North Coast Regional Water Quality Control Board
Fire Response Monitoring Plan

Purpose

Surface waters within and downstream of areas affected by the recent wildfires in Sonoma County include impaired waterbodies, endangered species habitat, and the source water for drinking water systems. During storm events, surface waters may be affected by pollutants in runoff from burn areas. In coordination with Regional Water Board staff, watershed partners have been working to implement post-fire best management practices (BMPs) within areas that were burned in an effort to prevent pollutant laden stormwater from entering stormdrains and reaching surface waters. Monitoring conducted by Regional Water Board staff will help identify areas where BMPs are functioning to effectively remove pollutants and areas where priority should be placed on increased or alternative BMP implementation.

Table 1. Monitoring Design Summary

Management Question	Are Post Fire BMPs Effective for Protection of Surface Water Beneficial Uses? • Sensitive Aquatic Resources • Drinking Water Sources
General Design	Comparison of Surface Water Runoff from Burn Affected Areas to Water Quality Objectives and Historic or Reference Site Data, Where Available
Target Flow Conditions	Post-Fire, First Flush, and Second Flush Storm Water Runoff
Selection of Burned Catchment	Surface Water in or Below Burned Urban Area Within the Russian River Watershed
Selection of Comparison Site	Same or Similar Site with Pre-Wildfire Data Availability
Indicators	Water Chemistry, Water Column Toxicity
Timing	Prior to First Flush, During First Qualifying Storm, and First Flush of a Second Qualifying Storm (A Qualifying Storm is Identified as Predicted Storm of 1 Inch or Greater within 24 Hour Period)

Monitoring Plan Overview

A range of BMPs are being implemented throughout burned areas in Sonoma County to address source control, post-fire erosion control, and run-off treatment. Some BMPs used to control erosion could also help reduce chemical contaminant loading, including revegetation and application of mulch material such as straw wattles, inlet filtration devices, and others. The Regional Water Board is interested in ensuring that sufficient BMPs are in place to protect downstream beneficial uses such as sensitive aquatic habitat and sources of drinking water in impacted watersheds.

This monitoring effort will evaluate the efficacy of BMPs being utilized in urban and rural areas severly impacted by the fire. Post-fire storm water runoff threats and impacts to the beneficial uses in surface waters downstream of these areas will be assessed by monitoring water column chemistry and through toxicity analyses. Staff will evaluate threats and potential impacts to beneficial uses by comparing toxicity results and concentrations of contaminants detected in surface water with water quality objectives established to protect those uses. Where readily available, staff will compare results to pre-fire data for similar parameters.

Chemical analyses will target constituents known to become elevated in response to fire and that have potential impacts on drinking water and aquatic life. Toxicity tests identify threats and

impacts to aquatic life through an assessment of unmeasured contaminants, including the synergistic effects of multiple contaminants below their individual toxic thresholds.

Sample Locations

Not all areas affected by the recent fires need be monitored to inform successive BMP management decisions. The information gained from this targeted sampling may be extrapolated to assist management decisions beyond the areal extent of monitoring, based upon similarities in land use, fire impacts, and BMP deployment.

The Regional Water Board staff will collect samples at three locations located downstream of burned areas:

1. Upper Mark West Creek at Leslie Road
2. Lower Mark West Creek at Fulton Road
3. Piner Creek at Marlow Road
4. Santa Rosa Creek at Willowside Road

The sampling sites shown in Attachment A, Figure 1 have been strategically chosen to assess stormwater runoff from urban locations damaged by fire, relative to the following:

- Land use and density of fire impacted areas
- Downstream drinking water systems
- Vulnerable aquatic habitat
- 303(d) listed waterbodies
- Availability of previous or companion water quality data

Sample Collection Timing

Staff will collect samples from the locations in Figure 1 on three occasions; pre-storm, during first flush of the initial qualifying storm of the season, and again during first flush of a second qualifying storm. Qualifying storm events shall be considered those storms which have a predicted rainfall of 1 inch or greater within a 24 hour period.

First flush monitoring is to designed to collect samples near the start of overland runoff to capture the highest pollutant concentrations of the storm event during lower stream flow rates at the beginning of the storm. First flush conditions have the greatest potential for adverse impacts to aquatic species and sources of drinking water. Obtaining first flush water quality samples provides the ability to evaluate monitoring results and determine if additional BMPs are necessary to reduce pollutant concentrations in storm water discharge.

The timing of monitoring for this effort has been determined based upon the likelihood of rainfall conditions to cause erosion or transport of pollutants from the landscape into surface waters. Pre-storm monitoring will be conducted to evaluate existing surface water conditions before the threat of significant pollutant movement associated with a first flush storm event. Pre-storm sampling will provide a baseline for assessment of BMP effectiveness during the first flush storm event. The three sampling events conducted in accordance with this monitoring plan will allow staff to understand the current conditions of surface water, alterations in those conditions

related to first flush, and improvements in surface water quality realized in response to any management decisions made as a result of the first two monitoring events.

