an exercise for the management of multiple evacuation centres dealing with large numbers of people for a protracted period over a widespread area.

While additional work is needed to ensure evacuation can be scaled up, the Inquiry notes that services were put under unnecessary additional strain in some areas as a result of people using evacuation services when they could have returned home or made alternative arrangements. This was reinforced by the State Emergency Operations Controller who stated:

*Batemans Bay evacuation centre became a de facto caravan park, with scores of people who did not need to be there and overwhelmed the assistance that WelFac and NGO bodies could provide ... In some respects, it was like a carnival atmosphere with the side show of helicopters, police, army and politicians keeping people entertained and many simply stayed to be part of the experience. All this much to the detriment of the real people in need.*¹²⁶⁹

While this was clearly not the case across the board, it should be noted that some pressure on evacuation services could have been alleviated if people who were able to return home had done so.

The State Emergency Operations Controller also noted generally about evacuation centres that:

Many complaints were received, more often from influencers [i.e. advocacy groups] rather than evacuees. Cleanliness, food quality, entertainment and communications

¹²⁶⁹ SEOCON (State Emergency Operations Controller). (2020). *Advice to the Inquiry provided 8 March 2020*.

*were all issues at the larger centres. Cleaning hours were increased and numbers of people preparing food strengthened.*¹²⁷⁰

5.10.1.4 Further work is needed to ensure evacuation centres are fit-for-purpose

An evacuation centre is generally an existing facility with appropriate infrastructure that can accommodate and provide basic services with little supplementation. Such centres may be registered and/or community clubs, community halls, Department of Sport and Recreation facilities and even schools and universities.¹²⁷¹

As part of the evacuation preparedness process, the LEMC, in close consultation with combat agencies, is responsible for the identification and evaluation of potential evacuation centres. When an evacuation centre is activated by the Incident Controller or Emergency Operations Controller, Welfare Services will be notified, and the evacuation centre will be established and managed by DCJ, with the assistance of non-government organisations.

The facilities used for the evacuation centres varied from church halls to bowling and other clubs. Clubs NSW noted that at least 38 clubs served as evacuation centres, taking in 24,000 displaced persons, and having to respond to the diverse needs of the evacuees, which included people who had a disability, the elderly and mothers with newborns.¹²⁷² Despite the arrangements in place for LEMCs to identify evacuation centres in the local area, the Clubs NSW submission (which recommends that the Government proactively identify clubs in regional NSW which are capable of acting as an evacuation centre) indicates that this has not been well communicated. The Clubs NSW submission goes on to recommend that the Government ensure that each identified club clearly understands which agency will direct whether the club is to be an evacuation centre, and what assistance the club will receive.¹²⁷³

By contrast, the five villages of North Bendalong, Bendalong, Manyana, Cunjurong Point and Berringer Lake were served by a community-facilitated and organised emergency centre at the Yulunga Hall in Manyana, which became a coordination centre for community-related activities, a medical treatment and triage centre, a distribution centre for donated goods and a community information point that operated for nine days with limited communications and no power from 31 December 2019 onwards.¹²⁷⁴

Recommendation 70: That, in order to ensure evacuation centres are fit-for-purpose, Resilience NSW work with Local Emergency Management Committees (LEMCs) to:

- a) update the guidelines for LEMCs identifying evacuation centres to require a risk assessment of potential locations, which should include identifying alternate sources of power for use by evacuation centres and recording these appropriately
- b) review existing evacuation centre locations to assess compliance with updated LEMC guidelines and report to the State Emergency Management Committee on their suitability.

¹²⁷⁰ Ibid.

¹²⁷¹ SEMC Evacuation Working Group. (2014). NSW Evacuation Management Guidelines. Retrieved from https://www.emergency.nsw.gov.au/Documents/publications/guidelines/Guideline_Evacuation-Management.pdf, p 27-28.

¹²⁷² Clubs NSW, Submission to the Inquiry.

¹²⁷³ Ibid.

¹²⁷⁴ Yulunga Reserve Committee Manyana, Submission to the Inquiry.

5.10.1.5 People who have been evacuated should only have to tell their story once

People attending an evacuation centre should be registered upon arrival. This should be done by the Red Cross using *Register. Find. Reunite* (RFR), a computer-based system that is operated and managed by the Australian Red Cross on behalf of the Commonwealth, state and territory governments. As its name suggests, the system is used to register, find and reunite all persons involved in an emergency event.

The system can register persons by several methods:

- a person's details are registered by a police officer or emergency service volunteer on a paper form – the form is then forwarded to a centre and transcribed into the online RFR system
- a person registers their own details into the online RFR system
- a police officer or emergency volunteer registers a person's details in the online RFR system
- a person phones the Public Information and Inquiry Centre and has a volunteer call-taker register the caller's details into the online RFR system.

The Australia-New Zealand Emergency Management Committee (ANZEMC) launched the RFR system in 2013 as a national means of conducting the disaster victim registration (DVR) process. In NSW the NSW Police Force (NSWPF) manages the DVR process. The NSWPF is also responsible for commissioning the use and application of the RFR system.

The NSWPF has a current Memorandum of Understanding with the Australian Red Cross defining this arrangement. The NSWPF also has Memorandum of Understanding agreements with Resilience NSW on the use of the RFR system for welfare and recovery purposes. In 2018, the NSWPF released internal standard operating procedures to provide guidance on the application of the RFR system during emergencies.

During the bush fires, the online capability of RFR was used with limited success, mostly due to the lack of IT resourcing of Red Cross volunteers (lack of tablet smart devices), but the problems were further exacerbated by limited/poor network connectivity in regional areas. Welfare Services raised the possibility of developing an offline capability so that, in areas of poor connectivity, the data can be entered and subsequently uploaded when able.¹²⁷⁵ To manage these limitations, RFR was conducted in a paper-based format at all evacuation centres (except in Tumut). The manual recording of RFR coupled with the volume of people needing to be recorded resulted in stocks running out and forms having to be photocopied, thus losing the unique registration number on the manual form.¹²⁷⁶

The Inquiry found that attendance at an evacuation centre for many people is the first time that personal details are provided to a government agency or non-governmental organisation. However, time and time again the Inquiry heard that community members were required repeatedly to 'tell their story' and repeatedly to provide their personal information to different agencies in order for assistance to be accessed.

The need for repeated provision of the same personal information to different government agencies continues into the recovery phase, and was identified in the community consultations and in some individual submissions as a source of frustration and as affecting individuals' mental health by the continued reliving of events. The Red Cross noted that this

¹²⁷⁵ Resilience NSW. (2020). *Advice to the Inquiry provided 13 May*.

¹²⁷⁶ Ibid.

“experience can be traumatic as well as frustrating and inefficient”.¹²⁷⁷ While individuals acknowledged that personal information is required to apply for the different assistance measures, there was an expectation that once this information was given, it would be able to be accessed by other government departments.

The Inquiry acknowledges the privacy provisions of existing legislation prevents the sharing of personal information between government agencies at both the State and Commonwealth level. The NSW Government should look to either amend or introduce legislation that would enable the sharing of information between State and local government agencies and non-governmental organisations which have a need for the information, and a role in response or recovery activities. Information sharing between agencies would enable a more proactive provision of assistance by government and other approved organisations assisting in recovery. In order to expedite this process, the Inquiry recommends the Government focus on sharing information between NSW government agencies in the immediate term, followed by Commonwealth government agencies if possible in the longer term.

Recommendation 71: That, in order to ensure people only need to tell their story once to access government agency support following an emergency, Resilience NSW and Service NSW jointly design an inclusive, person-centred approach to information collection at evacuation centres. This should be supported by an opt-in scheme enabling personal information to be shared between NSW government agencies, local councils and non-governmental organisations administering support services for disaster-affected people.

5.10.1.6 Aboriginal people were not well-supported during evacuation in some communities

The Inquiry acknowledges that Aboriginal communities across the State were greatly affected by bush fires, particularly on the South Coast. The requirement that the Inquiry undertake most community consultations online prevented some Aboriginal people from participating. In order to ensure it heard about Aboriginal people’s experiences, the Inquiry met with representatives from Aboriginal Affairs. The Inquiry was disappointed to learn that in some communities Aboriginal people felt unwelcome at evacuation centres, and in some cases support services were reluctant to provide immediate relief. These experiences compounded the trauma they had already experienced as a result of the bush fires, and in some cases led to people putting themselves at risk as they feared how they would be treated in evacuation centres.

The Inquiry emphasises that everyone has the right to receive support following a natural disaster, and that discrimination in evacuation centres should not occur under any circumstances. While this was not the case in all communities, it is clear that further work is needed to ensure evacuation support is inclusive and is delivered in a culturally safe way.

In discussions with Aboriginal Affairs the Inquiry noted there are two primary means by which this can occur. First, Aboriginal communities should be included in emergency planning and preparation to form good working relationships ahead of a disaster occurring, and ensure processes incorporate the needs of Aboriginal communities. Secondly, all staff delivering services in evacuation centres (both government and non-government) should be culturally competent. In some cases, this may require additional training.

¹²⁷⁷ Australian Red Cross, Submission to the Inquiry.

Recommendation 72: That, in order to ensure Aboriginal people can access appropriate support during evacuation, Resilience NSW work with Local Emergency Management Committees and Aboriginal Affairs to ensure:

- a) local Aboriginal communities are included in emergency planning and preparation
- b) all staff involved in evacuation centres and support services are culturally competent.

5.10.1.7 Vulnerable people should have been better supported during evacuation

In December 2019, the Commonwealth Department of Health noted advice from the NSW RFS that Vulnerable Facility Managers should take the necessary steps to prepare their sites, staff and clients for the threat of bush fire in their local area.¹²⁷⁸ Welfare Services developed the *Evacuation Decision Guidelines for Private Health and Residential Care Facilities* in September 2016,¹²⁷⁹ and a link to this is provided on the Commonwealth Department of Health website. Despite the warning, evacuation centres found themselves having to respond to the needs of vulnerable people from care facilities who had been dropped at centres without appropriate support. For example, one aged care facility relocated patients to an evacuation centre, which resulted in elderly people being forced to sleep in upright chairs.

At a State level, guidance material has been produced to support evacuation centre operations. In 2014, the State Emergency Management Committee approved the *NSW Evacuation Management Guidelines* (released March 2014) and the *Major Evacuation Centre Guidelines* (released June 2014). Both documents were prepared as a resource for all emergency practitioners and are written for all hazards applications. Both documents are due for review, which should occur no less than every three years or following an emergency resulting in significant evacuations. Recommendation 40 of Exercise Deerubbin (2019) was for a review and rewrite of both sets of guidelines.¹²⁸⁰

The *NSW Evacuation Management Guidelines* recommend that facilities have appropriate plans in place should evacuation be required, and notes that some facilities are required to have such plans as part of their regulatory and funding requirements.¹²⁸¹ Welfare Services advised the Inquiry that NSW Health has lodged formal complaints of negligence against those facilities that were alleged to have breached their duty of care.¹²⁸² Welfare Services appropriately tried to prioritise vulnerable clients into temporary commercial accommodation,

¹²⁷⁸ Department of Health (2019). Preparation for dangerous fire conditions in NSW. Retrieved from <https://www.health.gov.au/news/preparation-for-dangerous-fire-conditions-in-nsw>.

¹²⁷⁹ NSW Government. (2016). Evacuation Decision Guidelines for Private Health and Residential Care Facilities. Retrieved from <https://www.emergency.nsw.gov.au/Documents/publications/guidelines/Guideline-Evacuation-Decision-Making-Guidelines-for-Health-and-Aged-Care-Facilities.pdf>.

¹²⁸⁰ Exercise Deerubbin was an exercise of the Hawkesbury-Nepean Flood Plan, conducted in three phases in mid 2019. All members of the State Emergency Management Committee were represented in the Exercise.

¹²⁸¹ NSW Government. (2014). NSW Evacuation Management Guidelines, p 17. Retrieved from https://www.emergency.nsw.gov.au/Documents/publications/guidelines/Guideline_Evacuation-Management.pdf.

¹²⁸² WELFAC (Welfare Services Functional Area Coordinator). (2020). Advice to the Inquiry provided 17 March 2020.

and engaged with the Health Services Functional Area to provide care in the evacuation centre itself.¹²⁸³

The Inquiry heard from people concerned about family members residing in the fire affected area who also live with serious mental health issues. The submission noted that those suffering mental health issues, or those with disabilities, addictions or other vulnerabilities, would not have a way to exit if a 'leave now' call came through.¹²⁸⁴ The Inquiry notes that Resilience NSW intends to develop on-line training on emergency readiness for older Australians, and would support the further expansion of this training. The Inquiry was pleased to be advised that Resilience NSW is partnering with the University of Sydney to foster inclusive practices in emergency management, and to assist in lessening the risk for people with disabilities, who are at higher risk of death in emergencies or disaster.¹²⁸⁵

Recommendation 73: That, in order to ensure the safety and wellbeing of vulnerable people during an evacuation, Resilience NSW:

- a) identify aged care facilities in fire and flood prone areas, and ensure that emergency plans are in place and comply with the *Evacuation Decision Guidelines for Private Health and Residential Care Facilities*
- b) develop/refresh evacuation centre protocols to specifically address the needs of vulnerable people.

5.10.1.8 People from border communities also experienced challenges accessing support

In discussions with the Victorian and NSW Cross-Border Commissioners, the Inquiry heard that people living near the NSW-Victorian border experienced difficulties accessing the appropriate level of support after they were evacuated. On both sides of the border, people were told to go to an evacuation centre in their home State in order to access support services, and reported being made to feel unwelcome if they attended a centre outside their home State.

In order to ensure every Australian citizen can have access to the appropriate range of support services when evacuating from a bush fire, regardless of where they may live, the Inquiry recommends that cross-border arrangements be reflected in evacuation centre standard management guidelines.

Recommendation 74: That, in order to ensure equitable access to evacuation centres and associated support services for people in border communities, Resilience NSW ensure cross-border access arrangements are reflected in evacuation centre management guidelines.

5.10.1.9 There was a lack of clarity for people evacuating with animals

The care of animals for evacuated persons was a sizeable concern during the 2019-20 bush fire period. Evacuation centres provide support to people and their companion animals who

¹²⁸³ Ibid.

¹²⁸⁴ Name withheld, Submission to the Inquiry.

¹²⁸⁵ Meeting with The Hon Gareth Ward MP, Minister for Family and Community Services on 13 May 2020.

have evacuated from an area.¹²⁸⁶ The Agriculture and Animal Functional Area (AASFA) (situated in the Department of Primary Industries) works with Welfare Services to support the welfare and accommodation of companion animals at evacuation centres or in designated care facilities.¹²⁸⁷ This summer, AASFA was required to provide support to over 11,400 animals at over 80 locations across the State.¹²⁸⁸ The number of animals involved necessitated the establishment of specific 'animal evacuation sites'. These were subsequently renamed 'animal safe places' due to concerns raised by WSFA that the term 'evacuation' may lead to a belief that Welfare Services would also be present at the animal facilities.

Welfare Services and AASFA should clarify the names of sites established due to the overflow of animals at evacuation centres; and should also clarify the provision of assistance to the evacuated people at the overflow locations, recognising that if people did not have animals, they would be receiving assistance at the evacuation centre. There is currently confusion as to where people evacuating with animals should go: an evacuation centre or animal safe place?

The AASFA, Welfare Services and LEMCs should work together to identify the requirements for evacuation centres that can cater for people and animals, and sites that could be utilised as animal safe places. The scale of the 2019-20 bush fires and the sheer number of evacuated animals resulted in sites spontaneously being identified as animal safe places. These did not appear in LEMC planning documents but were accessed out of necessity. Further redundancies for animal sites should be identified, with prioritisation of preferred locations built into local evacuation plans.

From 20 December 2019 to 20 January 2020, the NSW SES piloted Project Ohana, which had a number of focus areas including that:

- animal owners understand their threat/s during emergencies, have made a plan and will leave early with their animals
- evacuation centres are well prepared to cater for both humans and their animals.

The SES worked with a range of Government and non-government stakeholders to deliver messages to animal owners during the 2019-20 season and reported on the pilot's findings in March 2020. The findings noted the need for improved messaging for people with animals during evacuations, and emphasised the need for 'coordinated evacuation centre auditing' by LEMCs, AASFA and Welfare Services.¹²⁸⁹

Recommendation 75: That, in order to improve support for people evacuating with animals, the Department of Primary Industries:

- a) work with Resilience NSW to develop evacuation protocols and procedures to ensure appropriate supports are provided for both people and animals (informed by the findings from Project Ohana), including a process for animal registration at evacuation

¹²⁸⁶ SEMC (State Emergency Management Committee). (2018). NSW State Welfare Services Functional Area Support Plan, p 6. Retrieved from <https://www.emergency.nsw.gov.au/Documents/plans/supporting-plans/Supporting-Plan-Welfare-Services-Functional-Area.pdf>.

¹²⁸⁷ Ibid, p 13.

¹²⁸⁸ NSW DPI (Department of Primary Industries). (2020). *Advice to the Inquiry provided 4 May 2020*.

¹²⁸⁹ SES (NSW State Emergency Service). (2020). *Advice to the Inquiry provided 22 June 2020*.

- centres and mutually agreed naming conventions, and provide this information to Local Emergency Management Committees (LEMCs)
- b) work with LEMCs to identify overflow sites that can be used for evacuated animals when preferred sites are full
- c) further develop the domestic pets evacuation protocol.

