Update on Post-Fire Monitoring

Current State of Knowledge
and
Future Planning

Item 9

September 6, 2018

December 2017 Board Meeting

- Comprehensive review of all Regional Water Board staff's fire response activities including surface water monitoring

- Board requested future update on monitoring activities and results

Panelists

Katharine Carter - North Coast Regional Water Quality Control Board

Kevin Lunde - San Francisco Bay Regional Water Quality Control Board

Janice Thomas - State Water Board – Division of Drinking Water

Heaven Moore - City of Santa Rosa

Break for Questions

Todd Schram- Sonoma Water (formerly Sonoma County Water Agency)

Lisa Micheli- Pepperwood Preserve

Virginia Mahacek- Office of Recovery & Resiliency – Watershed Task Force

Chuck Striplen - North Coast Regional Water Quality Control Board

Break for Questions

Take questions for all 8 panelists

Panelists

Katharine Carter - North Coast Regional Water Quality Control Board

- Winter 2017/2018 surface water monitoring & conclusions
- Winter 2018/2019 surface water monitoring

Kevin Lunde - San Francisco Bay Regional Water Quality Control Board

- Winter 2017/2018 surface water monitoring & conclusions
- Winter 2018/2019 surface water monitoring

Janice Thomas - State Water Board – Division of Drinking Water

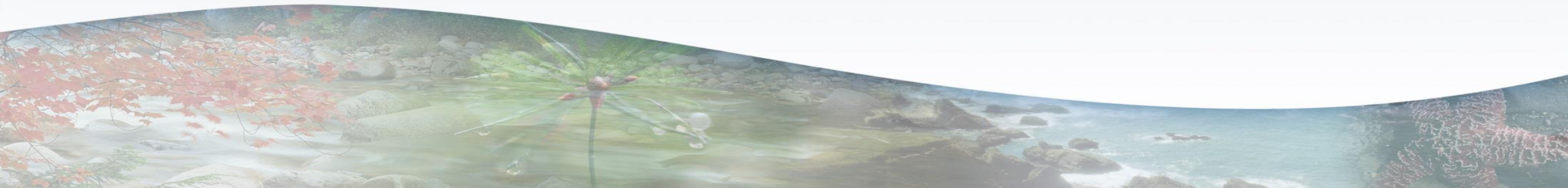
- Winter 2017/2018 drinking water monitoring

Heaven Moore - City of Santa Rosa

- Winter 2017/2018 first flush, BMP effectiveness, & post debris removal monitoring
- Winter 2018/2019 monitoring & winter preparedness planning

Break for Questions

North Coast
Regional Water Quality Control Board
Katharine Carter



Surface Water Monitoring Response (Winter 17/18)

- Fires burned 93,363 acres in Mark West & Santa Rosa Creek
- Water quality concerns
  - Public Health
  - Aquatic Life
- Primary objectives:
  - Surface water characterization
  - Determine stormwater BMPs effectiveness

Surface Water Monitoring Plan

(Winter 17/18)

