Key learnings from Australian drinking water authorities for catchment bushfire response – Preparedness, priorities, and performance

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Key Points

- The 2019/2020 Black Summer Bushfires impacted every state and territory throughout Australia
- Many communities experienced compounding natural disasters (bushfire then floods) with far-reaching impacts to essential services and the environment.
- Water authorities throughout Australia had to implement response strategies to mitigate potential water quality impacts.
- Pre-fire planning was essential to post-fire response and ensured swift and efficient response.
- Post-fire catchment response strategies must be considered specific to catchment contexts
- Limited evidence and research in an Australian context hindered response efforts in often sensitive environmental settings.
- Post-intervention monitoring should be integrated into bushfire plans to improve future bushfire response.
- Agencies and research institutions should share and promote best practice, research knowledge gaps, and share 'lessons learned' to build more resilient communities.

Abstract

Following the 2019/2020 Black Summer Bushfires, the Soil Conservation Service (SCS) reviewed strategies implemented by Australian water authorities to manage drinking water catchments post-fire. SCS interviewed drinking water authorities in six states/territories to discuss post-fire catchment management strategies and identify key learnings/recommendations. SCS identified pre-fire planning was essential to post-fire response. Water authorities with detailed risk assessment, contingency planning and response procedures were the best prepared for responding rapidly following bushfire. Due to the unprecedented nature of 2019/2020 Black Summer Bushfires, a 'give it a go' attitude was integral in most bushfire catchment response case studies. Post-fire catchment response strategies must be considered in specific catchment contexts, especially literature from international studies. This review provides water authorities and catchment managers with key learnings for bushfire preparedness and response in an Australian context. Knowledge gaps including limited post-intervention monitoring were common to many authorities and should be integrated into bushfire response plans to improve future bushfire response.

Keywords

Bushfire, Catchment, Water Planning, Water Quality, Water Supply, Planning

Introduction

The 2019/2020 Black Summer Bushfires (Black Summer Bushfires) impacted every state and territory throughout Australia with over 24 million hectares of bushland burnt nationwide. The bushfires started during Australia's hottest and driest year on record while much of the country was in drought but were followed by storms and floods compounding disaster impacts for many communities and the environment.

Natural disasters are expected to become more frequent, intense, hard to predict, and more difficult to manage. It is also likely we will see more compounding disasters with far-reaching consequences- threatening not only lives and homes, but also the nation's economy, critical infrastructure and essential services, such as our electricity, telecommunications and water supply.

The Royal Commission into National Natural Disaster Arrangements tabled in Parliament on 30 October, 2020 suggests to ensure Australia is more resilient to natural disasters, we need to build the capacity of communities to prepare for, adapt to, and recover from disasters. This requires agencies and research institutions to share and promote best practice, research knowledge gaps, and share 'lessons learned'.

To better prepare for future natural disasters, WaterNSW engaged the Soil Conservation Service (SCS) to consult other key water authorities throughout Australia who were impacted by the Black Summer Bushfires. Some water authorities had also been impacted by past bushfire events.

The objective of this consultation was to:

- Review physical interventions that have been implemented by other water authorities to mitigate potential post-fire raw water contamination risk.
- Understand the background, reasoning and context of the post-fire response undertaken by other water authorities throughout Australia.
- Provide recommendations, actions and lessons learnt to plan for future natural disasters and climatic events.
- Identify knowledge gaps and research opportunities for future water and catchment management planning.

This paper outlines the key drivers, lessons learnt, and knowledge gaps identified through discussions with Australian water authorities after the Black Summer Bushfires.

Approach

Bushfire preparedness and response methods were reviewed for six key water authorities throughout Australia. Water authorities involved in the study included:

- Melbourne Water (Victoria)
- SA Water (South Australia)
- Icon Water (Australian Capital Territory)
- Water Corporation (Western Australia)
- TasWater (Tasmania)
- WaterNSW (New South Wales)

Water authority information was compiled by reviewing bushfire response documents and interviewing water authority personnel between 2 July 2020 and 7 July 2020. All discussions were undertaken via online meetings due to COVID Restrictions.

The catchment context of the bushfire affected water storages for each interviewed water authority is outlined in Table 1 and highlights the variety of water supply systems in existence throughout Australia.

Table 1 Summary of bushfire effected water supply storages managed by interviewed Australian water authorities.