5.10.1.10 Functional areas should be closely aligned to agencies responsible for service delivery

The extraordinary nature of the 2019-20 season demonstrated the importance of functional areas being able to scale up quickly in response to increasing demand, while continuing to deliver a high level of service to local communities. In particular, Welfare Services and the AASFA were required to provide high levels of support during the season. The Inquiry noted that the AASFA currently sits with the Department of Primary Industries, although many community members identify Local Land Services (LLS) as the support provider, as AASFA responses are generally conducted by LLS staff based in regional towns.

In addition, the Inquiry notes Welfare Services heavily relied on staff from the Department of Communities and Justice to provide support staff for evacuation centres, although a recent Machinery of Government change has resulted in Welfare Services (part of Resilience NSW) being located in the Department of Premier and Cabinet cluster.

To ensure functional areas are closely aligned to the agencies responsible for delivering services on the ground, the Inquiry recommends Resilience NSW review existing functional area arrangements to determine if any changes are needed.

Recommendation 76: That Resilience NSW review existing functional area arrangements to ensure they are closely aligned to agencies responsible for direct service delivery.

5.10.1.10.1 Early media reports on damaged and destroyed properties caused distress

The Inquiry heard through submissions and community meetings that a number of community members were distressed when media gained access to areas that had been closed off to residents. In many instances, these residents had not been informed that their property had been burned, only to see it appear destroyed or damaged on the media.

*Why is the Media allowed into burnt areas within half an hour of the fires, yet residents who stayed and saved their houses are not allowed back into their places when its in lockdown afterwards?*¹²⁹⁰

*I wasn't allowed back through the road-block even though Sydney television crews were filming in our village. That's how I found that my neighbour's home had burnt to the ground.*¹²⁹¹

This caused great distress to the residents as the photos or footage were shown over and over without their consent and without their being able to gain similar access. Media ethics is currently part of the RFS' media bush fire safety training course (as discussed earlier in this Chapter). It should be enhanced to include lessons learnt from the 2019-20 fire season.

¹²⁹⁰ Peter Richer, Submission to the Inquiry.

¹²⁹¹ Kaye Whitbread, Submission to the Inquiry.

6 NEXT STEPS AND CONCLUSION

The Inquiry found that the 2019-20 bush fires in NSW were some of the worst the world has ever seen. As discussed in Chapter 2, these fires were caused by multiple factors all working in the same direction to amplify the risk of serious fires. And while fires will not be of the scale and type seen in the 2019-20 season every year, a repeat of fires of that scale, or worse, is a realistic prospect. Indeed, we should expect to see serious fires more frequently.

The NSW RFS, working in partnership with other NSW fire authorities along with the community, did an impressive job in limiting loss of life and damage to property compared to what could have occurred. This report is focused on making sure changes happen across the spectrum of bush fire preparedness and response, to further reduce the likelihood of deaths and damage if or when fires of this magnitude recur, and to ensure our first responders are less in harm's way. Many of the Inquiry's recommendations focus on improving **firefighter safety** through equipment upgrades, appropriate protective clothing and equipment and ongoing mental health support.

One of the major successes during the 2019-20 season was the clear message to communities to leave early and get out. There is an increasing understanding that these megafires are very dangerous – they are big, they move fast and are almost impossible to fight under some conditions. The Inquiry's recommendations address the need to have strong and relatively uninterrupted **communications** capability during a bush fire to ensure at-risk communities can receive warning messages and enable fire fighting agencies to communicate on the firegrounds. In the medium term, the Inquiry recommends accelerating the building of the State Digital Twin so NSW RFS will have authoritative guidance on which assets we want to protect from fire and where they actually are. In the longer term, the Inquiry recommends an extension of the State's **strategic planning framework** to improve bush fire resilience and discourage new developments in areas of high bush fire risk.

The operational response during the 2019-20 season highlighted that NSW has systems and processes that work well in a 'standard' bush fire season, and were tested and pushed to the extreme this season given many 'monster' fires were being fought simultaneously. However, there are opportunities to improve **operational systems and processes** so the overall fire fighting machine is in more robust shape before another catastrophic fire season occurs. The Inquiry also recommends trialling new **fire fighting strategies** and reviewing existing ones in light of emerging research about extreme fire behaviour.

Some of the systems that need improving are aimed at preparedness. While more can and should be done, it is important to acknowledge that **hazard reduction** is not robustly effective in the face of megafires. Hazard reduction is best focused locally and targeted to asset protection. As a strategic and integrated system of **fire trails** is critical to preparing for more extreme fire seasons, the Inquiry strongly recommends accelerating the construction, delivery and ongoing maintenance of a State-wide fire trail network. Given the number of government agencies that need to work together to improve bush fire preparedness, strengthened **governance and accountability** mechanisms are also needed to emphasise collective responsibility at both the State and local level.

The extreme fires during the 2019-20 season raised lots of questions, many of which highlight our imperfect understanding of preparing for and fighting fires on this scale and the need for **research and further trials**. The experience of the past season is also an opportunity for the State – **to establish NSW as a major world centre of bush fire**

research, technology development and commercialisation, as well as education and training.

The Government has already made significant commitments ahead of the next season, including:

- \$10.7 million for additional Mitigation Crews to help fast-track hazard reduction burning
- \$34.4 million to upgrade the NSW RFS fire fighting fleet, which will deliver 120 new vehicles and 70 refurbished trucks by the end of the 2020-21 financial year
- \$22.9 million to NPWS for increased hazard reduction activity in and around the highest risk areas in the lead-up to the next bush fire season and boost aerial rapid-response fire fighting capability by up to 80 firefighters and an additional helicopter.

These commitments align with priorities identified by the Inquiry including the importance of undertaking appropriate hazard reduction (noting the limited windows of time in which this can be done), the need to ensure fire fighting vehicles have appropriate safety protections and the critical role that early suppression plays in extreme fire seasons. The Inquiry supports the Government targeting additional resources in these areas and emphasises the need for this funding to be ongoing.

The Inquiry notes the NSW RFS has commissioned the Bushfire and Natural Hazards CRC to undertake research into people's experiences of the 2019-20 bush fires in NSW.¹²⁹² The results will be used to inform strategies aimed at improving community bush fire safety. Given the strong community engagement with the Inquiry through both written submissions and community meetings, these insights will provide a rich source of data for the research project.

Noting the work that has already been committed to or is underway, the Inquiry's recommendations are aimed at putting NSW in a stronger position ahead of future fire seasons. The recommendations can be classified as:

- Recommendations requiring **immediate action** before the 2020-21 fire season
- Recommendations that will need to commence now and be implemented over the **medium term** (1-2 years). Sometimes, for example, significant policy development is required before change can be implemented
- Recommendations that signal the need for **further research** to improve our understanding of extreme fire behaviour, and the flow-on impacts for bush fire preparedness and response
- Recommendations that require **national cooperation** through existing inter-jurisdictional forums.

6.1 NEXT SEASON – ARE WE PREPARED?

6.1.1 Pre-season views

The NSW RFS informed the Inquiry that the risk profile for the 2020-21 fire season will be primarily determined by winter and spring rainfall, grass growth and the key climate drivers (IOD, ENSO and SAM – discussed in 2.2.1.4). The Bureau of Meteorology (BoM) indicates that conditions may reach or exceed the threshold for La Niña by the end of spring, while the IOD is expected to remain neutral.

¹²⁹² RFS (NSW Rural Fire Service). (2020). Research into the 2019-2020 bush fires. Retrieved from <https://www.rfs.nsw.gov.au/news-and-media/general-news/research-into-the-2019-2020-bush-fires>.

While 2019 was the driest year on record for Australia, the first half of 2020 has seen more normal rain patterns for southern and eastern Australia.¹²⁹³ Recent rainfall associated with an east coast low in mid-July is likely to have reduced the intensity of the drought in south-eastern NSW. However, the northern ranges and far north coast are still experiencing drought conditions.¹²⁹⁴ Overall, long term rainfall deficiencies remain across the State.¹²⁹⁵

The longer term outlook for eastern Australia indicates that spring is likely to bring wetter than average conditions, which is likely to increase grass fuels in central NSW.¹²⁹⁶ NSW RFS has advised that it continues to monitor the increasing grass fuel loads and grass fuel dryness in central NSW.

For forested regions, as of 14 July 2020, the forest fuel moisture in NSW is approximately average for this time of year. That, plus the rainfall outlook outlined above, means the risk posed for the 2020-21 bush fire season is considered to be average for forested regions of NSW.

6.1.2 Recommendations

The Inquiry notes the 2020-21 fire season commences on 1 October 2020 – only two months from the date we are required to report. In addition, the ongoing impact of COVID-19 will restrict current NSW RFS members' ability to participate over the coming season, and will likely mean that new recruits are unable to complete all the requisite training ahead of the season commencing.

Noting these challenges, the Inquiry is of the view there are some actions that should be taken before the 2020-21 season commences.

In addition to recommendations for immediate action, the Inquiry has made recommendations for action that need to start now but will extend for some time to ensure NSW is well prepared the next time an extreme fire season occurs. As noted above, some of these recommendations are aimed at filling current knowledge gaps, while others will require collaboration with other Australian governments to develop and implement.

#	Recommendation	S	M	R	C
Legend: immediate start (S); commence now, implement over 1-2 years (M); further research (R); collaboration (C)					
Chapter 1 INTRODUCTION AND OVERVIEW					
1	That, in order to ensure recommendations accepted by the Government are implemented in a timely and transparent manner, Government establish a central accountability mechanism to track implementation of recommendations from bush fire-related reviews and inquiries and consider expanding this to other policy areas.	✓			

¹²⁹³ Bushfire and Natural Hazards CRC. (2020). Australian Seasonal Bushfire Outlook: July 2020 Hazard Notes. Retrieved from <https://www.bnhcrc.com.au/hazardnotes/75>.

¹²⁹⁴ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 16 July 2020*.

¹²⁹⁵ Bushfire & Natural Hazards CRC. (2020). Australian Seasonal Bushfire Outlook: July 2020 Hazard Notes. Retrieved from <https://www.bnhcrc.com.au/hazardnotes/75>.

¹²⁹⁶ RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 16 July 2020*.

#	Recommendation	S	M	R	C
Legend: immediate start (S); commence now, implement over 1-2 years (M); further research (R); collaboration (C)					
Chapter 2 CAUSES AND CONTRIBUTING FACTORS					
2	That at the start of each fire season, based on advice from the Bush Fire Coordinating Committee, Government provide a public statement with an evaluation of the likely fire season risk and the effectiveness of the planning and preparation for the upcoming season. This should be based on sophisticated monitoring of the key risk factors and signals for an extreme fire season. It should form the basis for clear public communication about these risks on a regional basis and the actions that Government proposes in preparation.	✓			
3	That the NSW Government, along with other Australian governments, ask AFAC 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.		✓		✓
4	That, in order to improve capability to detect ignitions and monitor accurately all fire edge intensity and progression automatically across the State in near real time, Government establish a spatial technology acceleration program to maximise the information available from the various remote sensing technologies currently in use and to plan for inclusion of new remote sensing systems that can sense precisely and rapidly through heavy smoke, cloud, fog and dust. This will require work within the State and with partners nationally and internationally.		✓	✓	✓
5	That Government establish NSW as a major world centre of bush fire research, and technology development and commercialisation. This should include: a) establishing a Bush Fire Technology Fund, modelled on the Medical Devices Fund, to assist with the rapid development of technologies and services to sense, fight, mop up after and protect from bush fires b) commissioning further research into extreme fire behaviour and building up the research and research training capacity in this field. This will improve our ability to understand, model and predict the likelihood of extreme fire behaviour in the landscape and enable targeting of fire fighting resources to areas where fires are likely to become most damaging.		✓		
6	That Government support training initiatives to increase the capacity of fire authorities to fight the kind of megafires seen in the 2019-20 season. The training initiatives should include: a) targeted training in local weather effects for fire behaviour analysts who are embedded in Incident Management Teams b) an increase in the number of trained fire behaviour analysts so that, should there be a repeat of the scale of these fires, all Incident Management Teams can have an embedded analyst and there is some redundancy under more normal conditions		✓		

#	Recommendation	S	M	R	C
Legend: immediate start (S); commence now, implement over 1-2 years (M); further research (R); collaboration (C)					
	c) training of more meteorologists in fire behaviour so there are more expert resources available to embed within the NSW RFS State Operations Centre		✓		
	d) dedicated training for firefighters in extreme fire behaviour		✓		
	e) support for research training in challenging firefighting problems.		✓	✓	
Chapter 3 PREPARATION AND PLANNING – EMERGENCY MANAGEMENT					
7	That the NSW RFS Commissioner consult with the Fire and Rescue NSW Commissioner and other emergency services to develop a protocol in the event that simultaneous emergency events necessitate the re-allocation of resources while a Section 44 declaration is in place.	✓			
8	That, to strengthen cross-agency accountability and deliver improved bush fire risk management outcomes:				
	a) Bush Fire Coordinating Committee (BFCC) members from NSW government agencies are at the level of Coordinator General/Deputy Secretary/Agency Head/Deputy Commissioner (or equivalent)	✓			
	b) the BFCC ensures all Bush Fire Risk Management Plans, Operation Coordination Plans and Fire Access and Fire Trail (FAFT) Plans are compliant with the timeframes outlined in section 52 of the <i>Rural Fires Act</i> as soon as practicable	✓			
	c) the BFCC develops a risk-based performance auditing cycle to ensure Bush Fire Risk Management Plans, Operation Coordination Plans and FAFT Plans are fit-for-purpose and any opportunities for improvement are identified and actioned	✓			
	d) the NSW RFS considers the best way of enhancing the transparency of BFCC decision-making, for example by publishing BFCC membership and minutes on its website	✓			
	e) the BFCC endorses the annual statement to Parliament on the likely fire risk and the effectiveness of planning and preparation	✓			
	f) relevant agencies review Bush Fire Management Committee (BFMC) membership and confirm to the NSW RFS that members have sufficient discretion and authority to agree and implement risk mitigation activities at the local level	✓			
	g) the NSW RFS Commissioner amends the BFMC Policy to require BFMCs to refer unresolved issues to the BFCC for resolution.	✓			
9	That the NSW RFS work with AFAC to analyse the impact of changing fire seasons on inter-jurisdictional resource sharing agreements, both domestic and international, and determine any flow-on effects for NSW fire fighting personnel capacity.		✓		✓
10	That, in order to expand NSW's specialist aviation personnel safety and capacity, Government expand simulator capabilities at the NSW RFS Training Academy.		✓		
11	That, in order to strengthen the capability of local councils in future emergency events:				

#	Recommendation	S	M	R	C
Legend: immediate start (S); commence now, implement over 1-2 years (M); further research (R); collaboration (C)					
	a) Resilience NSW, in consultation with local government, develop specific training that focuses on the role, responsibilities and expected functions of the Local Emergency Management Officer (LEMO), including regular 'refresher' components		✓		
	b) Councils support their staff to participate in LEMO training on an ongoing basis, and ensure that staff who are LEMOs are appropriately senior and have the authority to commit resources.		✓		
12	That Government work with other Australian governments to provide long-term funding certainty to AFAC, including the National Resource Sharing Centre (NRSC) and the National Aerial Firefighting Centre (NAFC).	✓			✓
13	That, to ensure updated resource-sharing arrangements are in place, the NSW and Victorian Governments progress and finalise a multi-agency Memorandum of Understanding before the 2020-21 fire season commences.	✓			✓
14	That in order to provide greater consistency in public information and warnings, especially in border areas:				
	a) the finalisation of the Australian Warning System be prioritised to provide greater consistency in public information and warnings		✓		✓
	b) the NSW State Emergency Management Committee, including the Public Information and Warnings Sub-Committee, prioritise the implementation of the Australian Warning System and data standards for relevant hazards within NSW.		✓		
15	That Government commit to:				
	a) evaluating existing bush fire preparedness programs to determine the most effective and efficient approach given increased frequency of extreme fire seasons, and develop outcomes-based measures to monitor programs' impact over time		✓		
	b) post-evaluation roll out the most effective bush fire preparedness programs to all communities and at-risk cohorts in bush fire prone areas across NSW.		✓		
16	That, in order to ensure tourism businesses are prepared for natural disasters including bush fires, Resilience NSW work with NSW RFS and Destination NSW to develop bush fire preparedness support for tourism businesses, based on research into existing models. Over time, this support could be expanded to include other natural hazards.		✓		
17	That the NSW RFS identifies remote bush fire prone areas that do not already have an indoor Neighbourhood Safer Place (NSP) and upgrades the relevant NSW RFS Stations to meet NSP guidelines. These stations would require adequate Asset Protection Zones and active/passive protection systems to provide short-term protection.		✓		

#	Recommendation	S	M	R	C
Legend: immediate start (S); commence now, implement over 1-2 years (M); further research (R); collaboration (C)					
Chapter 4 PREPARATION AND PLANNING – LAND AND ASSETS					
18	That, in order to equip NSW RFS with comprehensive information on all structures and assets at risk of bush fire, Government ensures that: ▪ there is a single whole-of-government procurement and acquisition program for imagery and LiDAR and that Government accelerate the building of the State Digital Twin and associated Digital Workbench ▪ owners/managers of assets (apart from private home owners whose information will be provided through local councils) in bush fire prone land are required to provide to the Digital Twin at least the following information/metadata with quality control certification on an annual basis (with annual census at least two months before the start of the fire season): • precise geolocation • description of asset including picture • value level • fire treatment on asset • Asset Protection Zone (APZ) details and how it is maintained • access details • what redundancy is available if relevant • any metadata requirements specific to the asset class • emergency contact and instructions on how to access where more information is held • any restrictions on data access and sharing. The Digital Twin must also be able to incorporate: ▪ information about the hazard reduction results for road verges, fire trails, APZs and other defendable space ▪ local information supplied by organisations such as local NSW RFS brigades.	✓			
19	That Government re-commit to the current, regionally based approach to planning and coordinating hazard reduction activities across all tenures through Bush Fire Management Committees but ensure that it is actually being implemented at a high-level of quality across NSW. Getting it to a high-level of quality requires:				
	a) implementing the Inquiry's recommendation about performance auditing of Bush Fire Risk Management Plans		✓		
	b) prioritising implementation of revised processes for bush fire risk management planning that incorporate new modelling and methods for quantifying risk and the residual risk profile as a result of proposed hazard reduction works		✓		
	c) ensuring regional priorities for hazard reduction, and how they are determined, are communicated clearly to the community, and their implementation is reported on transparently. This will include being very clear about the objectives of hazard reduction activities and communicating that hazard reduction does not eliminate the risk of fire affecting properties		✓		
	d) the methodology for assessing and planning for risk reduction becomes an ongoing area of research and the frameworks are formally reviewed every three years.		✓	✓	
20	That Government, noting that hazard reduction targeted in proximity to assets is on balance more likely to provide help than hinder, should:				