Monitoring Parameters

Wildfire alters the hydrologic response of watersheds, including peak discharge resulting from rain events, transport of sediment, and rate of erosion and deposition. Increased storm runoff and transport of contaminants by storm water runoff after a wildfire raises concerns about water quality. Some of the concerns for water quality after a fire include erosion and transport of ash or other materials containing chemicals created or left exposed in burned areas. If sedimentation rates are high, they can alter and often destroy fish habitats and spawning beds, damage drinking water infrastructure, and increase risk of flooding.

Fertilizer is a major component of fire retardants, often consisting of ammonia and phosphate or sulfate ions. Previous studies have shown that a single retardant drop directly into a stream may be sufficient to raise the concentration of ammonia enough to elicit a lethal response in fish and other aquatic organisms. Effects such as this are dependent upon the waterbody size, flow conditons and the volume of retardant reaching the waterway. Additionally, ashes remaining after a fire can impact the environment and ecosystems by raising soil and water pH levels. Post-fire research shows that ash can generate caustic alkalinity in contact with rainwater producing pH levels >12.

Research also shows that fire affected areas contain increased concentrations of contaminants including nutrients (e.g. nitrates and phosphorus), polycyclic aromatic hydrocarbons (PAHs), copper, zinc, mercury, lead and other metals. Several of these pollutants, especially heavy metals, can be detrimental to human health and are often toxic to aquatic life. High levels of nutrients can encourage the development of harmful algal blooms and in the case of Sonoma County wildfires, downstream waters are already listed as impaired for these constituents. Many pollutants often attach to suspended particles and enter the water. Therefore an increase in turbidity or total suspended solids (TSS) can often indicate potential pollution, not just a decrease in water quality related to sediment.

The Regional Water Board staff have reviewed available fire response literature, considered the parameters anticipated to be elevated as a result of wildfire, and developed a list of monitoring analytes. Targeted monitoring analytes consider: 1) correlation to fire impacts, 2) potential impacts to water resources, and 3) potential for management practices to mitigate threats or impacts identified through this monitoring effort. In addition to rainfall, Table 1 below provides the list of analyses and field parameters to be performed during this effort.

Table 1 Monitoring Analytes

Temperature	Nitrate	Aluminum	Manganese
Specific Conductance	Ammonia	Arsenic	Mercury
Dissolved Oxygen	Total Phosphorus	Cadmium	Nickel
pH	Total Organic Carbon	Chromium	Selenium
Turbidity	Hardness	Copper	Zinc
Total Suspended Solids	Alkalinity	Iron	PAHs
Total Dissolved Solids	Sulfate	Lead	Water Toxicity

Data Evaluation

The Basin Plan specifies numerous water quality objectives for the protection of inland surface waters which include: color, tastes and odors, suspended material, biostimulatory substances, sediment, turbidity, pH, dissolved oxygen, temperature, toxicity, and chemical constituents. Staff will compare monitoring data results to the water quality objectives presented in Attachment B, and to past data collected at or near these sites during similar times of year, to evaluate whether surface water downstream of fire-impacted areas is meeting water quality objectives for the protection of beneficial uses and whether the impacts are likely caused due to insufficient or ineffective BMPs resulting in pollutant laden storm water runoff to surface water. This assessment will be conveyed in a timely manner to staff working with entities in the watershed to inform and prioritize implementation of new or additional BMPs where needed for pollutant control.

Monitoring Quality Assurance and Control

The protocol for sample collection and analyses will follow the State of California Surface Water Ambient Monitoring Program Standard Operating Procedures (SOP) and Quality Assurance Program Plan (QAPrP). The QAPrP serves as an umbrella document for use by each of the Surface Water Ambient Monitoring Program's (SWAMP's) contributing projects. It describes the program's quality system in terms of organizational structure; the functional responsibilities of management and staff; the lines of authority; and the interfaces for those planning, implementing, and assessing all activities conducted.

Data Management

After sampling and analysis, the Regional Water Board staff shall enter this data into California Environmental Data Exchange Network (CEDEN) for incorporation into the statewide database, which will be then available to all resource managers. .

