Appendix H
Monitoring water quality and managing turbidity after the Perth Hills bushfire

Appendix H is available on the WSAA website

wsaa.asn.au/publication/bushfire-recovery-case-study-4-monitoring-water-quality-and-managing-turbidity-after

MONITORING WATER QUALITY AND MANAGING TURBIDITY AFTER THE PERTH HILLS BUSHFIRE

The Perth Hills bushfire in January 2005 impacted more than 27,000 hectares of the region's drinking water catchment area. The effect this bushfire had on the water quality varied throughout the affected catchments, with increased sediment load observed in areas with steep slopes, higher rainfall recorded, and an increase in fire intensity. Turbidity was also observed to have risen at most sites.

Perth Hills Bushfire 2005 (Water Corporation)

The 2005 Perth Hills bushfire impacted 27,000 hectares of the region's drinking water catchment area, including Mundaring, Lower Helena, Canning, Kangaroo Gully and Victoria. The intensity of the bushfire varied throughout the area, mainly as a factor of fuel age and loading.

Significant impacts on Mundaring reservoir, Kalgoorlie's main source of water

Extensive work was undertaken in the two years after the Perth Hills bushfire to monitor and manage the water quality response. Of particular concern was the Mundaring reservoir, which provides the majority of Kalgoorlie's water supply (servicing a population of around

29,000 in 2005/06). Mundaring saw the most significant increases in turbidity following the bushfires.

A significant increase in E. coli was observed in the raw water, attributed to the lack of vegetation buffer and increased overland flow. Nutrients were also observed to have increased significantly, however there was a shift in speciation corresponding to a rise in ammonia levels.

A dynamic sampling program was revised in response to results

The catchment sampling programs developed by Water Corporation included nutrients, turbidity, organic carbon, and bacteriological analysis.

Bacteriological sampling was due to several factors such as the lack of vegetation buffer, the increased turbidity load, and increased distance of overland flow. Other sampling parameters were also considered, such as testing for dioxins and furans, however they were considered low risk to water quality due to their strong absorbance to soils.

The sampling frequency was defined as the first significant flush after a bushfire and then quarterly for at least one wet season. As the season progressed, the sampling was amended based on results, priorities, and resources.

The sampling program was designed to cover streams, reservoirs and raw water points. In defining the sampling program, it was important to consider the availability of historic data as it creates context when assessing any new data collected.

In addition to water samples, turbidity probes were deployed at a number of locations. However, due to a combination of high variation in turbidity levels and equipment malfunctions, limited useful data was collected.

Results varied throughout the catchment and appeared to be dependent on:

- Rainfall intensity
- Steepness of slope
- Soil type and erodibility
- Fire intensity

Rainfall intensity and slope steepness appear to be of greater importance than fire intensity in influencing water quality, based on the variation observed across the catchment.

Managing turbidity by stream dosing with poly aluminium chloride

Mundaring Reservoir did not have any treatment in place apart from chlorination and as such it was essential to ensure that turbidity levels were maintained below 5 NTU.

The majority of stream sampling sites recorded an increase in turbidity following rainfall, from minor increases of 5 NTU to in situ samples exceeding 1,000 NTU. The most significant

increases were observed in the Darkin and Little Darkin streams in the Mundaring catchment.

Reservoir sampling on Mundaring displayed a distinctive response to significant rainfall events. Turbidity peaks were observed at the back of the reservoir, revealing a maximum level of 37 NTU, with peaks decreasing when approaching the wall. During the season apparent colour levels at the raw water point increased significantly with in situ readings as high as 30 hu. Potential sources were turbid water from Lower Helena pumpback, coloured water from the Darkin River, and turbid water as a result of the bushfire.

Based on historical data, the Darkin River contributes approximately 30 per cent of streamflow to the Mundaring reservoir. It is a highly coloured inflow (true colour > 200 hu) that enters the back of the reservoir approximately 10 km from the wall. Water from the Lower Helena was also identified to have high colour and turbidity values as a function of catchment characteristics.

Water Corporation investigated options of dosing the Darkin River, the Lower Helena or the Mundaring reservoir with a flocculant to reduce turbidity and colour. Water Corporation determined that the Darkin River should be dosed with a flocculant (poly aluminium chloride) to reduce the colour load and off-set the potential impacts from Lower Helena and any additional turbidity load as a result of the bushfire.

Dosing the Darkin River also allowed the Mundaring reservoir to be kept online which was important as it was the only water supply source for Kalgoorlie. Due to a lack of detention time and minimum distance between the Lower Helena pumpback outlet to the Mundaring offtake, dosing Lower Helena or the reservoir itself while keeping Mundaring online was not viable.

Approval to dose the Darkin River was granted by the Drinking Water Quality Board and the DEC. Dosing began on 23 June 2005 and finished on 3 October 2005, with approximately 130kL added to the stream.

Comparison with data from 1996 when Mundaring reservoir overflowed suggests that the dosing improved water quality. The data also revealed an increase in acid soluble aluminium levels and therefore it is not recommended to continually dose streams. The decision to steam dose should be considered by understanding the severity of the issue and examining what the other management options are.

Remediation to reduce erosion and turbidity loads

The majority of burnt catchment areas were in a State Forest or National Park, which are managed by the Department of Environment and Conservation (DEC). Water Corporation therefore worked in conjunction with DEC to identify areas of serious concern, for example, the impact to water quality and how work undertaken by the DEC should be prioritised.

Water Corporation commenced additional remediation work within catchments, focusing on high risk areas. Advice was sought from Australian water utilities that had experienced bushfires in their catchments previously. Remediation was directed towards reducing erosion and turbidity loads to the reservoir by filtering or reducing the speed of overland flow. Remediation measures were installed at Mundaring, Kangaroo Gully, and Araluen, and included the installation of limestone weirs, geofabric curtains, coir logs, trash tracks, and silt mesh.

Water Corporation did not install booms in reservoirs due to limited effectiveness, therefore considerable volumes of floating ash were transported from the catchment to the Mundaring reservoir. Under the correct wind conditions, ash was blown to the dam wall and when there was a significant build-up, the ash was removed using scoop nets. This occurred three times during 2005.

Learnings

- Importance of a dynamic, event based response sampling program to identify water quality issues that may not be picked up through routine monitoring.
- The use of targeted poly aluminium chloride dosing in catchment streams to reduce colour, turbidity and other contaminants.
- The importance of remediation activities such as limestone weirs, silt curtains and coir logs.
- The importance of good relationships with other landholders and government agencies (in this case the Department of Environment and Conservation).

More information

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