#	Recommendation	S	M	R	C
Legend: immediate start (S); commence now, implement over 1-2 years (M); further research (R); collaboration (C)					
	a) support local councils and partner agencies to implement more comprehensive hazard reduction at a local level around towns/cities, communities and local infrastructure assets, and provide incentives for communities to organise themselves to prioritise and implement local hazard reduction initiatives. This will involve a suite of hazard reduction techniques depending on the landscape including prescribed burning, clearing, mowing, and mechanical treatments, and easy disposal of green waste into processors turning it into bioenergy or biofuels		✓		
	b) beyond the local level priorities for hazard reduction, prioritise prescribed burning in parts of the landscape where fuel treatment may help reduce probability of fires escalating quickly and where terrain and potential atmospheric interactions are likely to escalate fires into fire-generated thunderstorms. This will likely involve a proactive program of treating ridge tops that are prone to dry lightning where reduced fuels may help reduce speed of spread when the fire first starts, or particular windward or lee-slopes that are susceptible to generating extreme fire behaviour and drive fire towards towns.		✓		
21	That, in order to improve understanding of optimal hazard reduction techniques and their application in the landscape:				
	a) Government extend the recently introduced program of mitigation crews so that hazard reduction activities can be undertaken when conditions are optimal (throughout the week and potentially at night)	✓			
	b) all fire authorities review prescribed burning techniques and their implementation, and commission further research into optimal prescribed burning regimes and techniques. This should include research to understand critical thresholds that, when breached, may render fuel treatment ineffective (i.e. fuel moisture thresholds), and the short, medium and long-term outcomes of hazard reduction burning regimes		✓	✓	
	c) Government commission research into a range of other hazard reduction techniques to understand better the cost versus benefit and effectiveness of different practices in various circumstances, including grazing.		✓	✓	
22	That, as part of the spatial technology acceleration program, Government support deployment of remote sensing and picture processing technologies to monitor and audit how well Asset Protection Zones and defendable space are being maintained, especially around towns.		✓		
23	That Government amend the <i>Rural Fires Act 1997</i> so that all public land management agencies be required to forward complaints received about bush fire hazards to the Commissioner of the NSW RFS. As an interim measure, heads of agencies should commence this practice immediately.	✓			
24	That government agencies managing land (at all levels and through all agencies) be the best neighbours possible by considering their neighbours when undertaking activities related to bush fire preparation and having clear, two-way communication about these activities, with the aspiration that government landholders will be seen as highly desirable neighbours.	✓			
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.	✓			

#	Recommendation	S	M	R	C
Legend: immediate start (S); commence now, implement over 1-2 years (M); further research (R); collaboration (C)					
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.		✓		
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.		✓		
28	That Government, acknowledging that a strategic approach to planning for bush fire will take time, and in order to protect, prepare and build resilience into existing communities better, should immediately: ▪ prepare, in association with the insurance sector, a model framework and statutory basis for the establishment of an enforcement, compliance and education program which adopts a risk-based approach to routine inspection of local bush fire prone developments to ensure that every local development on bush fire prone land is prepared for future bush fire seasons in accordance with bush fire protection standards of the day, that account for worsening conditions ▪ ensure local government is resourced to enable effective audit, enforcement and compliance powers in respect of local developments and assets on bush fire land ▪ consider the introduction of subsidies for property owners to undertake site mitigation works to reduce bush fire risk and work with the Insurance Council of Australia to develop an agreed set of measures to insure against with a view to risk reductions resulting in lower insurance premiums ▪ review vegetation clearing policies to ensure that the processes are clear and easy to navigate for the community, and that they enable appropriate bush fire risk management by individual landowners without undue cost or complexity.		✓		
29	That, in order to maximise the protection of critical infrastructure in a bush fire, Australian governments revise the regulatory framework for the provision to government authorities of information about all critical infrastructure (public and private) including a possible change to compel the owners of critical assets to provide all needed metadata, updated annually, for appropriate planning, preparation and response for bush fire. This would include information about location, ownership, access, details of service the infrastructure supports, and fire treatments of building and surrounding zones.		✓		✓

#	Recommendation	S	M	R	C
Legend: immediate start (S); commence now, implement over 1-2 years (M); further research (R); collaboration (C)					
30	That, in order to minimise communication outages and extend basic communication coverage during bush fires, the NSW Government work directly, or together with other Australian governments and/or their relevant power and telecommunications regulatory, policy and market bodies, to: - ensure there are sufficient redundancy options available (e.g. backup diesel generators, deployed temporary telecommunications facilities, etc.) to supply power to essential telecommunication infrastructure or alternative telecommunications infrastructure - ensure that the telecommunication entities' and electricity network providers' Bush Fire Risk Management Plans are updated annually and reported on in the NSW RFS Commissioner's annual statement to Parliament on the upcoming bush fire season and include details of all actions taken to mitigate those risks including maintenance of APZs and access roads - ensure there is appropriate auditing of distributors' preparedness for risks arising from network assets being affected by bush fire, as well as the risk of networks initiating a bush fire - facilitate cross-carrier roaming arrangements between carriers and the public for basic text, voice and data during the period of emergency in areas directly affected by fire - enable NSW RFS to require carriers to provide regular information on the status of outages and areas affected by fire.	✓			✓
31	That, in order to improve bush fire planning and protection of road infrastructure and to ensure communities, freight movers and fire fighting agencies have appropriate access and egress in a bush fire event, Government, working with local government as needed: - develop a formal bush fire risk assessment process for all State roads and bridges, to identify: 'high-risk' communities where access and egress in the event of a fire will be affected, for example rural communities connected by a single road surrounded by bushland, and ensure community bush fire planning processes (i.e. Bush Fire Risk Management Plans (BFRMPs) or Community Protection Plans) include plans to 'leave early' or enforce mandatory evacuation orders - how waterways can be integrated better into the transport network as evacuation routes or places of shelter when road and rail transport is unavailable – waterways should be included in regional emergency management plans - route options for rapid identification of needed road closures in the event of fire - key sections of the State's road network for future upgrade to ensure whole corridors are resilient to fire impacts, regardless of who manages the asset - audit, through the NSW RFS Audit Unit (to be established) the inclusion of critical road infrastructure in BFRMPs prepared by Bush Fire Management Committees (ensuring that appropriate transport representation is provided to BFMCs) and Local Emergency Management Committees across the State. In support of these measures, it will be critical that the community is given early warning of bush fire events and has ample time to evacuate prior to or during an emergency.		✓		

#	Recommendation	S	M	R	C
Legend: immediate start (S); commence now, implement over 1-2 years (M); further research (R); collaboration (C)					
32	That, in order to ensure outcomes-based roadside vegetation management to reduce roadside tree fall and grass ignitions in planning and preparing for bush fire, Transport for NSW, working with local government and NSW RFS, establish a consistent framework for roadside vegetation management that analyses road priority, utility, amenity, strategic value and risk. The framework should: - take into consideration landscape characteristics like distance, slope, set back, vegetation maturity and type. Acceptable outcomes under this framework could include clear verges, or alternatives such as safe zones/pull-outs. - tie in formally with other strategic land use and biodiversity processes.		✓		
33	That as a matter of urgency, in order to accelerate and finalise a State-wide strategic fire trail network, the NSW RFS Commissioner and Bush Fire Coordinating Committee (BFCC): - set a deadline for Bush Fire Management Committees to complete all outstanding Fire Access and Fire Trail (FAFT) Plans for submission to BFCC for approval, and a related deadline for BFCC consideration of these - assess the completed suite of FAFT Plans to identify high-priority trails of relative strategic importance across the State for urgent construction or upgrades with particular reference to the needs of upcoming fire seasons - enforce completion of annual fire trail condition assessment reporting by relevant landholders. Following this, the BFCC should, as part of its standard business, undertake an audit of all FAFT Plans and annual fire trail condition assessment reports - develop a single asset management system to capture the outcomes of annual fire trail condition assessment reporting on a tenure-blind basis to support BFCC strategic and budgetary prioritisation and inform funding allocation to agencies for capital works programs - commission a review of FAFT Plans, with particular assessment of containment line potential, following a significant bush fire event in their area, as part of the planned review of BFCC Policy and NSW RFS Standards in 2020-21. Where it is not feasible to construct a fire trail completely on public land, and private landowners are not satisfied with proposed negotiated arrangements to construct the trail across their land, Government should negotiate acquisition of an easement interest, with appropriate compensation, over private land.	✓			
34	That, in order to capture and understand the impacts of bush fire smoke better, Government invest in operational air quality forecasting and alert systems, and public health research and policy development. This would involve investment to: - develop a comprehensive system of forecasting and alerts for air quality incidents and all pollutants of concern, including but not limited to bush fire smoke, ozone and dust, and which is ideally nationally consistent - investigate further the health impacts of bush fire smoke, based on improved data collection and including research on the long-term health impacts of poor air quality as a result of sustained exposure to severe bush fire smoke, particularly for vulnerable and at-risk segments of the community (children, elderly, firefighters, etc).		✓	✓	✓

#	Recommendation	S	M	R	C
Legend: immediate start (S); commence now, implement over 1-2 years (M); further research (R); collaboration (C)					
35	That, in order to improve the provision of evidence-based public health messaging about air quality during bush fire events, Government develop a public education campaign and supporting systems before the next bush fire season. This should include: - a public education campaign (like sun exposure), to help people make their own decisions about exposure to bush fire smoke - tailored messaging to target: - smoke-vulnerable cohorts of the community - general practitioners, particularly in rural and regional areas, so they can advise patients with relevant, susceptible comorbidities - employers, to support development of appropriate workplace health and safety guidance for outdoor workers - an improved air quality alert system such as an enhanced Air Rater app.	✓			
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.		✓	✓	
Chapter 5 RESPONSE TO THE BUSH FIRES					
37	That, in order to ensure all firefighters understand how local situational awareness reflects (or may not reflect) the broader scale situation presented by a large/extreme bush fire and the implications this may have on asset protection and fire suppression strategies, the NSW RFS: - develops information packages for all types of operating environments to improve out-of-area crews' understanding of the local terrain and fuels, and distributes information to out-of-area crew members from all fire authorities - accelerates the roll out of Mobile Data Terminals into all fire fighting vehicles to improve delivery of briefings and incident information/intelligence to field commanders.		✓		
38	That, in order to ensure the safety of local landholders on firegrounds, the NSW RFS emphasises the importance of local landholders using protective clothing while fire fighting as part of the RFS' 'Farm Fire Unit Integration' priority for 2020-21.	✓			
39	That, in order to ensure frontline personnel have appropriate personal protective clothing during bush fires:				

#	Recommendation	S	M	R	C
Legend: immediate start (S); commence now, implement over 1-2 years (M); further research (R); collaboration (C)					
	a) FRNSW review the current design of its bush fire jacket, noting improvements that have been made since 2002 that meet AS/NZS4824:2006 Protective clothing for firefighters, and increase the allocation of bush fire coats to two jackets per member		✓		
	b) NSW RFS issue two sets of personal protective clothing to operational members, and others as appropriate.		✓		
40	That, in order to improve firefighter safety, Government fire authorities:				
	a) ensure all light tankers used as part of active frontline bush fire fighting operations are fitted with a single point crew protection safety spray system and radiant heat protection blankets as a minimum standard across all NSW fire authorities		✓		
	b) ensure all medium/heavy tankers are fitted with radiant heat protection blankets, wheel and 'halo' sprays fitted as a minimum standard across all NSW fire authorities		✓		
	c) undertake additional research to determine the most appropriate cabin protection for the different frontline vehicles.		✓	✓	
	d) provide ongoing investment for NSW RFS fleet upgrades.		✓		
41	That, in order to ensure all NSW RFS members can access the mental health support they need, the NSW RFS expands in-house mental health support for members.		✓		
42	That, to ensure firefighters can access mental health support through GPs, Government work with the Commonwealth Government to:				
	a) provide a free mental health screen to firefighters post-fire event and waive any gap payments if additional treatment is required		✓		✓
	b) create a new Medicare Benefits Scheme item number to enable Governments to track demand for mental health services from firefighters over time and ensure an appropriate level of support is available.		✓		✓
43	That, in order to ensure firefighter sustenance is of sufficient volume and quality, the NSW RFS reviews food standards and procedures in consultation with volunteers. The review should include catering service standards, including food safety, as well as the viability of sourcing commercial contracts and providing 12-hour food packs to firefighters.		✓		
44	That, in order to ensure suitably skilled and experienced personnel operate as Divisional Commanders during major fire incidents, Bush Fire Management Committees identify appropriate personnel as part of their plan of operations.		✓		
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% is an appropriate KPI for the NSW RFS and NPWS		✓		
	b) NSW fire authorities deploy remote area fire fighting 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.		✓		

#	Recommendation	S	M	R	C
Legend: immediate start (S); commence now, implement over 1-2 years (M); further research (R); collaboration (C)					
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.		✓		
47	That, in order to enhance fire fighting strategies in severe conditions, the NSW RFS implements 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 2019-20 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	✓			
	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.		✓		
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.		✓	✓	
49	That, in order to maximise the efficiency and effectiveness of heavy plant used in dry fire fighting techniques, the NSW RFS expand and introduce the following in respect to heavy plant:				
	a) increase the number of trained Heavy Plant Supervisors and Managers to ensure an appropriate level of supervision in future significant fire seasons		✓		
	b) expand ARENA software to include the Heavy Plant Register, including the introduction of GPS tracking for all agency and contracted plant, to improve contractual compliance and to facilitate better the identification and tasking of appropriate localised heavy plant contractors; and review the feasibility of linkage to the SAP system for invoicing improvements. This should be introduced prior to the 2020-21 fire season	✓			
	c) review the existing contractual process to ensure all heavy plant is categorised into types, size and functionality along with exploring potential for a standardised hourly rate for that category of equipment		✓		
	d) work with Soil Conservation Service to ensure appropriate standards for the engagement and management of heavy plant to deliver safe and effective heavy plant service, including the delivery of standards and auditing.		✓		
50	That, in order to ensure Australia's fire fighting 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 fire fighting systems to provide the Australian Defence Force with the capacity to augment aerial fire fighting during major disasters		✓		✓

#	Recommendation	S	M	R	C
Legend: immediate start (S); commence now, implement over 1-2 years (M); further research (R); collaboration (C)					
	b) work with states and territories through the National Aerial Firefighting Centre to review the current mix of aviation assets and determine whether it is fit-for-purpose, noting the current lack of mid-sized fire fighting aircraft.		✓		✓
51	That, in order to enhance NSW's ability to improve situational awareness, Government expand FRNSW's Remotely Piloted Aerial Systems (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.		✓		
52	That, in order to enhance NSW's fire fighting capacity, Government trial aerial fire fighting at night in the 2020-21 season with a view to full implementation if successful.	✓			
53	That Government develop and implement a policy on injured wildlife response, rescue and rehabilitation including:				
	a) a framework for the co-ordination and interaction with emergency management structures		✓		
	b) guidelines for Incident Management Plans to include wildlife rescue and rehabilitation as a consideration		✓		
	c) a requirement for all vets and wildlife rescue volunteers to obtain the Bush Fire Awareness accreditation		✓		
	d) guidance for firefighters on handling injured wildlife.		✓		
54	That, to ensure mobile generators are sourced and distributed on a priority basis during natural disasters, the EUSFAC work with the NSW Telco Authority, relevant NSW government agencies and commercial stakeholders to develop a mobile asset deployment strategy. The strategy should reduce duplication in purchasing, maintaining and housing mobile generators and improve agility in deployment.		✓		
55	That, in order to improve fireground communications between NSW agencies and interstate personnel:				
	a) Government ensure all NSW fire authority personnel and vehicles can access and utilise the Public Safety Network (PSN). This should include access to NSW RFS Private Mobile Radio networks where PSN coverage is not yet available.		✓		
	b) the NSW Telco Authority review cross-border communications availability and planning and advise NSW fire authorities on next steps to enable multi-state interoperability for wide area communications.		✓		
56	That, in order to ensure the State Emergency Operations Centre (SEOC) can maintain communications during emergencies, the Government provide the SEOC with independent Public Safety Network functionality.		✓		
57	That, in order to ensure emergency response agencies can communicate across state and territory borders, the Commonwealth Government allocate 10 + 10 MHz as a dedicated spectrum for Public Safety Mobile Broadband (PSMB) at no cost to states and territories.		✓		✓
58	That, in order to ensure all agencies have a clear understanding of cross-border communication channels during bush fires, all MoUs between state or territory agencies include an agreed protocol about how agencies will communicate across borders and that these are reflected in Incident Action Plans.	✓			