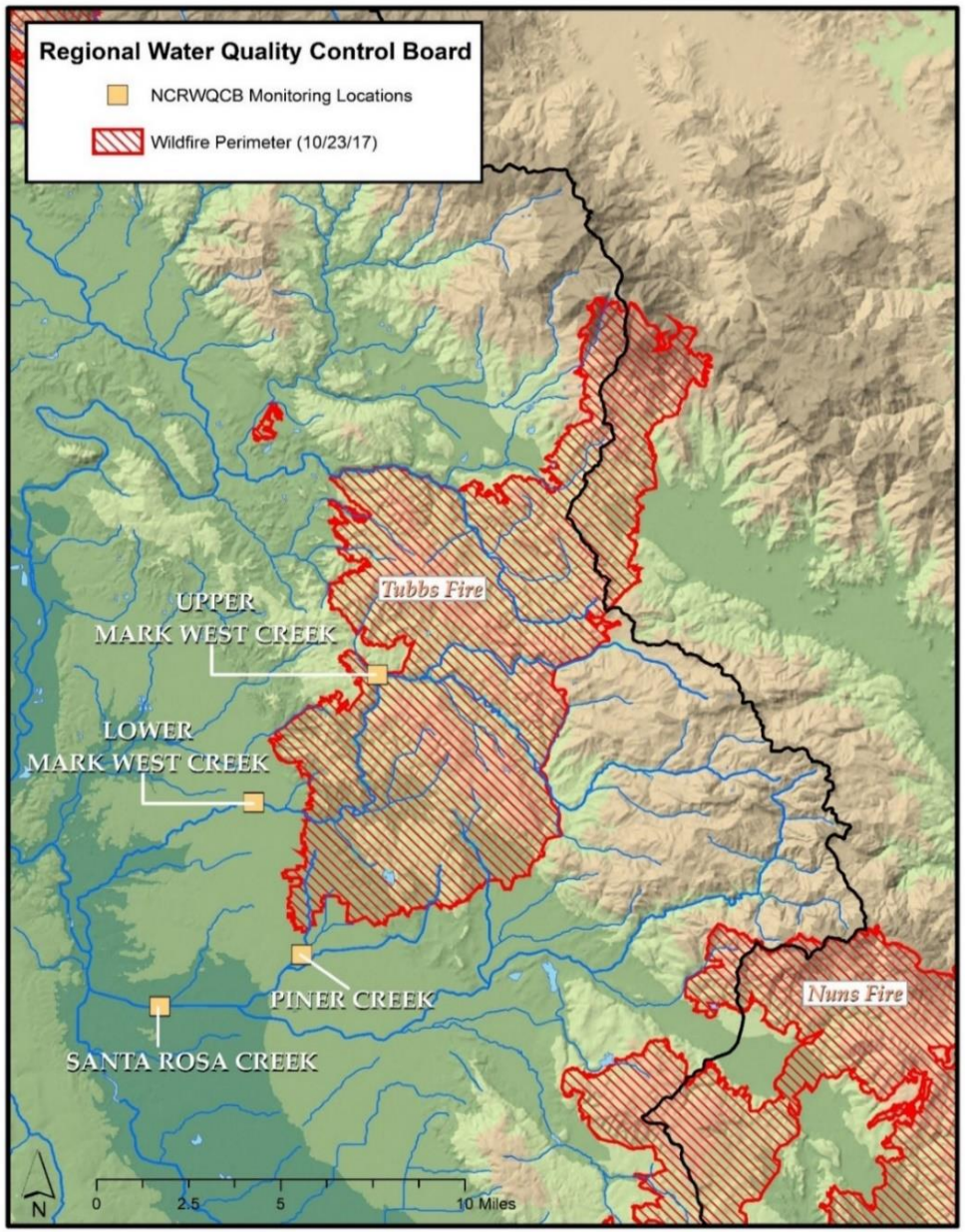


Photo Credit: Alvin Jornada / Press Democrat

Surface Water Monitoring Plan
(Winter 17/18)