Reservoir	Water Agency	Total Capacity (GL)	Supply (%)	Treatment Type	Approximate Catchment Area (ha)	Total Burnt Area (ha)	Burnt Catchment Area (%)
Warragamba Dam	WaterNSW	2027	80%	Treatment Plant	905,000	320,000	30%
Thomson Reservoir	Melbourne Water	1068	60%	Chlorination	48,700	6,266	13%
Mt Bold Reservoir	SA Water	46.4	Network	Filtration + Chlorination	38,900	1,700	4%
Millbrook Reservoir		15.7	Network		3,700	3,700	100%
Middle River Reservoir		0.54	80%		14,500	14,500	100%
Corin Dam	ICON Water	70.9	75%	Filtration + Chlorination	19,700	19,500	99%
Bendora Dam		11.4			9,300	164,914	29%
Cotter Dam		76.2			19,230		
Mundaring Weir	Water Corporation	63.6	10%	Chlorination	150,000	18,060	12%
Lower Helena		0.14			3,300	132	4%
Canning		90.5			73,000	1,785	2%
Kangaroo Gully					5,900	5,110	93%
Victoria		9.5			3,700	1,690	46%
Huon River	TasWater	N/A	Network	Filtration	262,000	65,500	25%

*note – all values are approximate.

Key Drivers

Through the consultation process it was identified, water authorities throughout Australia had to act quickly to address potential risks to water quality often utilising research and methodologies trialed and tested in an international context. For some authorities, the drought also added the need to protect dwindling water supplies from the risk of contamination. From discussions, it was evident the key drivers influencing bushfire response include:

- Catchment context and key landscape characteristics (such as terrain, land use, bushfire extent and severity).
- Relevant legislation and environmental approval pathways.
- Land ownership, accessibility and key stakeholders.
- Water source characteristics (such as catchment size, reservoir size and supply/demand).
- Water quality objectives and parameters of concern.
- Operational systems and treatment options.
- Environmental constraints and cultural heritage assets.
- Burn severity and extent.

Bushfire response strategies generally followed a process of pre and post-fire planning, post-fire response, post-fire monitoring and strategy review. Due to experience with previous bushfire events some water authorities had more strategies in place prior to the Black Summer Bushfires and could more easily take

action when required. An outline of response strategies and key learnings from the bushfire response process is summarised in Table 2.

Table 2 Summary of water authority bushfire preparedness and response strategies utilised by the interviewed water authorities

Respsonse	Action	Key Learning and Description
Pre-fire Planning	Pre-fire planning, Pre-fire stakeholder liaison	Enables effective fire management and response.
	Erosion control stockpile	Allows rapid post-fire catchment management response.
Post-fire Planning	Rapid Risk Assessment Desktop Rapid Risk Assessment On-ground, Post-fire action plan	Guides targeted post-fire catchment management response specific to event and catchment conditions.
Post-fire Response	Coir log channel check	Able to be effectively installed manually with minimal disturbance footprint. Low environmental risk and do not require removal.
	Straw bale channel check	Difficult to install effectively and risk of introducing weed species to sensitive environment. Not recommended.
	Wire channel check	Able to be effectively installed manually with minimal disturbance footprint. Low environmental risk and can remain in situ.
	Rock channel check	Suitable for locations with good vehicle and machine access, such as adjacent to fire trails. Machine use can cause a greater disturbance footprint in sensitive environments compared to manually installed erosion control devices.
	Debris Rack and Settling Basin	Specific to debris flow processes. Suitability should be determined based on catchment context.
	Hydromulch	Unsuitable for high energy flow conditions. Unknown risk in sensitive environments and unknown effect on natural regrowth.
	Hand seeding	Requires large supply of suitable local provenance seed. Does not provide immediate erosion control. Unknown risk to natural regrowth and vegetation communities
	Sediment fence	Unsuitable for high energy flow conditions. Synthetic materials that require removal after initial erosion threat.
	Sediment boom	Water quality outcomes need to be investigated further to determine if suitable for the catchment context. Should not replace strategies that control sediment at the source and should not be used in locations or events that experience major fluctuations in water level.
	Adjustable offtake, water storage transfer, reservoir dosing, New or upgrade WTP	Enables water supply from a greater range of water storage conditions.
	Fire trail repair / Control Line Remediation, Fire trail sediment trap	Mitigates the effects of additional sediment supply and conveyance from fire trail/control line network. Provides effective access within catchment for post-fire response and routine catchment management. Can be implemented during fire trail repair works.
	Fire trail closure/reconciliation	Mitigates the effects of additional sediment supply and conveyance from fire trail network
Post-fire Monitoring	Sediment controls, water quality and catchment parameters	Enables effective review and update of post-fire response strategies.
Post-fire Review	Post-fire Response review and report	Enables effective review and update of post-fire response strategies.