#	Recommendation	S	M	R	C
Legend: immediate start (S); commence now, implement over 1-2 years (M); further research (R); collaboration (C)					
59	That, in order to improve response times to Triple Zero calls, the NSW RFS implements the integrated dispatch system before the 2020-21 fire season commences.	✓			
60	That, in order to ensure timely payment and maintain positive ongoing supplier relationships during large-scale bush fires, the NSW RFS implements an automated logistics solution, informed by the outcomes of the Emergency Logistics Project.		✓		
61	That, in order to improve cross-agency communication and coordination during bush fires, the NSW RFS review Fire Control Centres (FCCs) in areas that were heavily affected by fire. The results should be combined with the Emergency Operations Centre (EOC) Facilities Review to identify areas that would benefit from a purpose-built FCC, enabling co-location with the EOC.		✓		
62	That, in order to ensure State Emergency Operations Centre (SEOC) interoperability during all natural disasters, Resilience NSW review the current SEOC arrangements and location including responsibilities for ongoing resourcing and maintenance.		✓		
63	That, in order to ensure the guiding principles and approval processes are contemporary, streamlined and more flexible, the NSW and Commonwealth Governments review the Defence Assistance to the Civil Community (DACC) arrangements. This review should include the circumstances in which the State can request Commonwealth assistance, and the level of information provided by the ADF to the State on available resources and capabilities.		✓		✓
64	That, in order to expand the pool of trained personnel able to undertake the Public Information Functional Area Coordinator (PIFAC) role, Resilience NSW and the NSW Police Media Unit (PIFAC) develop and deliver a training package for Emergency Management Media Liaison Officers.		✓		
65	That, in order to improve information flows and increase public awareness of ABC emergency broadcasts, Government:				
	a) include an ABC Manager in the Public Information Functional Area Coordinator (PIFAC) team within the State Operations Centre	✓			
	b) strategically place roadside signage with local/regional ABC station frequency band throughout the State.		✓		
66	That, in order to provide real-time information on evacuation doorknocking during emergency events, Government explore a shared data gateway for NSW agencies based on the NSW State Emergency Service Collector app and a common mapping and analytics platform.		✓		
67	That, in order to ensure people can access clear information on cross-border fires, the NSW RFS:				
	a) incorporate information on fires in neighbouring states and territories into Fires Near Me NSW	✓			
	b) collaborate with other states and territories to develop a national app as part of the Australian Warning System being developed through the AFAC Warnings Group.		✓		✓
68	That the NSW RFS include the following priorities in the Fires Near Me improvements roadmap:				
	a) text enlargement functionality	✓			

#	Recommendation	S	M	R	C
Legend: immediate start (S); commence now, implement over 1-2 years (M); further research (R); collaboration (C)					
	b) a clear statement about the app's limitations and the importance of heeding public warnings and relying on personal observations	✓			
	c) fire spread prediction maps on extreme/catastrophic days		✓		
	d) update fire map information as technology improves.		✓		
69	That, in order to ensure evacuation arrangements can be scaled up when needed, Resilience NSW:				
	a) ensure staff who are willing to be deployed to evacuation centres are trained as soon as possible to bolster evacuation centre staff surge capacity	✓			
	b) train council and NSW government regional staff in evacuation centre establishment and management, supported by a one-page 'start up sheet' for opening an evacuation centre	✓			
	c) enable interested community members to be trained to assist in evacuation centre establishment and management and provide an avenue for skilled volunteers to register their interest		✓		
	d) develop an exercise for the management of multiple evacuation centres dealing with large numbers of people for a protracted period over a widespread area.		✓		
70	That, in order to ensure evacuation centres are fit-for-purpose, Resilience NSW work with Local Emergency Management Committees (LEMCs) to:				
	a) update the guidelines for LEMCs identifying evacuation centres to require a risk assessment of potential locations, which should include identifying alternate sources of power for use by evacuation centres and recording these appropriately		✓		
	b) review existing evacuation centre locations to assess compliance with updated LEMC guidelines and report to the State Emergency Management Committee on their suitability.		✓		
71	That, in order to ensure people only need to tell their story once to access government agency support following an emergency, Resilience NSW and Service NSW jointly design an inclusive, person-centred approach to information collection at evacuation centres. This should be supported by an opt-in scheme enabling personal information to be shared between NSW government agencies, local councils and non-governmental organisations administering support services for disaster-affected people.		✓		
72	That, in order to ensure Aboriginal people can access appropriate support during evacuation, Resilience NSW work with Local Emergency Management Committees and Aboriginal Affairs to ensure:				
	a) local Aboriginal communities are included in emergency planning and preparation	✓			
	b) all staff involved in evacuation centres and support services are culturally competent.	✓			
73	That, in order to ensure the safety and wellbeing of vulnerable people during an evacuation, Resilience NSW:				
	a) identify aged care facilities in fire and flood prone areas, and ensure that emergency plans are in place and comply with the <i>Evacuation Decision Guidelines for Private Health and Residential Care Facilities</i>	✓			

#	Recommendation	S	M	R	C
Legend: immediate start (S); commence now, implement over 1-2 years (M); further research (R); collaboration (C)					
	b) develop/refresh evacuation centre protocols to specifically address the needs of vulnerable people.		✓		
74	That, in order to ensure equitable access to evacuation centres and associated support services for people in border communities, Resilience NSW ensure cross-border access arrangements are reflected in evacuation centre management guidelines.	✓			
75	That, in order to improve support for people evacuating with animals, the Department of Primary Industries:				
	a) work with Resilience NSW to develop evacuation protocols and procedures to ensure appropriate supports are provided for both people and animals (informed by the findings from Project Ohana), including a process for animal registration at evacuation centres and mutually agreed naming conventions, and provide this information to Local Emergency Management Committees (LEMCs)		✓		
	b) work with LEMCs to identify overflow sites that can be used for evacuated animals when preferred sites are full		✓		
	c) further develop the domestic pets evacuation protocol.		✓		
76	That Resilience NSW review existing functional area arrangements to ensure they are closely aligned to agencies responsible for direct service delivery.		✓		

APPENDICES

Appendix One Projects provided by NSW Bushfire Risk Management Research Hub

Reference	Authors
NSW Bushfire Risk Management Research Hub (2020) 'Fuel dryness'	Rachael Nolan
NSW Bushfire Risk Management Research Hub (2020) 'Fuel hazard'	Rachael Nolan
NSW Bushfire Risk Management Research Hub (2020) 'Fire weather'	Rachael Nolan and Hamish Clarke
NSW Bushfire Risk Management Research Hub (2020) 'Influence of tenure on forest Vegetation structure'	Rachael Nolan, Michael Bedward and Ross Bradstock
NSW Bushfire Risk Management Research Hub (2020) 'Estimated risk mitigation from prescribed burning prior to the 2019/20 fire season'	Rachael Nolan, Hamish Clarke, Brett Cirulis and Trent Penman
NSW Bushfire Risk Management Research Hub (2020) 'Fire spread'	Grant Williamson and Owen Price
NSW Bushfire Risk Management Research Hub (2020) 'Fire severity and past fire impact'	Grant Williamson, Rebecca Gibson, Anna Matala and Brett Cirulis
NSW Bushfire Risk Management Research Hub (2020) 'Fire severity statistics'	Grant Williamson, Rebecca Gibson, Anna Matala and Brett Cirulis
NSW Bushfire Risk Management Research Hub (2020) 'Logging and fire severity'	Grant Williamson, Rebecca Gibson, Anna Matala and Brett Cirulis
NSW Bushfire Risk Management Research Hub (2020) 'Smoke and human health'	Katharine Haynes and Nicolás Borchers Arriagada
NSW Bushfire Risk Management Research Hub (2020) 'Probability of house destruction'	Katharine Haynes and Owen Price
NSW Bushfire Risk Management Research Hub (2020) 'Demographic characteristics of populations affected by the 2019/2020 bushfires in NSW'	Katharine Haynes, Josh Whittaker and Michael Bedward
NSW Bushfire Risk Management Research Hub (2020) 'Ignition impacts'	Katharine Haynes and Stephanie Samson
NSW Bushfire Risk Management Research Hub (2020) 'The social benefits of cultural burning'	Katharine Haynes
NSW Bushfire Risk Management Research Hub (2020) 'Fire threshold analysis'	Grant Williamson
NSW Bushfire Risk Management Research Hub (2020) 'Impact on priority NSW flora'	Mark Ooi
NSW Bushfire Risk Management Research Hub (2020) 'Ecosystem Impacts'.	Mark Ooi and David Keith
NSW Bushfire Risk Management Research Hub (2020) 'Ecosystem impacts case study'.	Mark Ooi and David Keith
NSW Bushfire Risk Management Research Hub (2020) 'Future risk analysis'.	Hamish Clarke

Appendix Two Community and stakeholder meetings

Disclaimer: This list is a good approximation of Bushfire Inquiry consultations but does not include all phone calls made to/from the Bushfire Inquiry.

Date	Agency/Group	Attendees
4 February 2020	Rural Fire Service	Commissioner, Shane Fitzsimmons Deputy Commissioner, Rob Rogers
4 February 2020	NSW Police Force	Commissioner Mick Fuller APM
5 February 2020	Department of Communities & Justice	Michael Coutts-Trotter, Secretary
5 February 2020	NSW State Coroner	Magistrate Teresa O'Sullivan
5 February 2020	NSW SES	Commissioner York
6 February 2020	Department of Planning, Industry & Environment	Jim Betts, Secretary
7 February 2020	ARC Centre of Excellence for Climate Extremes, University of New South Wales	Professor Andy Pitman AO
7 February 2020	ARC Training Centre for Fire Retardant Materials Safety, University of New South Wales	Professor Guan Heng Yeoh
7 February 2020	Department of Biological Sciences, Macquarie University	Emeritus Professor Mark Westoby
7 February 2020	Australian Bureau of Meteorology	Dr Andrew Johnson, CEO and Director of Meteorology
10 February 2020	---	Dr John Keniry AM, former Commissioner, Natural Resources Commission
10 February 2020	Councillor – The Climate Council	Greg Mullins AO AFSM, Former Commissioner Fire & Rescue NSW
10 February 2020	Office of the NSW Chief Scientist & Engineer	Dr Chris Armstrong PSM, Deputy Chief Scientist & Engineer with other OCSE staff
11 February 2020	Disaster Recovery Office	Mick Willing, Lead Recovery Coordinator
11 February 2020	Disaster Welfare, NSW Department of Communities	Matthew McFarlane, Director
11 February 2020	Centre for Environmental Risk Management of Bushfires, University of Wollongong	Professor Ross Bradstock
14 February 2020	Data Analytics Centre	NSW Chief Data Scientist, Dr Ian Oppermann

Date	Agency/Group	Attendees
17 February 2020	Acting Coordinator-General, Environment, Energy + Science – Department of Planning, Industry & Environment	Tracy Mackey, Coordinator-General, Environment, Energy + Science Atticus Fleming, Deputy Secretary (NPWS) Stephen Beaman, Director Waste & Resource Recovery (EPA)
17 February 2020	Minister for Transport and Roads Member for Bega	The Hon Andrew Constance MP
17 February 2020	Spatial Services, Department of Customer Service	Greg Wells, Deputy Secretary, Digital and ICT Bruce Thompson, Executive Director, and colleagues
17 February 2020	Coordinator-General Regions, Industry, Agriculture & Environment – Department of Planning, Industry & Environment	Gary Barnes, Coordinator-General Regions, Industry, Agriculture & Environment (DPIE) Steve Orr, Executive Director Georgina Beattie, Executive Director
18 February 2020	Ministry of Health	Elizabeth Koff, Secretary
18 February 2020	Fire & Rescue NSW	Commissioner, Paul Baxter
19 February 2020	Deputy Premier, and Minister for Regional NSW, Industry and Trade Member for Monaro	The Hon John Barilaro MP
19 February 2020	Bushfire & Natural Hazards CRC	Dr Richard Thornton, CEO
19 February 2020	University of Adelaide	Professor Gus Nathan, Professor of Mechanical Engineering
19 February 2020	National Aerial Firefighting Centre	Richard Alder, General Manager
19 February 2020	Black Ash Bushfire Consulting	Lew Short, Director
20 February 2020	Bureau of Meteorology	Shoni Maguire, General Manager, Public Safety
20 February 2020	State Emergency Service	Commissioner, Carlene York Deputy Commissioner, Fatima Abbas Deputy Commissioner, Daniel Austin
20 February 2020	Minister for Police and Emergency Services	The Hon David Elliott MP
21 February 2020	NSW RFS (Flyover of fire affected areas)	---
21 February 2020	School of Science, University of New South Wales Canberra	Associate Professor Jason Sharples
21 February 2020	Research School of Earth Sciences, Australian National University	Professor Nerilie Abram

Date	Agency/Group	Attendees
24 February 2020	NSW RFS (Flyover of fire affected areas)	---
24 February 2020	Incident Controller, Rural Fire Service IMT reps including Lithgow DICs	IMT Reps
24 February 2020	Rural Fire Service Field Commander, Mt Wilson	---
24 February 2020	Centre for Environmental Risk Management of Bushfires, University of Wollongong	Professor Ross Bradstock
25 February 2020	Blue Mountains Aboriginal Culture and Resource Centre Aboriginal Affairs NSW	Mick Beltran, Manager Adrian Hansen (AANSW)
25 February 2020	Incident Controller, Rural Fire Service IMT reps	IMT Reps
25 February 2020	National Parks and Wildlife Service	David Crust, Deputy Incident Controller
25 February 2020	Lithgow City Council	Ray Thompson, Mayor Graeme Faulkner, General Manager
25 February 2020	Community Meeting	Lithgow Community
26 February 2020	Secretaries Board	Made up of the Secretaries of NSW Clusters and the Public Service Commissioner
26 February 2020	Natural Resources Commission	Neil Byron, Assistant Commissioner Bryce Wilde, Executive Director
26 February 2020	Australian Fire & Emergency Service Authorities Council	Paul Consodine
27 February 2020	University of Tasmania	Associate Professor Fay Johnston, Menzies Institute for Medical Research, University of Tasmania
27 February 2020	University of Tasmania	Professor David Bowman, <i>Professor</i> of Environmental Change Biology, University of Tasmania
28 February 2020		David Shoebridge MLC
28 February 2020	NSW Chief Scientist & Engineer	Professor Hugh Durrant-Whyte
28 February 2020	Minister for Energy and Environment	The Hon Matthew Kean MP
2 March 2020	NSW RFS (Flyover of fire affected areas)	---
3 March 2020	NSW RFS (Flyover of fire affected areas)	---
4 March 2020	Australian Centre for Field Robotics, University of Sydney	Associate Professor Ian Manchester
5 March 2020	State Emergency Operations Controller	Deputy Commissioner Gary Worboys

Date	Agency/Group	Attendees
6 March 2020	Country Mayors	---
6 March 2020	NSW Health	Dr Richard Broome, Director Environmental Health
8 March	Community	Community meeting – Tenterfield
8 March 2020	Member for Lismore	Ms Janelle Saffin MP
9 March 2020	NSW RFS (Flyover of fire affected areas)	---
9 March 2020	Incident Controller, RFS and IMT reps – Glen Innes	IMT Reps
9 March 2020	Minister for Agriculture and Western NSW Member for Northern Tablelands	The Hon Adam Marshall MP
9 March 2020	Glen Innes Council	Carol Sparks, Mayor
9 March 2020	Community	Community meeting – Glen Innes
10 March 2020	National Farmers Federation	Fiona Simson, President
10 March 2020	Chief Executive of Innovation Pro Pty Ltd,	Craig Lapsley, Former Victorian Emergency Management Commissioner
11 March 2020	Centre for Environmental Risk Management of Bushfires, University of Wollongong	Professor Ross Bradstock
11 March 2020	Commissioner, Independent Planning Commission	Peter Cochrane
12 March 2020	Bureau of Meteorology, Melbourne	Shoni Maguire, General Manager Public Safety, National Forecast Services Adrienne Murphy Clint Saarinen Imelda Plaza Dominic Lane Allistair Dawson
13 March 2020	Aboriginal Housing Office	Jody Broun, Chief Executive
13 March 2020	Crown Solicitors Office DPC Legal Branch	Maire Grimes (CSO) Laura Shumack (DPC)
13 March 2020	Department of Education and Training	Kathy Powzun, Executive Director, Bushfire Relief Strategy, School Operations & Performance
16 March 2020	Royal Commission into National Natural Disaster Arrangements	Air Chief Marshal Mark Binskin AC (Retd) (by phone) The Honourable Dr Annabelle Bennett AC SC Amanda Cartwright

Date	Agency/Group	Attendees
16 March 2020	Nature Conservation Council	Chris Gambian, Chief Executive Bob Conroy G Banks K McShea
16 March 2020	Latrobe Valley Information Network	Lance King, Coordinator Emergency Management
18 March 2020	Transport NSW	John Dinan, Executive Director, Community and Place
18 March 2020	Bundjalung Jagun, Firesticks Alliance	Oliver Costello, Chief Executive Officer
18 March 2020	Infrastructure NSW	Simon Draper, Chief Executive Clare Gardner-Barnes, Head of Strategy, Planning & Innovation
19 March 2020		Dr Robert Kooyman, Honorary Research Associate, Royal Botanic Gardens Emeritus Professor Mark Westoby, Department of Biological Sciences, Macquarie University
19 March 2020		David Howell
19 March 2020	The Ripper Group	Susan Calvert, Advisory Board member
19 March 2020	Commissioner, Independent Planning Commission	Annelise Tuor
24 March 2020	Mid Coast IMTs	IMT reps
26 March 2020	Community Member	Mr Steve Scott Tenterfield
27 March 2020	Forestry Corporation of NSW	Nick Roberts, CEO, and Ross Dickson, Chief Forester and Company Secretary
27 March 2020	Australasian Fire and Emergency Service Authorities Council	Stuart Ellis, Chief Executive Officer
31 March 2020	Member for Lismore	Ms Janelle Saffin MP
1 April 2020	Department of Planning, Industry & Environment	Alison Frame, Group Deputy Secretary, Property & Housing
1 April 2020	Crown Land Commissioner	Professor Richard Bush
1 April 2020	Transport NSW	Craig Moran, Director of Operations and Planning, NSW Transport Management Centre
1 April 2020	Fire Brigade Employees Union	Leighton Drury, State Secretary
2 April 2020	Minister for Mental Health, Regional Youth and Women	The Hon Bronwyn Taylor MLC
2 April 2020	Minister for Planning and Public Spaces	The Hon Rob Stokes MP