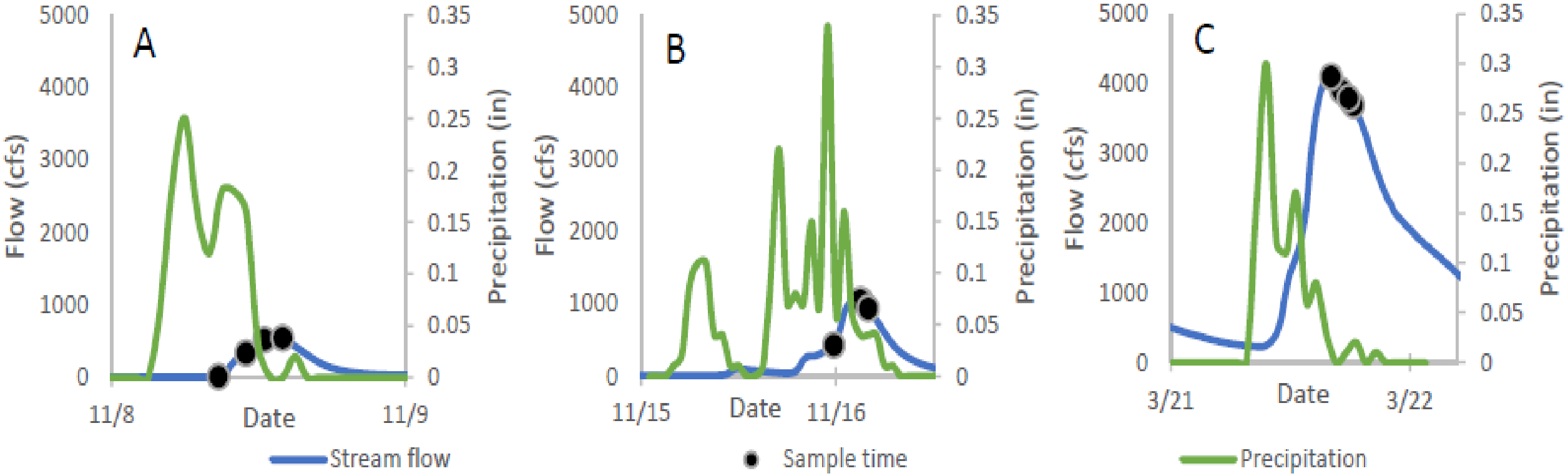


Figure 3. Hydrographs showing stream flow and precipitation vs. sample time for (A), a 1.36" storm on Nov. 8-9, (B), a 1.95" storm on Nov. 15-16, and (C), a 1.21" storm on March 22. Flow data was collected from the USGS flow gauge on Santa Rosa Creek at Willowside Road, USGS Gage #11466320. Precipitation data was collected from the Santa Rosa CalFire weather station.

Surface Water Monitoring Results (Winter 17/18)

CALIFORNIA WATER BOARDS North Coast - R1

Conclusions

- No immediate threat to public health or aquatic life
- Some metals exceeded thresholds for aquatic life but were in historic range of concentrations observed during storm runoff
- No aquatic toxicity exhibited
- BMPs and debris removal prevented pollutants from entering waterways

Caveats

- Only third storm event suggests erosion

North Coast Regional Water Board Fact Sheet Available at:
https://www.waterboards.ca.gov/northcoast/water_issues/programs/swamp/

Water Boards

FACT SHEET

Santa Rosa Post-Fire Water Quality Monitoring

Tubbs and Nuns Fires

In October 2017, the Tubbs and Nuns Fires burned a combined 93,363 acres. This amounted to 8% land coverage of the Russian River watershed and 28.5% of the Laguna-Mark West Creek sub-watershed[1,2]. More than 8,000 structures were damaged or destroyed, elevating the potential for toxics-laden runoff within these watersheds. Surface waters within and downstream of the Tubbs and Nuns Fires include impaired waterbodies, endangered species habitat, and source water for drinking water systems.

Figure 2. BMP controls installed downslope of a burned structure.

Surface Water Monitoring

Regional Water Board staff assessed potential impacts to surface waters downstream of burned areas by monitoring surface water quality. Samples were collected at four locations within the Mark West Creek watershed (Fig. 1). The first set of samples was collected on November 1st, prior to any storm events as a baseline dataset. Three subsequent sampling events were timed to collect samples in conjunction with storm runoff events on Nov. 8, Nov. 15 and March 22 (Fig. 3).

The State Water Board's Division of Drinking water coordinated with drinking water purveyors to ensure that drinking water was safe to drink. Tests conducted by the Sonoma County Water Agency and others reflected no issues with drinking water after the fire.

Post-Fire Pollutants

During storm events, surface waters may be affected as rain carries pollutants away from burned areas. Research shows that fire affected areas in Southern California contained increased concentrations of contaminants including nutrients (e.g. nitrates and phosphorus), polycyclic aromatic hydrocarbons (PAHs), copper, zinc, mercury, lead, and other metals [3,4]. Several of these pollutants, especially metals, can be detrimental to human health and toxic to aquatic life. Many pollutants often attach to suspended particles and enter the water as runoff. Therefore, high flows can transport sediment bound pollutants to creeks and downstream to the Russian River. To minimize this transport of pollutants, Regional Water Board staff worked with local partners to implement post-fire best management practices (BMPs) in an effort to mitigate pollutants entering surface water during post-fire storm events (Fig. 2).