Key Learnings

Pre-fire Planning

Pre-fire planning and the development of stakeholder relationships prior to natural disasters is essential for effective fire management and response. Strategies implemented and identified by interviewed water authorities include:

- The development of a disaster response management plan framework for key supply catchments that may be at risk. Example plans may include Fire Management Plan, Post-Fire Recovery Strategy and Fire Recovery Manual, RRAT Report, Post-Fire Action Plan (implement recommendations from the RRAT).
- Identifying water supply sources that are vulnerable to natural disasters such as bushfires and high intensity storm events.
- If fire plans and risk assessments indicate erosion and sediment control is required to mitigate identified water quality risks, water authorities should consider developing and maintaining a stockpile of erosion and sediment control supplies to enable rapid post-fire deployment.
- Investigating opportunities to diversify the water supply network and plan for altered network configurations during natural disasters.
- Investigating opportunities to upgrade specific treatment plants to deal with additional post-fire contaminants.
- Development of cooperative fire management arrangements with key stakeholders such as environmental government agencies, private landholders, firefighting services, Aboriginal communities and water authorities. Liaise and engage with stakeholders regularly.
- Development of a streamlined environmental approval pathway for emergency post-fire erosion control works.
- Development and implementation of bushfire RRAT framework and process and the involvement of water authority representatives in this process.
- Ensuring trail networks are repaired and maintained to best practice standards to reduce background sediment transport rates. Following natural disasters, a rapid response inspection and repair/maintenance process should be undertaken.

Post-fire Response

Depending on the context, the post-fire response to the Black Summer Bushfires varied, with some authorities identifying the lack of evidence in an Australian context as a key hindrance to implementing response strategies. Water authorities that implemented strategies, provided the following lessons learnt:

- Timing is critical. Post-fire assessment and response should be actioned as soon as it is safe to do so.
- Immediate deployment of Bushfire RRAT (or similar) should be undertaken to complete a desktop and on-ground catchment assessment in bushfire affected water supply catchments to inform land managers of priority risks, practical treatment solutions and approximate costs for risk mitigation.
- Post-fire response should be specific to the water supply catchment and bushfire event. Not all interventions are suitable for all landscape settings and on-ground works may not be necessary.

- Where deemed appropriate and safe, erosion control methods should be implemented within a few weeks of a bushfire event to mitigate immediate risk to water quality.
- Weeds are a major issue following fire and should be addressed immediately. This may require allocation of additional funding for disaster response planning.
- Where possible, structures should only be designed to have a short-term lifespan with the aim to 'buy time' while natural recovery takes place.
- Australia should look to international post-fire response experiences with particular reference to catchments and water storages with a similar context.

Knowledge Gaps

Post-fire erosion mitigations works have been implemented for several recent fires within Australia and throughout the world. Overall, it is poorly understood how successful mitigation works are and the associated high costs typically lead to their limited application in high risk catchments (DSE, 2012). Many of the interviewed water authorities implemented on ground works to minimise the delivery of contaminants and sediment to water storages, however very few had the funding or resources to monitor the efficacy or impact of the structures on water quality objectives. Water authorities therefore identified it is necessary to:

- Undertake routine catchment condition monitoring including developing an understanding of watercourse condition to develop a baseline dataset for post-fire water quality monitoring.
- Monitor erosion control measures to ensure they are functioning appropriately. This should also include documentation of the efficacy of structures for future response planning.
- Develop an understanding of the geomorphic context of a catchment to further understand sediment transport processes and interactions within water storage.

The development of research studies in this field will assist water authorities and environmental managers to plan for future natural disasters and determine the impact of post-fire response activities on the surrounding environment in an Australian context.

Conclusions

Discussions with key Australian water authorities has provided many insights for the future management of water storages and water planning in NSW. It should be noted, following the 2019/2020 bushfire season most water authorities interviewed were looking to improve internal processes, research new erosion mitigation methods and learn from national/international experiences. Water authorities, catchment managers and researchers should collaborate and share lessons learnt to ensure management strategies can be developed in an Australian context.

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