Date	Agency/Group	Attendees
2 April 2020	Minister for Regional Transport and Roads Member for Bathurst	The Hon Paul Toole MP
3 April 2020	National Parks & Wildlife Service, DPIE	Atticus Fleming, Deputy Secretary
6 April 2020	University of Adelaide	Professor Sandy McFarlane AO, Professor of Psychiatry
6 April 2020	Local Land Services	Richard Bull, Chair of the Board David Witherdin, Chief Executive Officer
7 April 2020	University of New South Wales Canberra	Associate Professor Jason Sharples
7 April 2020	Forestry Corporation NSW	Nick Roberts, CEO and Executive Director Ross Dickson, Chief Forester and Company Secretary
7 April 2020	Far South Coast IMTs	IMT Reps
8 April 2020	Fire & Rescue NSW	Deputy Commissioner Adam Dewberry Assistant Commissioner David Lewis
8 April 2020	Department of Primary Industries	Scott Hansen, Director General Kate Lorimer-Ward, Deputy Director General, Agriculture and CEO of the Rural Assistance Authority Dr Sarah Britton, NSW Chief Veterinary Officer and Group Director Animal Biosecurity Brett Fifield, Deputy Director General, Agriculture Nick Milham, Group Director, Forestry
8 April 2020	Risk Frontiers	Andrew Gissing, General Manager, Resilience Dr Ryan Compton
8 April 2020	Minister for Water, Property and Housing Member for Oxley	The Hon Melinda Pavey MP
9 April 2020	Rural Fire Service	RFS State Operations and State Air Desk
9 April 2020	Rural Fire Service	Senior Assistant Commissioner – Infrastructure and Equipment
14 April 2020	Green Wattle IMT	IMT Reps
14 April 2020	Unions NSW	El Leverington, Legal/Industrial Officer
14 April 2020	Bureau of Meteorology	Dr Karl Braganza, Head of Climate Monitoring Shoni Maguire, General Manager, Public Safety Barry Hanstrum, NSW Regional Director Jane Golding, NSW/ACT Manager of Weather Services
14 April 2020	Currowan IMT	IMT Reps

Date	Agency/Group	Attendees
15 April 2020	Mackay Strategic & Commissioner, Independent Planning Commission	Richard Mackay
15 April 2020	Dunns Road IMT	IMT Reps
16 April 2020	National Parks & Wildlife Service, DPIE	Atticus Fleming, Deputy Secretary Carl Hollis, Acting Director, Fire & Incident Management Naomi Stephens, Program Director – Future Robert Quirk, Regional Manager
16 April 2020	Community	Lake Conjola community meeting
17 April 2020	Community	Mid North Coast community meeting
20 April 2020	Minister for Customer Service	The Hon Victor Dominello MP
20 April 2020	Department of Planning, Industry & Environment Office of Local Government	Luke Walton, Executive Director of Planning Policy (DPIE) Monica Gibson, Specialist Policy Planner (DPIE) Tim Hurst, Acting Chief Executive (OLG)
20 April 2020	Parliamentary Secretary to the Deputy Premier Member for Cootamundra	The Hon Stephanie Cooke MP
21 April 2020	University of New South Wales Canberra	Associate Professor Jason Sharples
22 April 2020	Transport for NSW	Rodd Staples, Secretary Rachel Simpson, Chief of Staff
23 April 2020	Department of Planning, Industry & Environment	Marcus Ray, Group Deputy Secretary Planning & Assessment
23 April 2020	Community	Mid-North Coast community
24 April 2020	University of Sydney University of New South Wales Canberra	Professor Salah Sukkarieh (University of Sydney) Professor Jason Sharples UNSW Canberra
24 April 2020	Macquarie University	Professor David Throsby
27 April 2020	Attorney General and Minister for the Prevention of Domestic Violence	The Hon Mark Speakman SC MP
27 April 2020	FrontierSI Ltd	Dr Graeme Kernich, CEO Phil Delaney, Chief Innovation and Delivery Officer
27 April 2020	Cooma IMT	IMT Reps
28 April 2020	NSW State Recovery Committee	---
28 April 2020	CSIRO	Dan Metcalfe
28 April 2020	NSW Telco Authority	Jane Want, Director Strategy, Risk & Performance

Date	Agency/Group	Attendees
28 April 2020	Department of Customer Service	Bruce Thompson, Executive Director Spatial Services
28 April 2020	The Mulloon Institute	The Hon Gary Nairn AO
28 April 2020	Qld Department of Natural Resources, Mines and Energy	Steven Jacoby, Executive Director Land & Spatial Information
29 April 2020	Community meeting	Snowy Valley community
29 April 2020	Shadow Minister for Women and the Prevention of Domestic and Family Violence, and Shadow Minister for Emergency Services Member for Blue Mountains	Ms Trish Doyle MP
30 April 2020	Canobolas BPMC	---
1 May 2020	Casino IMT	IMT Reps
1 May 2020	National Parks & Wildlife Service, DPIE	Atticus Fleming, Deputy Secretary
1 May 2020	Department of Planning, Industry & Environment	Alexandra O'Mara, Group Deputy Secretary, Place Design and Public Spaces Brett Whitworth, Acting Deputy Secretary, Planning + Design
1 May 2020	Australian Space Agency	Reece Biddiscombe, Director Earth Observation
1 May 2020	Community	Shoalhaven community
4 May 2020	Principal, Fell Consulting Commissioner, Independent Planning Commission	Professor CJD Fell AM
4 May 2020	Community	Northern Rivers/Clarence Valley community
5 May 2020	Rural Fire Service	Assistant Commissioner Kelly Browne, Director ICT & Chief Information Officer Bruce McDonald, Executive Director, Infrastructure Services
5 May 2020	Rural Fire Service	Commissioner Rob Rogers
6 May 2020	Affected community members – Cobargo fire	Dr Brian Hickman & Margo Nettheim
6 May 2020	NSW State Coroner	Magistrate Teresa O'Sullivan
6 May 2020	Community	Far South Coast community
7 May 2020	SA Country Fire Service	Brett Loughlin, Director Preparedness Operations
7 May 2020	Community	Southern Highlands community
8 May 2020	US Bureau of Land Management	Elden Alexander, Fire operations specialist
8 May 2020	Australian Road Research Board	Michael Caltabiano, Chief Executive Officer

Date	Agency/Group	Attendees
		Alan Hay, National Strategy Analyst
8 May 2020	Alberta Wildlife Management Branch, Slave Lake Forest Canada	Kevin Parkinson, Wildfire Operations Officer
8 May 2020	Farmer	Earle Ball
8 May 2020	Australian Space Agency	Anthony Murfett, Deputy Head
8 May 2020	Farmer	Glen Olsen
11 May 2020	Farmer	Gemma Porter
11 May 2020	Nature Conservationist	Arthur Bain
11 May 2020	Community	Hawkesbury community
12 May 2020	Civil Aviation Safety Authority	Graeme Crawford, Group Executive Aviation Manager
12 May 2020	Department of Planning, Industry & Environment	Brett Whitworth, Acting Deputy Secretary, Planning + Design
12 May 2020	Community	Blue Mountains community
12 May 2020	Minister for Families, Communities and Disability Services Member for Kiama	The Hon Gareth Ward MP
12 May 2020	Office of the Minister for Industry, Science & Technology – The Hon Karen Andrews MP	Anne-Marie Elias, Senior Policy Advisor
13 May 2020	Community	Capital to Coast community
13 May 2020	NSW RFS Association	Sharon Ellicott Brian McDonough Greg Dezman
15 May 2020	University of New South Wales – Canberra Centre for Environmental Risk Management of Bushfires, University of Wollongong	Professor Jason Sharples (UNSW Canberra) Professor Ross Bradstock (UoW)
18 May 2020	University of New South Wales	Professor Les Field, Professor of Chemistry
19 May 2020	Safework NSW	Lisa Foley
19 May 2020	Aboriginal Affairs NSW	Melissa Ellis, South Coast Regional Manager
22 May 2020	Aboriginal Affairs NSW	Kristy Swan, North Coast Regional Manager
22 May 2020	Community Member – Kangawalla Fire	Ros Alexander
25 May 2020	Member for Wagga Wagga Community	Snowy Valleys community meeting

Date	Agency/Group	Attendees
26 May 2020	Department of Primary Industries Local Land Services Regional NSW	Nick Milham, Group Director Forestry Policy, Research and development (DPI) Nick Myer, Plantation Forestry (DPI) Christine Stone, Forest Science (DPI) Jacqueline Tracey (LLS) Adam Tyndall, Manager Private Native Forestry Review (LLS)
27 May 2020	School of Life and Environmental Sciences, University of Sydney	Professor Chris Dickman
29 May 2020	CSIRO	Jenny Baxter, Project Manager, CSIRO Innovation Fund Dr Randall Donohue, Senior Research Scientist Dr Tim Mcvicar, Research Scientist
1 June 2020	University of Melbourne	Professor Patrick Baker – silviculture and forest ecology Professor Rod Kennan – forests and climate change, forest ecosystems services and forest environmental policy Dr Kevin Tolhurst – fire ecology and management, fire behaviour and risk management
1 June 2020	The Fenner School of Environment and Society, Australian National University	Professor David Lindenmayer
2 June 2020	NBN Co.	Gavin Williams, Chief Development Officer – Regional & Remote, NBN Bushfire Resilience Mike Whitelaw, Group Resilience Business Continuity
2 June 2020	University of New South Wales	Scott Mooney, Deputy Head of School, School of Biological, Earth and Environmental Sciences, Faculty of Science
4 June 2020	Department of Primary Industries, Regional NSW	Dr Sarah Britton, NSW Chief Vet Jenni Johansson
9 June 2020	NSW Telco Authority	Jane Want, Director Strategy, Risk & Performance
10 June 2020	National Parks & Wildlife Service, DPIE	Atticus Fleming, Deputy Secretary
10 June 2020	Audit Office of NSW	Margaret Crawford, Auditor-General Ian Goodwin, Deputy Auditor-General
11 June 2020	Insurance Council of Australia	Rob Whelan, Executive Director and CEO Karl Sullivan, Head of Risk and Operations
11 June 2020	Cross-Border Commissioner	James McTavish, Cross-Border Commissioner Emma Watts, NSW Cross Border Assistant Commissioner

Date	Agency/Group	Attendees
11 June 2020	Baker McKenzie and Commissioner, Independent Planning Commission	Ilona Millar
12 June 2020	Essential Energy	Natalie Lindsay, Head of Regulatory Affairs
15 June 2020	Rural Fire Service	Assistant Commissioner Kelly Browne, Director ICT & Chief Information Officer
16 June 2020	Vic Inspector-General for Emergency Management	Tony Pearce, Inspector-General Julie Hoy, Manager Evaluation and Review
17 June 2020	Hub researchers	Brett Cirulis, University of Melbourne David Bowman, University of Tasmania David Keith, University of NSW Grant Williamson, University of Tasmania Hamish Clarke, University of Wollongong Katharine Haynes, University of Wollongong Mark Ooi, University of NSW M Boer, Western Sydney University MB Edward, University of Wollongong Owen Price, University of Wollongong Rachael Nolan, Western Sydney University Ross Bradstock, University of Wollongong S Samson, University of Wollongong Trent Penman, University of Melbourne W Joshua, University of Wollongong
18 June 2020	Resilience NSW	Shane Fitzsimmons, Commissioner
19 June 2020	Various	Oliver Costello, Firesticks Alliance Den Barber, Koori Country Firesticks Alliance Glenn Wilcox, Bega Local Aboriginal Land Council Aunty Sharyn Halls, Gundungurra ILUA Nathan Brennan, Coffs Harbour Local Aboriginal Land Council Mick Beltran, Blue Mountains Aboriginal Culture and Resource Centre Stu Gordon, NSW Aboriginal Land Council Graham Kelly, Local Land Service Noel Webster, Local Land Service Bhiamie Williamson, Australian National University Claude McDermott, Aboriginal Affairs NSW

Date	Agency/Group	Attendees
		Michelle McKemey, PhD candidate, University of New England Andry Sculthorpe, Firesticks Jessica Wegener, Firesticks Dr Peta Standley, Firesticks Rachael Cavanagh, Forestry Corporation NSW Elle Daly, Rural Fire Service Jamie Bertram, Rural Fire Service Naomi Stephens, National Parks & Wildlife Service Danielle Flakeler, National Parks & Wildlife Service Gregory Summerell, National Parks & Wildlife Service Mal Ridges, National Parks & Wildlife Service Tanya Koeneman, Department of Planning, Industry & Environment Jake Kinred, National Parks & Wildlife Service Chanelle Burman, National Parks and Wildlife Service Harriet Jobson, Aboriginal Affairs NSW Vanessa Cavanagh, University of Wollongong Victor Steffensen Katharine Haynes, University of Wollongong
22 June 2020	Deloitte	Simon Cooper, Deloitte Digital Allan Mills
23 June 2020	Rural Fire Service	Assistant Commissioner Kelly Browne, Director ICT & Chief Information Officer
25 June 2020	Minister for Local Government Member for South Coast	The Hon Shelley Hancock MP
25 June 2020	Ian Cathels – Community Member	Community Member Batlow
29 June 2020	Department of Planning, Industry & Environment	Rebecca Gibson PhD, Remote Sensing Scientist, Remote Sensing and Regulatory Mapping Jeremy Black, Director Remote Sensing and Landscape Science
30 June 2020	NSW DPIE	Dr Sarah Britton Chief Vet NSW
30 June 2020	Australian Energy Market Operator	Audrey Zibelman, CEO and Managing Director
2 July 2020	Vic Inspector-General for Emergency Management Vic Cross-Border Commissioner NSW Cross-Border Commissioner	Tony Pearce, Inspector-General for Emergency Management Luke Wilson, Vic Cross-Border Commissioner James McTavish, NSW Cross-Border Commissioner

Date	Agency/Group	Attendees
6 July 2020	Vets Beyond Borders	Dr Sally Colgan
7 July 2020	Coordinator-General, Environment, Energy + Science Environment Protection Authority DPIE	Dr Paul Grimes PSM, Coordinator-General, Environment, Energy + Science Stephen Beaman (EPA)
8 July 2020	University of Adelaide	Professor Sandy McFarlane AO
9 July 2020	Lockheed Martin Space	David Ball, Regional Director – Australia & New Zealand Dr Timothy Payne, STELaRLab
13 July 2020	Chair of the Upper House Inquiry into health impacts of exposure to poor levels of air quality resulting from bushfires and drought	The Hon Greg Donnelly MLC
14 July 2020	Crown Land Commissioner	Professor Richard Bush
17 July 2020	Department of Planning, Industry & Environment	Alexandra O'Mara, Group Deputy Secretary, Place Design and Public Spaces
20 July 2020	Department of Planning, Industry & Environment	Matthew Riley, Director Climate and Atmospheric Science, Science, Economics and Insights
Various	Australian Space Agency	Dr Megan Clark AC, Head
Various	Melinda Pavey MP	---

Appendix Three List of submissions and summary of key themes

Key theme	#	What the Inquiry heard
Hazard reduction	631	▪ Landholders/residents should be allowed to conduct hazard reduction burns in the right conditions ▪ there is a shrinking window for favourable weather conditions to conduct hazard reductions ▪ allegations of hazard reduction burns not being appropriately monitored.
Climate change	579	▪ Climate change is real and needs to be acknowledged/addressed by governments ▪ call for action by the Commonwealth Government in relation to emissions reduction ▪ anxiety/distress/anger regarding the perceived inaction/denial of the Commonwealth Government.
Operational response	524	▪ Response was generally good, but many residents felt local knowledge was not well utilised. ▪ See also RFS resourcing.
RFS resourcing, coordination, deployment and equipment	504	▪ Many expressed the view that RFS Sydney Headquarters was out of touch with local communities ▪ many submissions praised the RFS ▪ a small number of submissions thought the RFS did not do enough to protect houses or communities.
Public communications	406	▪ While some submissions praised the Fires Near Me app, others stated it was inaccurate or misleading ▪ while public communication was generally good, some submissions stated communication to residents from police/RFS to residents was not clear enough.
National Parks and Wildlife Service (NPWS)	320	▪ Many submissions were of the view NPWS staffing/funding cuts over several years had an adverse impact NPWS fire fighting expertise ▪ complaints about lack of fuel management in national parks (national parks were described as being 'locked up').
Planning controls	283	▪ Many noted the 10/50 vegetation code should be reviewed ▪ BAL (Bushfire Attack Level) - need to review/overhaul the accreditation of Bush Fire Consultants to assess level of risk.
Forestry	277	▪ Logging industry complaints – submissions stating there has been over-clearing of native forests, and also submissions stating under-clearing ▪ failure to reduce fuel loads in State Forests.
Public land management	275	▪ Claims of lack of fuel reduction on Government managed land (see also NPWS and Forestry).
Personal or community resilience	274	▪ Personal stories of strong community spirit, adaptability and inventiveness ▪ many personal stories of those who stayed to defend their neighbourhood, community/local businesses.
Wildlife and biodiversity	274	▪ More funding/support for wildlife volunteers/organisations ▪ submissions noted that a lack of hazard reduction and fuel management in national parks may have resulted in more animals being killed from bushfires.
Telecommunications	267	▪ Telecommunication failures posed significant safety risk - no reception to receive public warnings, warn others, tell family you were safe; radio comms within/between RFS units.