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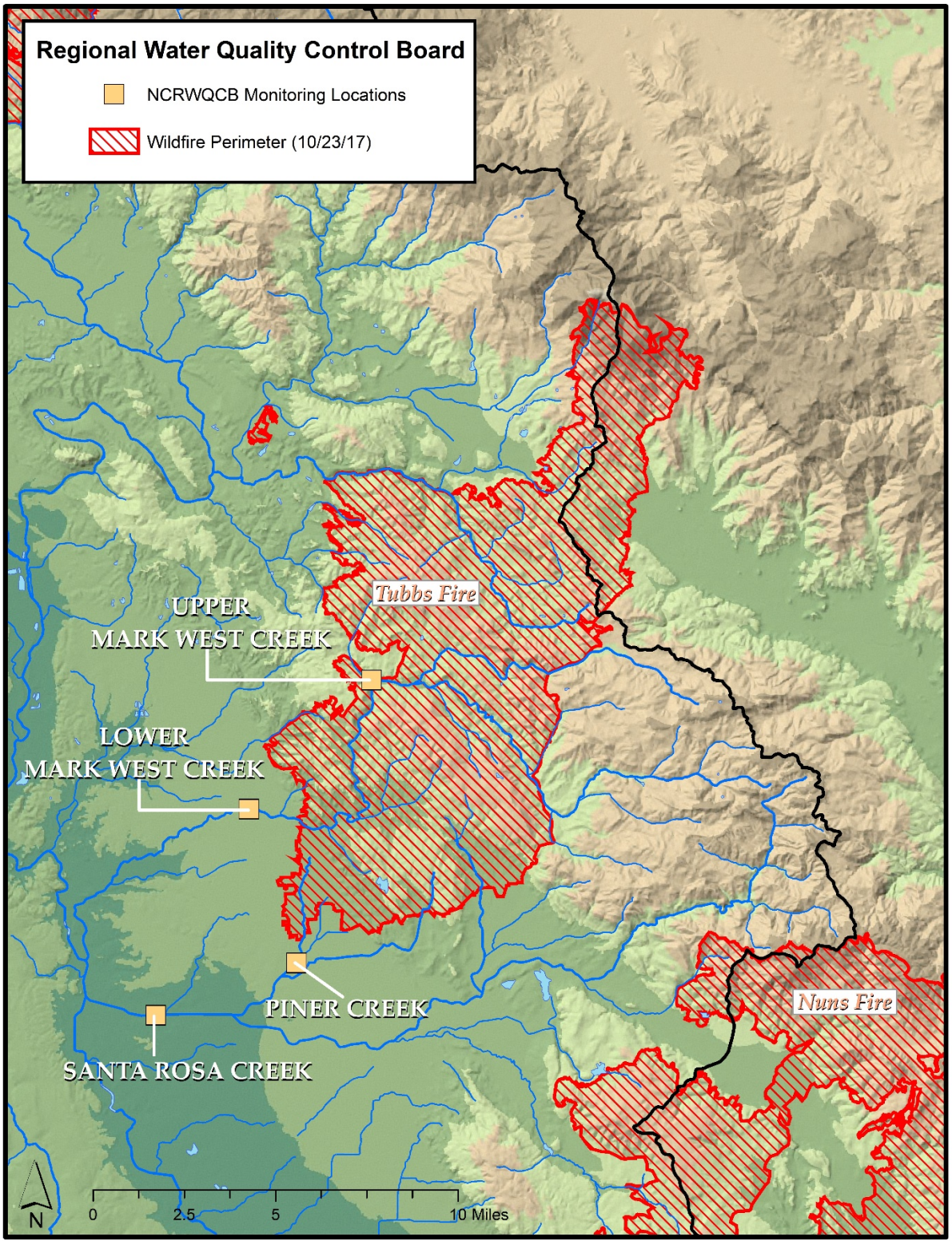
Attachment A



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Attachment B

		Water Quality Objectives		
Monitoring Parameters		**Basin Plan Objective**	**Human Health Objective**	**Aquatic Life Objective**
Temperature		X	***	***
Dissolved Oxygen		6.0-9.0	***	8.0 mg/L
pH		6.5-8.5	6.5-8.5	6.5-9.0
Specific Conductance		250-320 Mho	900 ug/L	***
Turbidity		20% increase	1.0 ug/L	***
Alkalinity		***	***	20 mg/L
Hardness		***	***	***
Total Suspended Solids		X	***	***
Total Dissolved Solids		150-170 mg/L	250 mg/L	***
Total Organic Carbon		***	***	***
Aluminum		X	50 ug/L	87 ug/L
Iron		X	300 ug/L	1000
Cadmium		X	0.04 ug/L	0.80 ug/L
Chromium, Total		X	50 ug/L	57 ug/L
Copper		X	300 ug/L	2.7 ug/L
Lead		X	0.2 ug/L	0.54 ug/L
Manganese		X	50 ug/L	***
Nickel		X	12 ug/L	16 ug/L
Zinc		X	5 mg/L	36 ug/L
Arsenic		X	0.004 ug/L	150 ug/L
Selenium		X	30 ug/L	1.5 ug/L
Mercury		X	12 ng/L	12 ng/L
Nitrate		X	10 mg/L	***
Ammonia		X	30 mg/L	pH & Temp Dependent
Total Phosphorus		X	***	***
Sulfate		X	250 mg/L	***
PAHs		X	*varies*	*varies*
Chronic Toxicity - Water	*Pimephales promelas*	X		
	Ceriodaphnia dubia			
	Capricornutum			

X indicates an applicable narrative objective