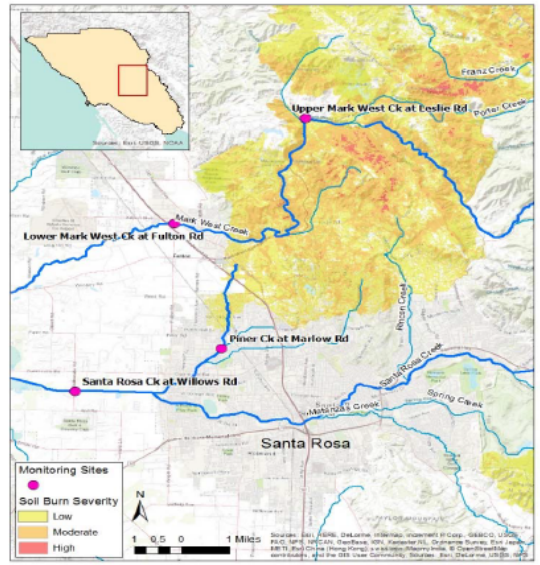
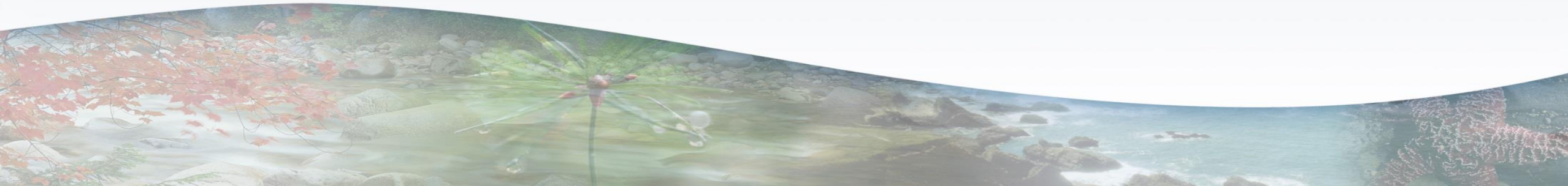


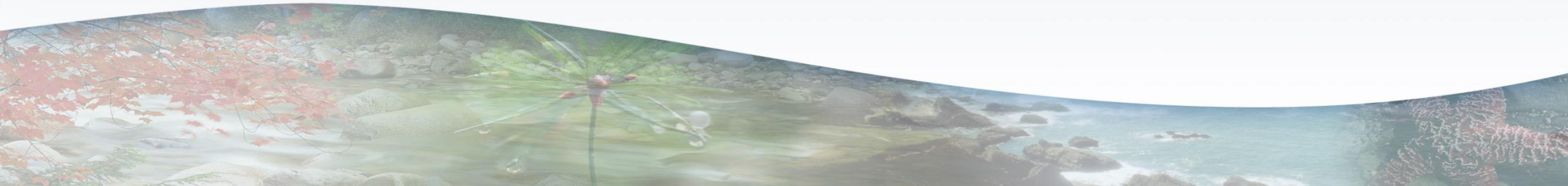
Figure 1. Post-fire water quality monitoring sites on Mark West Creek, Piner Creek, and Santa Rosa Creek.