Evacuation	261	▪ Evacuation centres not purpose-built for vulnerable people (disabled people, elderly, children, carers) ▪ many stories of the trauma of evacuation ▪ misinformation/poor public communication ▪ praise for Red Cross.
Drought	260	▪ Effects of drought exacerbated intensity of bush fires ▪ mental health toll of drought-bushfires-COVID in quick succession.
Private land management	203	▪ Complaints regarding lack of Council approval to remove dangerous fuel loads/trees ▪ issues with private properties adjoining public land (ie public land managers not being good neighbours).
Recovery support	201	▪ Complaints regarding funding eligibility and delays to clean up ▪ praise for ADF deployment (including assisting local councils with managing oversupply of donated goods).
Aboriginal land management	195	▪ More support training/funding of indigenous practitioners is needed ▪ is effective, but needs to be combined with other methods.
Health impact	192	▪ Many submissions noted the health impact of bush fire smoke.
Personal account – property damage	188	▪ Praised RFS for defending properties, or blamed RFS for failure to defend properties ▪ many viewed whether homes were lost or saved as good or bad luck, and often weather dependent.
Asset Protection Zone	164	▪ Submissions noted there were critical infrastructure failures - water, electricity, telecommunication towers
Back burning	155	▪ Complaints about backburns that allegedly were out of control or not appropriately monitored ▪ earlier backburns could have prevented fire spread ▪ residents should be informed in advance of backburns and/or changes to them ▪ confusion that "backburning" synonymous with "hazard reduction."
Weather	152	▪ Many noted homes/communities were impacted or saved due to luck – 'good weather' or 'bad weather'.
Roads	145	▪ Need to upgrade unsafe roads ▪ submissions noted improvements were needed where properties or towns only had one road in and one road out for evacuation purposes.
Commonwealth Government	143	▪ submissions noted there has been inaction on climate change ▪ complaints about recovery support ▪ support/criticism of ADF deployment.
Access and fire trails	125	• Trails were not well-maintained, overgrown • criticism that NPWS do not adequately maintain fire trails to an appropriate standard.
Cultural burning	119	See Aboriginal land management
Economic impact	85	▪ Impact on local small business and services ▪ anger/disappointment at tourists being allowed to visit despite bushfire warnings.
Technical products	85	▪ Smoke detection ▪ hazard reduction by heavy machinery.

Lightning	82	▪ Lightning strikes caused some fires.
Defendable space	70	▪ Examples of residents who successfully defended properties, were well-prepared/knowledgeable ▪ other residents believed they were prepared but were overcome despite this (e.g. by ember attack; water supply failed) ▪ need to educate communities on preparedness e.g. appropriate action to take and equipment required to defend homes.
Safety of first responders	65	▪ Fatigue ▪ mental health ▪ morale e.g. complaints about the quality of sustenance provided to fire fighters.

Appendix Four 2019-20 ground and aerial appliances

Ground Appliances	NSW RFS	FRNSW	NPWS	FCNSW
Category 1 – Medium Tankers (3,000 - 4,000L)	1,626		3	
Category 2 – Medium Tanker	271		1	
Category 3 – Medium Tanker	24		1	
Category 4 – Medium Tanker	6			
Category 5 – Heavy Tanker (>4,000L)	1			
Category 6 – Heavy Tanker	52			
Category 7 – Medium Tanker (800 – 1,600L)	1,327		12	
Category 8 – Medium Tanker	5			
Category 9 – Light Tankers (<800L)	531		288	
Category 10 – Pumpers	17			
Category 11 – Medium Pumpers	47			
Category 12 – Personnel Vehicles	338			
Category 13 – Bulk Water Carriers	52			
Category 14 – Tanker Trailers	589			
Category 15 – Marine Vessels	34			
Category 16 – Group & Command Vehicles	515			
Category 17 – Logistics Vehicles	596			
Category 18 – Catering Vehicles	88			
Category 19 – Communications Vehicles	36			
Category 20 – Other Vehicles	177			
Category 21 – Rescue Vehicles	N/A			
Category 22 – Community First Responder	N/A			
4WD Vehicles – Transport & Logistics			283	
Fire Trucks with Pumps*		582		
*Includes 158 Tankers suitable for off road and 25 Compressed Air Foam Systems				
Trucks with Ladder Platforms, Ladders & Aerial Pumpers		28		
Rescue and Hazardous Materials (Hazmat) Vehicles		96		
Large Forest Fire Tankers (4,000L)				50
Slip on water units (400L)				319
Heavy Plant equipment (bulldozers, graders & excavators)			180	
Bulldozers				15
Front End Loaders				5
Graders for road and trail maintenance				9
Total	6,332	706	768	398
<i>Vehicle resources Forestry Corporation NSW had access to during the 2019-2020 season via pre-season hire arrangements on a call when needed basis</i>				
Bulldozers				65
Graders				16
Water trucks				17
Total				98

Aerial Appliances	NSW RFS	NPWS

Aerial Appliances owned by Agencies at the start of the 2019-2020 season

Light Helicopter (Aerial Intelligence – streaming video feed and Aerial Incendiary)	1	
Medium Helicopter (Search & Rescue, Winch Operations; Aerial Incendiary)	2	
Large Air Tanker (Boeing 737-700) (Firebombing)	1	
Rotary Wing Aircraft		4
Fixed Wing Aircraft		1
Total	4	5

Aerial Appliances	NSW RFS

During the 2020-21 financial year, the NSW RFS will add four additional aircraft to the fleet it owns

Fixed Wing Lead Plane (Lead plane; high frequency scanning; personnel transport)	2
Medium Helicopter (Search and Rescue; Winch Operations; Aerial Incendiary)	2
Total	4

Aerial Resources engaged by the NSW RFS at the start of the 2019-2020 fire season through the National Aerial Firefighting Centre

Heavy (High Volume) Helicopters (Firebombing)	2
Single Engine Air Tankers (Firebombing)	8
Single Engine Air Tankers on floats – Fireboss (Firebombing)	1
Medium Helicopters (Firebombing)	3
Medium Helicopters (Firebombing/Winch)	5
Light Helicopter (Firebombing)	1
Fire Spotter (Air Attack / Aerial Intelligence)	2
Light Helicopter (Air Attack / Aerial Intelligence)	1
Light Helicopter (camera – Special Intelligence Gathering)	1
Fixed Wing Line Scan (Line Scan)	3*
* 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.	
Large Air Tanker (Firebombing)	2
Fixed Wing Lead Plane (Air Attack)	2
Total	31

Aircraft that became available and/or released from service in Queensland that the NSW RFS engaged during the 2019-2020 fire season

Heavy Helicopter (Firebombing)	1
Single Engine Air Tanker (Firebombing)	2
Very Large Air Tanker (Firebombing)	2
Large Air Tanker (Firebombing)	1
Fixed Wing Lead Plane (Air Attack)	1
Total	7

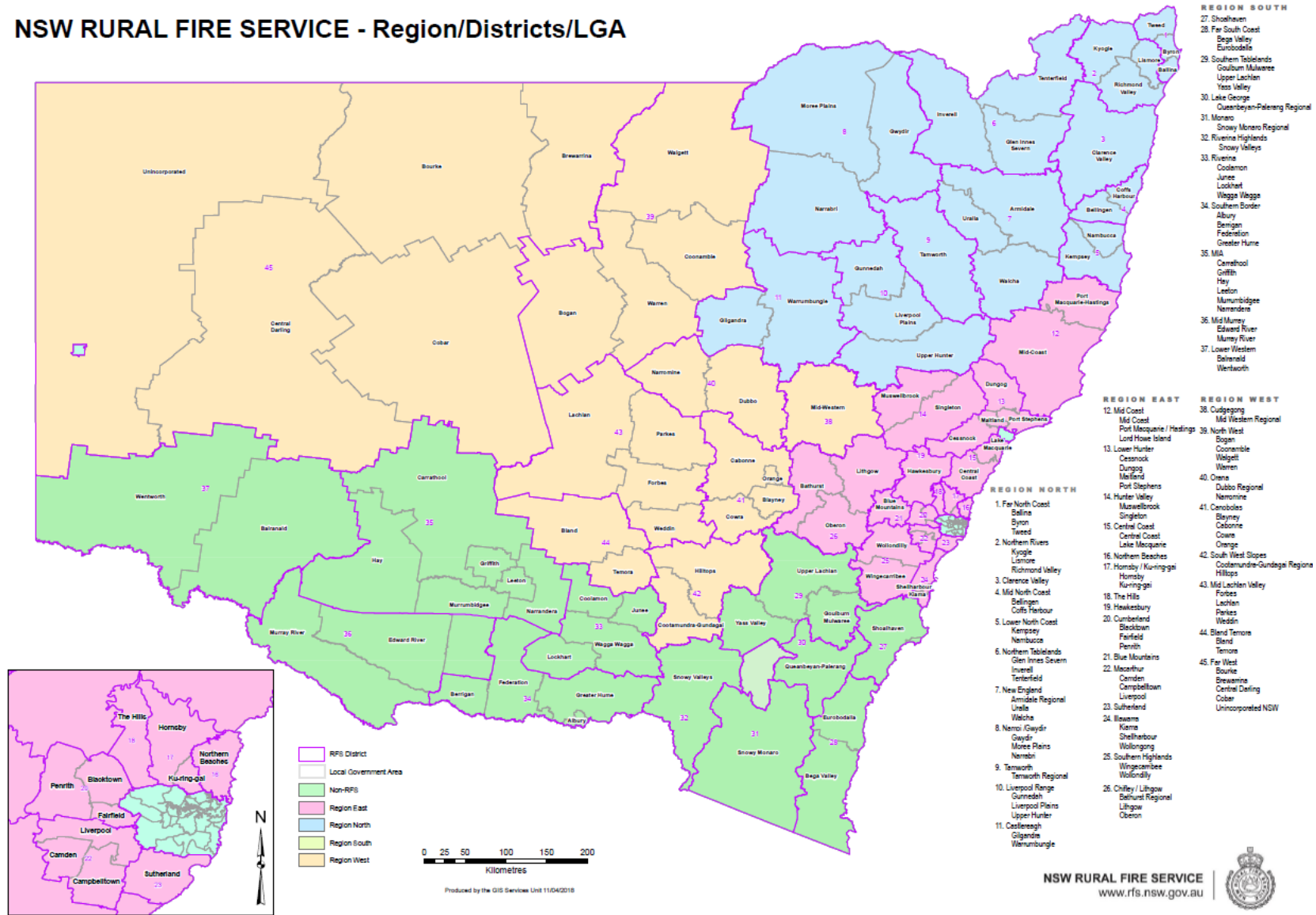
Fire & Rescue NSW – Remotely Piloted Aircraft System (RPAS)

Platforms up to sub 25 kilograms	15

Appendix Five

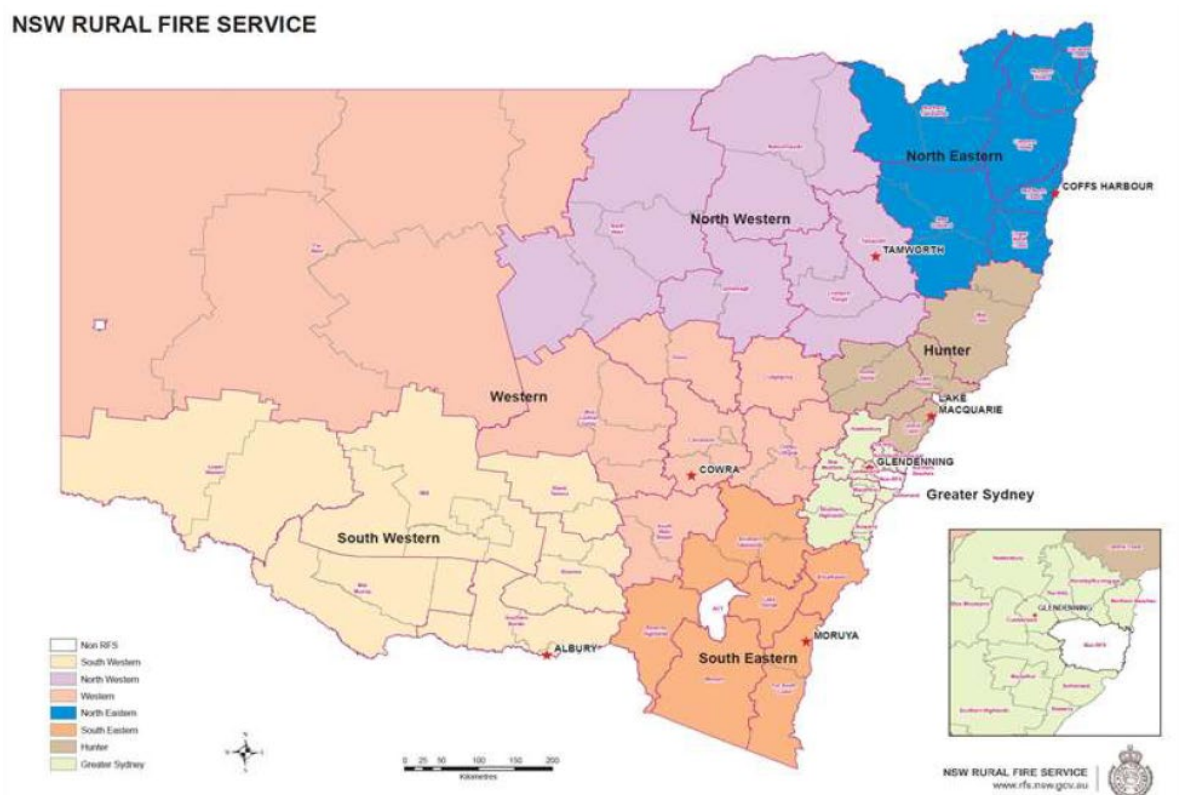
NSW Rural Fire Service – Region/Districts/LGA map

NSW RURAL FIRE SERVICE - Region/Districts/LGA



Appendix Six

NSW Rural Fire Service – Area management map



Area Name	Office Locality	Districts and Mitigation Crews
South Western	Albury	Lower Western, MIA, Mid Murray, Southern Border, Bland Temora, Riverina, Mitigation Crews (Wagga and Griffith).
North Western	Tamworth	North West, Namoi/Gwydir, Liverpool Range, Castlereagh, Tamworth, Mitigation Crews (Tamworth and Coonabarabran).
Western	Cowra	Far West, Orana, Mid Lachlan Valley, Canobolas, Cudgegong, South West Slopes, Chifley Lithgow, Mitigation Crews (Dubbo 1, Dubbo 2, Dubbo 3, Mudgee, Orange, Bathurst, Oberon, Bourke and Brewarrina).
North Eastern	Coffs Harbour	Northern Rivers, Far North Coast, Clarence Valley, Northern Tablelands, Mid North Coast, Lower North Coast, New England Mitigation Crews (Casino, Glen Innes 1, Glen Innes 2, Urunga 1 and Urunga 2).
South Eastern	Moruya	Monaro, Lake George, Far South Coast, Southern Tablelands, Riverina Highlands, Shoalhaven, Mitigation Crews (Nowra 1, Nowra 2, Nowra 3, Batemans Bay 1, Batemans Bay 2, Cooma 1, Cooma 2, Braidwood, Bega 1 and Bega 2).
Hunter	Lake Macquarie	Lower Hunter, Hunter Valley, Central Coast, Mid Coast, Mitigation Crews (Taree 1, Taree 2, Maitland 1, Maitland 2, Wyong 1 and Wyong 2).
Greater Sydney	Glendenning	Southern Highlands, Illawarra, Macarthur, Cumberland, Hawkesbury, Sutherland, Hornsby/Ku-ring-gai, The Hills, Northern Beaches, Blue Mountains, Mitigation Crews (Water NSW 1, Water NSW 2, Water NSW 3, Water NSW 4, Glendenning 1, Glendenning 2, Glendenning 3, Glendenning 4, Glendenning 5, Glendenning 6, Glendenning 7 and Mittagong).

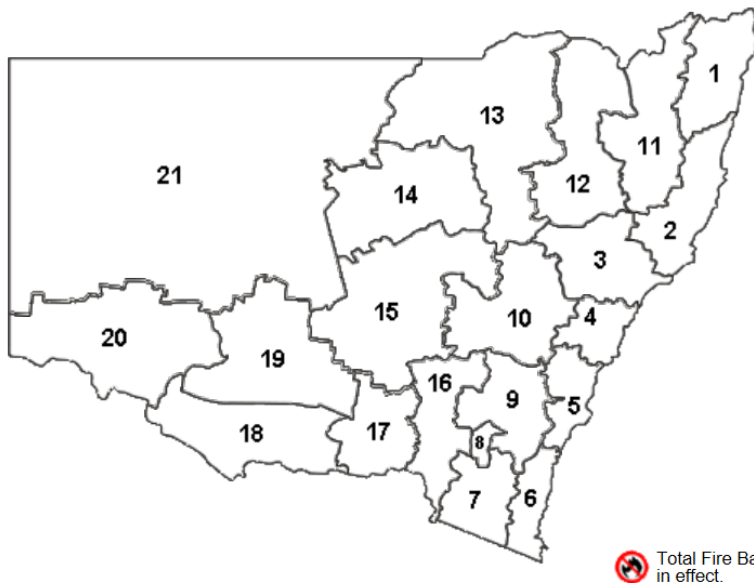
Source: NSW RFS (Rural Fire Service). (2020). *Advice to the Inquiry provided 8 May 2020.*

Appendix Seven NSW Rural Fire Areas

MAP VIEW TODAY

MAP VIEW TOMORROW

TABLE VIEW

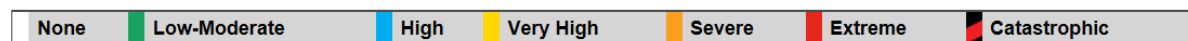


NO AREA SELECTED
FIRE AREA: 0

Councils Affected:

Choose a fire area by selecting the area number.

Fire Danger Rating



NSW Fire Areas

1	Far North Coast	2	North Coast	3	Greater Hunter
4	Greater Sydney Region	5	Illawarra/Shoalhaven	6	Far South Coast
7	Monaro Alpine	8	ACT	9	Southern Ranges
10	Central Ranges	11	New England	12	Northern Slopes
13	North Western	14	Upper Central West Plains	15	Lower Central West Plains
16	Southern Slopes	17	Eastern Riverina	18	Southern Riverina
19	Northern Riverina	20	South Western	21	Far Western

Source: RFS (NSW Rural Fire Service). Fire Danger Ratings and Total Fire Bans. Retrieved from <https://www.rfs.nsw.gov.au/fire-information/fdr-and-tobans>.

Appendix Eight

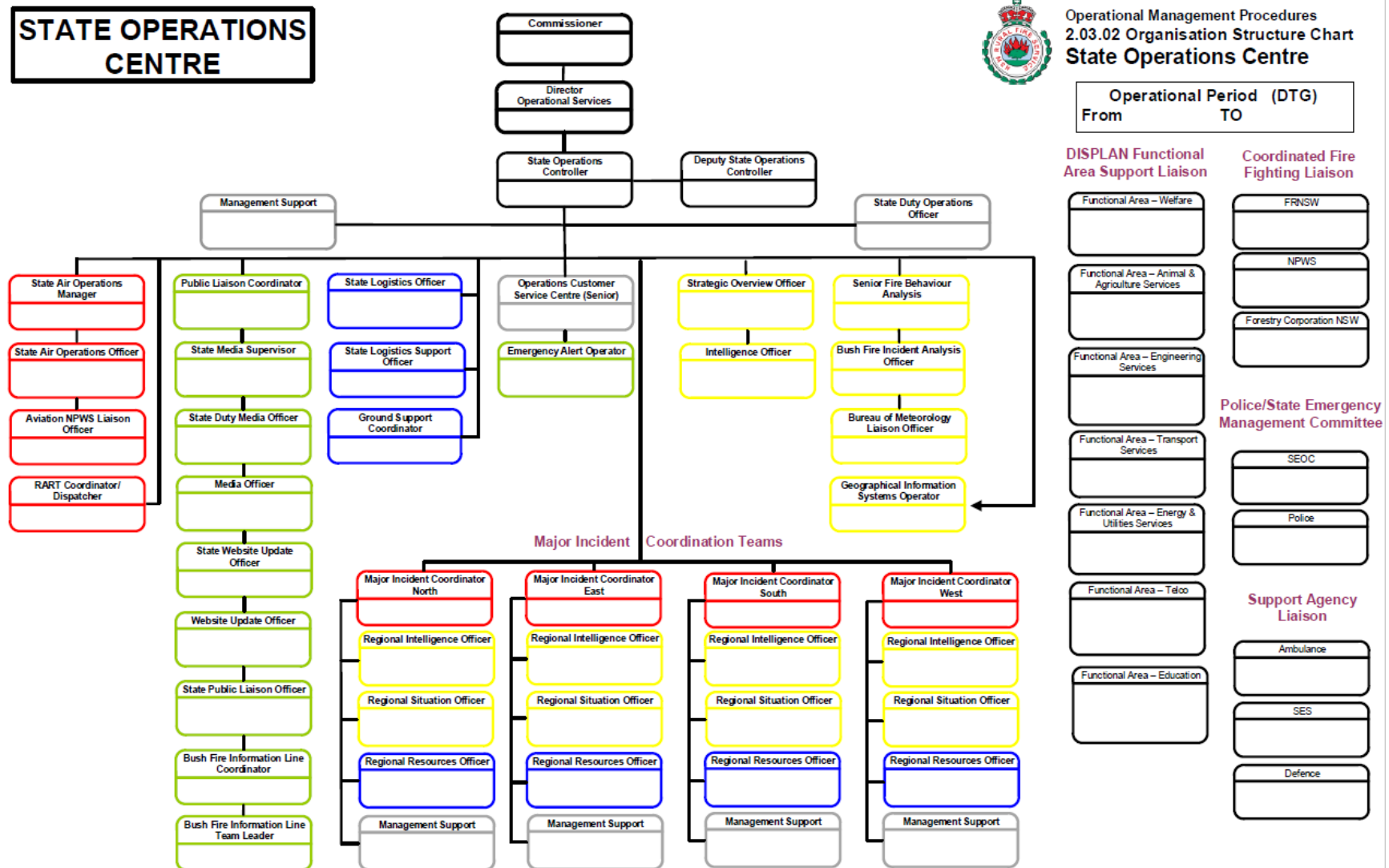
NSW Rural Fire Service fleet categories

Category	Description
Category 1	Medium Tankers (3,000 – 4,000L)
Category 2	Medium Tanker
Category 3	Medium Tanker
Category 4	Medium Tanker
Category 5	Heavy Tanker
Category 6	Heavy Tanker (> 4,000L)
Category 7	Medium Tanker (800 – 1,600L)
Category 8	Medium Tanker
Category 9	Light Tankers (<800L)
Category 10	Pumpers
Category 11	Medium Pumper
Category 12	Personnel Vehicles
Category 13	Bulk Water Carriers
Category 14	Tanker Trailer
Category 15	Marine Vessels
Category 16	Group & Command Vehicles
Category 17	Logistics Vehicles
Category 18	Catering Vehicles
Category 19	Communications Vehicles
Category 20	Other Vehicles
Category 21	Rescue Vehicles
Category 22	Community First Responder

Source: NSW RFS (Rural Fire Service). (2020). *Advice to the Inquiry provided 18 May 2020*.

Appendix Nine

State Operations Centre and Incident Management Team governance frameworks

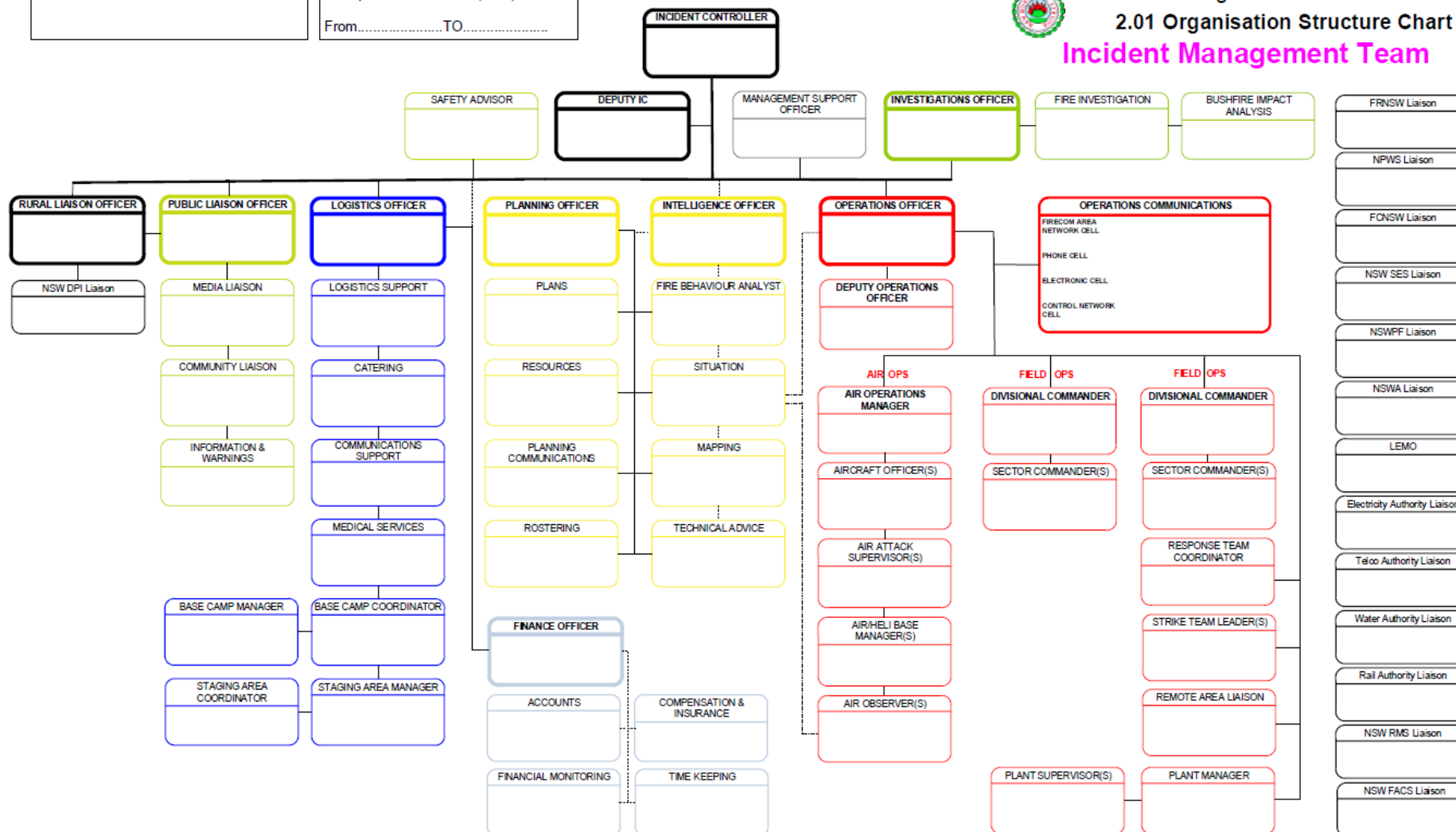


FIRE NAME

Operational Period (DTG)
 From.....TO.....



Incident Management Procedures
2.01 Organisation Structure Chart
Incident Management Team



Appendix Ten

NSW National Parks and Wildlife Service (NPWS) – Wollemi Pine Operation Case Study, May 2020.

The Wollemi Pine was thought to have been extinct for 60 million years until it was rediscovered in 1994 growing in a remote sandstone canyon in Wollemi National Park in the Blue Mountains, 150 km west of Sydney. The existence of ancient relatives of this species was known from widespread Gondwanan pollen and macrofossils from fossil records dating back over 100 million years. It was dubbed “the botanical find of the century” and famously described by the then Director of the Royal Botanic Garden Sydney, Professor Carrick Chambers, as “the equivalent of finding a small dinosaur still alive on Earth”. The species is of considerable significance in the study of the evolutionary relationships of early Gondwanan flora and has contributed to our understanding of long-term regional floristic change.

Discovery of the Wollemi Pine has also raised public enthusiasm, awareness and knowledge of environmental and biodiversity conservation issues. Fewer than 100 mature Wollemi Pines remain in the wild and the species is currently listed as Critically Endangered (the highest threat category) on the IUCN *Red List of Threatened Species*, as well as under national and State threatened species legislation. It is one of only six species, and the only plant species, to be recognised as ‘iconic’ under the NSW Saving Our Species Program.

Management of the Wollemi Pine is guided by the *Wollemi Pine Recovery Plan* (Dec 2007). This identifies actions to address key risks to the ongoing survival of the species including the introduction of pathogens (particularly *Phytophthora cinnamomi*), unauthorised visitation and collection, climate change and catastrophic fire.

Fire protection strategies for Wollemi Pines included:

- Incorporation of the protection of the Wollemi Pine into the NPWS’ hazard reduction program including undertaking prescribed burns to reduce fuel loads and enhance the capacity of NPWS to manage wildfires in the vicinity of the populations. In the three-year period leading up to the 2019-20 fire season, NPWS completed four large scale prescribed burns (covering more than 9,000 hectares) to achieve this goal.
- Establishment and management of a rapid aerial response team (RART) program to provide a quick response to ignitions in Wollemi NP including the Wollemi Pine sites. Rapid response to fire ignitions is a key factor in preventing the spread of remote area fires and this work is undertaken by specialist remote area firefighters that are deployed by helicopter to directly attack fires. For example, during the 2019-20 fire season NPWS RART responded to 20 remote area fires across the Greater Blue Mountains World Heritage Area and contained these to an average area of less than 1.2 hectares.
- The establishment of Wollemi Pine translocation sites to minimise the risk of extinction in the wild in the event of a catastrophic fire. Translocation is the re-establishment of a population of a species in a location where it previously existed but does not currently exist.

During the 2019-20 fire season, high intensity fires burning under extraordinarily dry conditions threatened all four sites of the last remaining wild populations of the Wollemi Pine. In response NPWS and the NSW RFS implemented the ‘Wollemi Pine Operation’ in spring 2019 and assembled a group of highly experienced firefighters and ecologists to work together to minimise the impacts of the approaching fires on the species. Over a 38-day period NPWS delivered the following key actions as part of this operation:

- i) Pre-fire site preparation. Two separate irrigation lines were established within the site containing the largest and oldest Wollemi Pines. One consisted of a 50 m line and the other a 100 m line, each with individual pumps and three sprinkler heads which covered 10 adult trees. Due to the remote and rugged nature of the terrain all materials were slung and dropped into the site via helicopter. Crews were then winched into the site on a daily basis over a 15-day period to irrigate the area as much as possible, given the limited water available on site to increase soil and fuel load moisture levels.
- ii) Direct attack on the approaching fire front. An experienced NPWS Air Attack Supervisor developed a retardant strategy to slow wildfire progression towards the Wollemi Pine sites and worked with NSW RFS to establish retardant lines using the Very Large Air Tanker.
- iii) Site impact reduction. Helicopter water bucketing was used to reduce fire spread and intensity as the fire front reached the Wollemi Pine population. NPWS ground crews were winched into the site the day after fire impact, repaired irrigation lines damaged by the fire and extinguished all active fire around the trees. 'Blacking out' by ground crews continued over the following days but was hampered by reduced visibility due to smoke and safety concerns as rocks and trees continued to fall from surrounding steep slopes.
- iv) Post-fire monitoring and assessment. Assessment of the impacts of the fires on the Wollemi Pine population commenced once suppression operations were complete. This was undertaken by a two-person field team who were winched into the sites over multiple days.

The Wollemi Pine Operation was successful in reducing impacts on the population from catastrophic fire. The upper canopies of the majority of adult trees survived the fires intact and no mortality of adult trees has been observed. However, there were still detrimental impacts. Adult trees were damaged by basal charring and the impact of falling rocks. Fire also burnt through the understorey of all four sites and scorched all juvenile plants burnt along with the lower trunks and lower canopies of most adult trees.

It is imperative that further fires are excluded from the Wollemi Pine population to enable post-fire recovery and re-establishment of the juvenile plants. NPWS is currently considering actions to reduce the future impacts of wildfire on threatened species including the iconic Wollemi Pine. Some of these opportunities include:

- Reviewing the current Wollemi Pine Recovery Plan. This review was already underway prior to the fire season and the review process will now be updated to include additional strategies for minimising the impacts of wildfire on the Wollemi Pine population.
- Implementing post-fire wildlife recovery actions including identifying plant and animal species most at risk and boosting targeted pest animal and weed control programs.
- Reviewing future levels of hazard reduction activity by applying a risk management framework. This will address the risks to environmental, social and economic assets on and adjacent to NPWS-managed land.
- Reviewing NPWS's bush fire suppression capacity including the organisation's long standing and highly successful rapid aerial fire response (RART) program.
- Enhancing NPWS' programs to measure the long-term impact of fire on ecological assets.
- Better communicating the role of NPWS in protecting both the community and environmental and cultural heritage from the impacts of wildfire.

Source: NPWS (National Parks and Wildlife Service). (2020). *Advice to the Inquiry provided 8 May 2020*.

Appendix Eleven Initial Aerial Attack for Early Fire Suppression (dispatch models used in South Australia and Victoria)

Victorian Model:

The 2009 Victorian Bushfire Royal Commission recommended the establishment of “a system that enables the dispatch of aircraft to fires in high risk areas without requiring a request from an Incident Controller or the State Duty Officer”.¹²⁹⁷ The Victorian model is based around the establishment of Pre-Determined Dispatch (PDD) to ensure fire fighting aircraft are dispatched at the earliest opportunity to an incident based on fire danger rating for a defined geographical area. The primary aim of PDD is to keep small fires small and to provide aerial fire fighting at the earliest opportunity to support ground crews in fire suppression.¹²⁹⁸ The model was developed to assist and align with sound fire fighting operations.

The Victorian aviation response fleet is made up of fixed wing and rotary aircraft and is supported by strategic aircraft that do not operate on the PDD arrangements and include intelligence and supervision aircraft. The aircraft are pre-positioned around the State and operate during the fire period to support response activities. As previously stated, the pre-positioned aircraft are supported by adequate personnel and ground equipment.

PDD commenced operations in Victoria during the 2012 season with a trial at Bendigo and has now been expanded to include all fire-bombing State Fleet Aircraft except the State Strategic Aircraft which are the LATs (Large Air Tankers), the Erickson Air Cranes and infra-red linescan aircraft.¹²⁹⁹

South Australian Model:

In 1997, the South Australian Country Fire Service (SACFS) developed and implemented procedures for the response of aerial fire fighting resources to bush fires based on an aggressive Rapid Initial Attack Strategy in support of ground resources. The strategy is executed within a number of established Primary Response Zones (PRZs) across South Australia.¹³⁰⁰

In South Australia, the objective of the initial attack is quickly to contain fires when they are small and thereby minimise the costs of suppression and damage that may result. In order to achieve this, South Australia has defined geographical areas called Primary Response Zones (PRZ). These are geographical areas where uncontrolled grass or bush fires may have serious consequences on life, community property, critical infrastructure, environmental and/or commercial assets. The primary function of aerial fire fighting resources within these PRZs is the rapid initial attack to assist ground resources with early control of the fire, coupled with the provision of community information.

¹²⁹⁷ 2009 Victorian Bushfires Royal Commission. (2010). Final Report Summary, Recommendation 20. Retrieved from

http://royalcommission.vic.gov.au/finaldocuments/summary/PF/VBRC_Summary_PF.pdf.

¹²⁹⁸ Department of Environment, Land, Water and Planning, Victoria. (2018). Pre-Determined Dispatch of Aircraft in Victoria: Operating Protocols.

¹²⁹⁹ Ibid.

¹³⁰⁰ Review of the Effectiveness of Rapid Initial Attack Aerial Fire fighting Operations in South Australia 2011/12 to 2016/17.

A Nominated Operating Base (NOB) is defined as the location (normally a designated airbase) at which contracted aerial fire fighting aircraft are based. In order to achieve its desired outcome, SACFS established the following principles to support the rapid air attack:

1. exclusive use contracts for 17 aerial fire fighting aircraft
2. automatic dispatch system within identified PRZs with ground resources
3. three (3) PRZs to minimise travel time
4. forty-one (41) strategically located airbases to increase fireground productivity through quick turnaround times.¹³⁰¹

The standby and automated dispatch system operates within a PRZ during peak bush fire periods for extended periods of time. Aircraft are automatically dispatched to any reported rural fire in a PRZ simultaneously with ground resources during this bush fire period:

*The standard aircraft response is two (2) single-engine air tankers (SEATs) and two (2) surveillance aircraft (1 air attack, 1 air observation) in support of ground resources of two (2) tankers or four (4) tankers and a Bulk Water Carrier (BWC) on days of TFB. A Type 1 Helitack is added to the initial attack response schedule for the identified Helitack Response Zone (HRZ) within the Mount Lofty Ranges PRZ.*¹³⁰²

The South Australian model, whilst implemented since 1997, had not been evaluated to determine its effectiveness. In 2017 an initial review was conducted with a second operational review conducted in 2018. The second review was undertaken as data had highlighted potential limitations to the success of the rapid initial attack at elevated fire danger ratings.¹³⁰³ The report recommended an increase in the weight (or number of aircraft) in the rapid response during the elevated fire danger period.

The increase in aircraft resulted in the introduction of a 2nd alarm (4 x Single-engine Air Tanker) aircraft dispatch on days of total fire ban (TFB) within PRZs. The results over the 2017-18 total fire ban days is on a limited data set. It showed significant operational improvement in keeping the fires small (below 10 hectares). The results also highlighted a decrease in total loads delivered (retardant).¹³⁰⁴

¹³⁰¹ Ibid.

¹³⁰² Ibid.

¹³⁰³ Government of South Australia. (2018). Operational Trial – 2nd Alarm Total Fire Ban (TFB) Aerial Firefighting Response Analysis.

¹³⁰⁴ Ibid.

Appendix Twelve Examples of aircraft that may assist to inform the initial aerial dispatch trial design

The Inquiry found that a vast array of aircraft is used in response to fighting fires, as outlined by AFAC in its submission to the Inquiry. The Inquiry is also aware that there has been considerable media interest in the use of fixed wing water scooping aircraft (skimmers) for fire fighting. These scooping aircraft may have the ability to apply large volumes of water rapidly to a fire provided they are within a reasonable distance from a suitable body of water (lake or ocean inlet) or airport for resupply.

AFAC advised the Inquiry that there was currently a variety of scooping aircraft on the market, sighting examples of Canadair (now Viking) CL415 turboprop (max. capacity 6,100 litres); Beriev Be200 (max. capacity 12,000 litres – not currently licensed to operate in Australia); and with developers in Japan and China currently developing large turboprop water scooping aircraft.¹³⁰⁵ A smaller version is the AirTractor 802 Fireboss (max. 3,200 litres).

The last evaluation of water scooping aircraft was conducted in 1996¹³⁰⁶ (CL415) that resulted in the earlier model being used in South Australia and Victoria in 1997. The Inquiry found that this research is now dated (24 years) and new research should be undertaken as to the use of these aircraft as part of the aviation fleet.¹³⁰⁷

The Inquiry reviewed the standards as set out in the NAFC tender documents for the last contractual period.¹³⁰⁸ The request for large air tankers related to Type 1 and Type 2 aircraft (capacity of 6,800 litres upwards) and tender for aerial fire fighting services that was Type 4 rotary fixed wing (greater capacity than 2,270). The NAFC procurement process has allowed for water scooping aircraft to be tendered. However, the 6,800-litre capacity has limited their viability and the evaluation panels considered that they did not offer better value for money than other tendered solutions. Smaller scooping aircraft (Fireboss) have been contracted.¹³⁰⁹ The submission by Emergency Leaders for Climate Change included a comparison chart between the Bombardier 415 and AT802 Fire Boss that is provided below in Figure X. The Inquiry notes this does not show the water sources required for each aircraft.

¹³⁰⁵ Australasian Fire and Emergency Service Authorities Council (AFAC), Submission to the Inquiry.

¹³⁰⁶ Ibid.

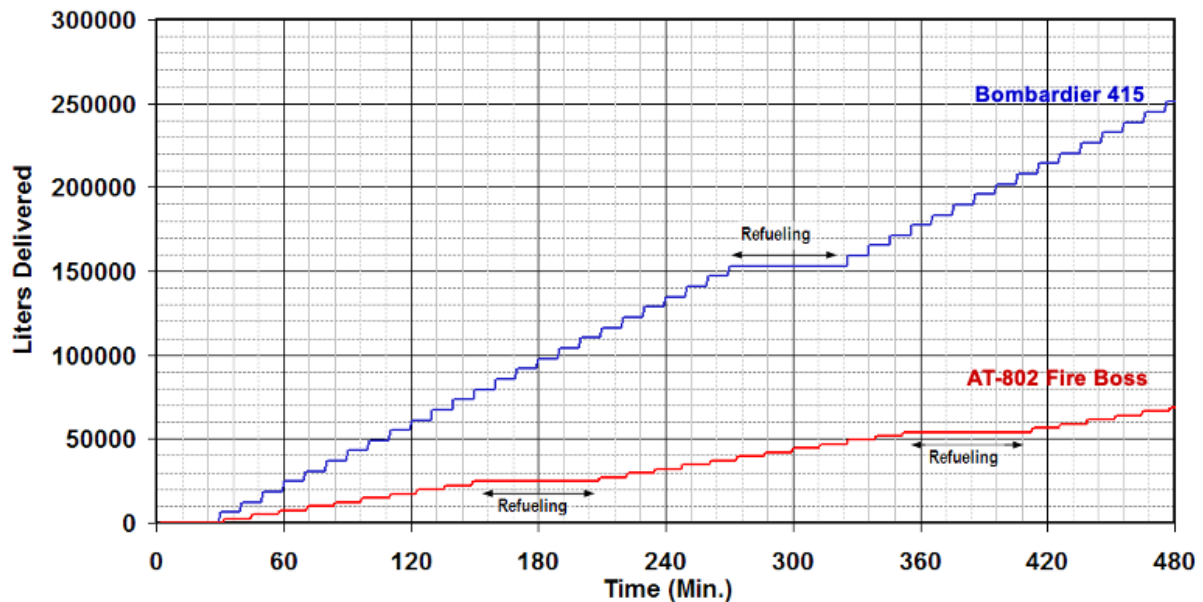
¹³⁰⁷ Keating, E, Morral, A, Price, C, Woods, D, Norton, D, Panis, C, Saltzman, E & Sanchez, R. (2012). Air Attack Against Wildfires. Understanding US Forest Service Requirements for Large Aircraft. Rand Homeland Security and Defense Centre. Sponsored by the United States Forest Service. Rand Corporation. Retrieved from <https://www.rand.org/pubs/monographs/MG1234.html>.

¹³⁰⁸ National Aerial Firefighting Centre (NAFC). Past tenders. Retrieved from http://nafc.org.au/?page_id=138.

¹³⁰⁹ Australasian Fire and Emergency Service Authorities Council (AFAC), Submission to the Inquiry.

The Bombardier 415 aircraft productivity versus AT-802 Fire Boss

The Bombardier 415 aircraft and the Fire Boss are the only two amphibious firefighting aircraft certified by EASA, FAA and Transport Canada.



Based on a 8 hours day - Base to fire distance of 30nm, water to fire of 10 nm, SL; ISA

BOMBARDIER

Figure Appendice-1: Comparison of drop efficiency between a Bombardier 415 water scooping aircraft and an AT-802 Fire Boss scooping aircraft.¹³¹⁰

¹³¹⁰ Emergency Leaders for Climate Action, Submission to the Inquiry.

Appendix Thirteen Summary of Australian Government Assistance (DACC requests)

Summary of Australian Government Assistance			
Request ID	Title	Details	Status
NSW Bush fire Season 2019-20 – No.001	Contingency air transport for operational firefighters	Provision of air transport for intra and interstate travel when commercial operation are not available between 04 November and 29 December 2019.	Complete 13 individual tasks currently within this request. Approximately 1,769 pax transported under this request. Superseded by No.013
NSW Bush fire Season 2019-20 – No.002	Provision of Accommodation and Meals in Singleton	Accommodation and sustenance for up to 149 in Singleton Barracks between 11 and 13 November 2019.	Complete (180 accommodated)
NSW Bush fire Season 2019-20 – No.003	Specialised Rotary Wing Support	Specialised rotary wing support for reconnaissance and emergency movements of firefighters and civilians between 12 – 13 November 2019	Complete Extended to 1900hrs 14 November 2019
NSW Bush fire Season 2019-20 – No.004	Activation of the International Charter 'Space and Major Disasters'	Activation of the Charter to facilitate high resolution, specialised satellite imagery of impact areas to support the damage assessment process.	Complete Completed on 29 November 2019.
NSW Bush fire Season 2019-20 – No.005	Provision of Accommodation and Meals at RAAF Base Richmond	Accommodation and sustenance for between 150 and 300 people in RAAF Base Richmond between 13 and 18 November 2019.	Complete Completed on 18 November 2019.
NSW Bush fire Season 2019-20 – No.006	Provision of Catering to the Northern Region	Provision of Catering based at Casino FCC for 7 days – first meal served AM of 18 November 2019. Personnel only, no equipment required.	Complete Completed on 16 December 2019. Superseded by No.014
NSW Bush fire Season 2019-20 – No.007	Continued Provision of Accommodation and Meals at RAAF Base Richmond	Accommodation and sustenance for between 150 and 300 people in RAAF Base Richmond between 19 November 2019 and 23 November 2019 with a pre-emptive provision until 25 November 2019.	Complete Completed on 23 November 2019
NSW Bush fire Season 2019-20 – No.008	Provision of Logistical Support across 5 areas of S44 Declaration	5 groups of crew with a truck to provide support to move equipment and stores as required. Commencing 26 November 2019 for 7 days.	Complete Superseded by No.17
NSW Bush fire Season 2019-20 – No.009	Assistance for the provision of aerial support	2 search and rescue helicopters to be deployed from 2 December 2019 to 4 December 2019 to be deployed in Greater Hunter and South Coast. Inclusion of reconnaissance activities in the request approved from 03 December 2019.	Complete Completed on 11 December 2019

Summary of Australian Government Assistance			
Request ID	Title	Details	Status
NSW Bush fire Season 2019-20 – No.010	Provision of 24/7 access to Marrangaroo Training Area as Air Base	24/7 access to Marrangaroo Training Area as Air Base for rotary wing operations for up to 5 rotary wing aircraft, personnel and pilots, 2 fuel trucks and maintenance crews (provided by NSW) for 4 weeks as of 2 December 2019	Complete Completed on 16 December 2019. Superseded by No.012
NSW Bush fire Season 2019-20 – No.011	Provision of flight line support to RFS aircraft	4 personnel to perform flight line support to load RFS aircraft with fire retardant and water for 14 days as of 3 December 2019	Complete Completed on 16 December 2019. Superseded by No.014
NSW Bush fire Season 2019-20 – No.012	Provision of 24/7 access to Marrangaroo Training Area as Air Base	24/7 access to Marrangaroo Training Area as Air Base for rotary wing operations for up to 5 rotary wing aircraft, personnel and pilots, 2 fuel trucks and maintenance crews (provided by NSW) for 6 weeks as of 16 December 2019 up to 26 January 2020.	Completed (terminated 14 January 2020 as per RFS request)
NSW Bush fire Season 2019-20 – No.013	Contingency air transport for operational firefighters	Provision of air transport for intra and interstate travel when commercial operation are not available between 29 December 2019 and 01 February 2020.	Complete
NSW Bush fire Season 2019-20 – No.014	Provision of catering and flight line support in Casino	Provision of Catering and flight line support based in Casino.	Complete
NSW Bush fire Season 2019-20 – No.015	Assistance for the provision of aerial support	2 search and rescue helicopters to be deployed from 19 December 2019 to 23 December 2019 to be deployed in Greater Hunter and South Coast to support reconnaissance and emergency extraction of fire fighting personnel and civilians	Complete
NSW Bush fire Season 2019-20 – No.016	Provision of 24/7 access to accommodation (50 beds) at Marrangaroo Training Area	Accommodation contingency requested for 50 beds to be made available at Marrangaroo Training Area which is being used as per No.12. Requested up to 26 January 2020.	Complete (terminated 14 January 2020 as per RFS request)
NSW Bush fire Season 2019-20 – No.017	Provision of Logistical Support across 5 areas of S44 Declaration	6 groups of crew with a truck to provide support to move equipment and stores as required. Commencing 22 December 2019 for 3 weeks up to 13 January.	Complete

Summary of Australian Government Assistance			
Request ID	Title	Details	Status
NSW Bush fire Season 2019-20 – No.018	Provision of Fire Suppression Support at Picton Air Base	An Aircraft Rescue and Fire fighting (ARFF) Striker to be provided as support at the Picton Air Base, commencing 23 December up to 26 December 2019.	Complete
NSW Bush fire Season 2019-20 – No.019	Provision of ADF Advisors to scope potential requests for assistance	ADF Specialist advisors will work with Incident Controllers and Local Government representatives to scope out any current capability gaps that may result in requests for Australian Government Assistance. 14 persons will deploy to 14 areas between 27 and 30 December 2019.	Complete
NSW Bush fire Season 2019-20 – No.020	Provision of Fire Suppression Support at Picton Air Base	Support for fire suppression during hot refuelling at Picton Air Base between 28 December 2019 and 03 January 2020.	Complete
NSW Bush fire Season 2019-20 – No.021	Specialised Rotary Wing Support	Specialised rotary wing support for reconnaissance and emergency movements of firefighters and civilians between 29 December 2019 and 02 January 2020	Complete
NSW Bush fire Season 2019-20 – No.022	Accommodation and Sustenance Support in Nowra	Support for accommodation and Sustenance for RFS personnel in Nowra at HMAS Albatross	Complete
NSW Bush fire Season 2019-20 – No.023	Response phase engineering support	Support to the RFS for engineering support previously identified by ADF advisors	Complete
NSW Bush fire Season 2019-20 – No.024	Recovery phase engineering support	Support to identified areas for engineering support previously identified by ADF advisors to enhance initial recovery operations.	Complete
NSW Bush fire Season 2019-20 – No.025	Continued Specialised Rotary Wing Support	Specialised rotary wing support for reconnaissance and emergency movements of firefighters and civilians between 02 January and 06 January 2020	Complete
NSW Bush fire Season 2019-20 – No.026	Continued Provision of Fire Suppression Support at Picton Air Base	An Aircraft Rescue and Fire fighting (ARFF) Striker to be provided as support at the Picton Air Base, continuing from 03 January until 26 January 2019.	Complete
NSW Bush fire Season 2019-20 – No.027	Use of HMAS Albatross as a Logistical Node	Use of HMAS Albatross as a Logistical Node and staging area for ongoing and predicted operations in the southern region.	Complete

Summary of Australian Government Assistance			
Request ID	Title	Details	Status
NSW Bush fire Season 2019-20 – No.028	Ongoing ADF Support to Ongoing Operations	The establishment of an ADF Joint Task Force to assist with overarching defence support throughout the state.	Complete
NSW Bush fire Season 2019-20 – No.029	Continued Specialised Rotary Wing Support	Specialised rotary wing support for reconnaissance and emergency movements of firefighters and civilians between 06 January and 13 January 2020	Complete
NSW Bush fire Season 2019-20 – No.030	Ongoing ADF Support to Ongoing Operations	Continuation of the current support arrangements covering both the response and immediate relief support provided by the Australian Government via ADF Joint Task Force up until 1 March 2020, subject to a review 21 February 2020.	Active
NSW Bush fire Season 2019-20 – No.031	Contingency air transport for operational firefighters	Extension of No.13 - provision of air transport for intra and interstate travel when commercial operation are not available between 01 February and 01 March 2020.	Active
NSW Bush fire Season 2019-20 – No.032	Planning and Coordination Support for S44 Make Safe Plans	Defence specialist to provide specialist advice and project management support to coordinate a strategy around the extensive make-safe plans for a period of 3 weeks, with a possible extension commencing 24 February 2020	Submitted to EMA

Source: NSW RFS (NSW Rural Fire Service). (2020). *Advice to the Inquiry provided 15 April 2020.*