Winter 18/19 Monitoring plans

- Seeking to secure contract for additional surface water monitoring
- Targeting larger storms
- Adding sediment toxicity monitoring
- Coordinate with City and County Partners



SF Bay Regional Water Quality Control Board
Kevin Lunde



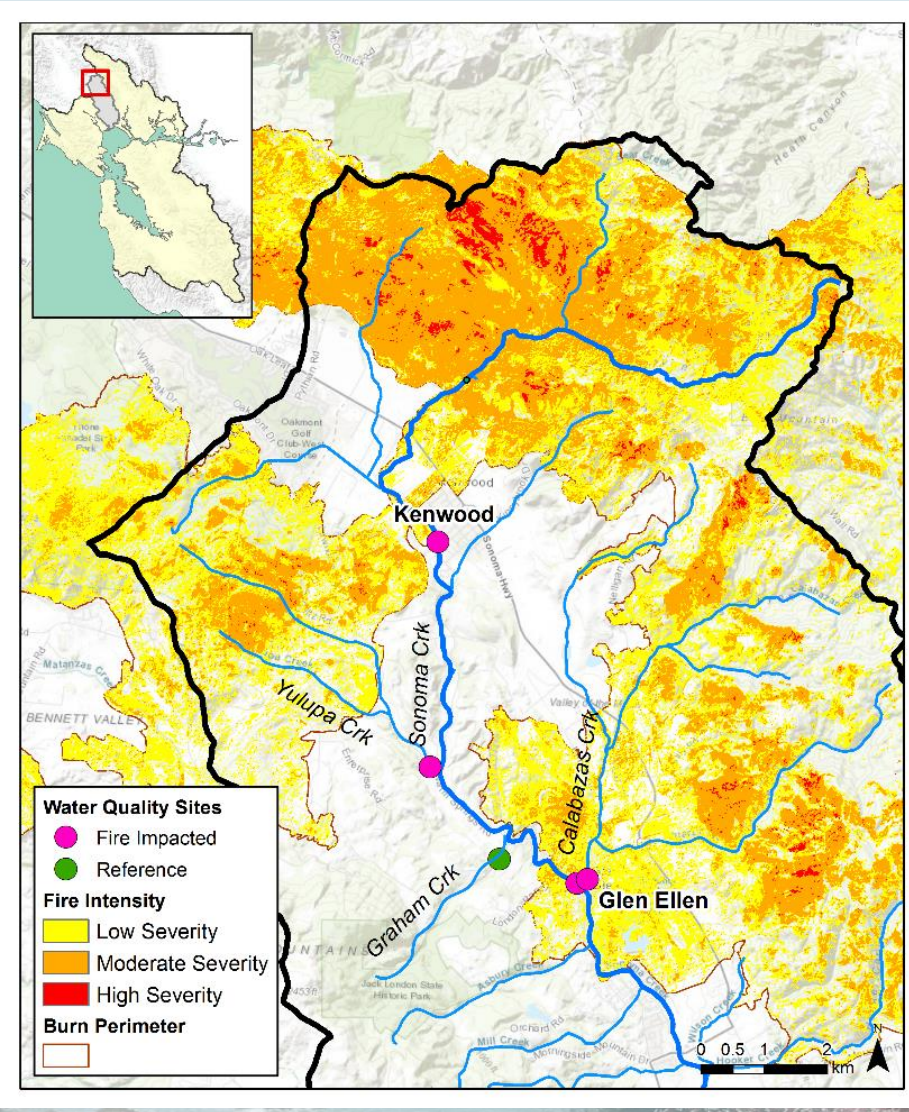
SF Bay Water Board
Water Quality Monitoring Response

- Fires affected 80,000 acres in Napa River and Sonoma Creek
- Water quality concerns
  - Aquatic resource impacts
  - Drinking water
- Primary objective to determine if stormwater BMPs effective

CALIFORNIA
WATER BOARDS
San Francisco Bay - R2

Monitoring Plan

- Consulted with North Coast & SCCWRP
- 10 sample locations in Napa & Sonoma
- Reference sites
  - Unburned watershed, pre-storm conditions
- Sampled heavy metals, PAHs, nutrients
- Used CAA funding



CALIFORNIA WATER BOARDS
San Francisco Bay - R2

Fire Monitoring Results

- Nearly every sample (~2000) below acute or chronic thresholds
- Small increase in storm samples resulted from typical storm response
- Concentrations metals 100x < S. Cal
- **Stormwater BMPs effective**


FACT SHEET

Napa Valley Post-Fire Water Quality Monitoring

Napa Valley Fires

Monitoring Plan

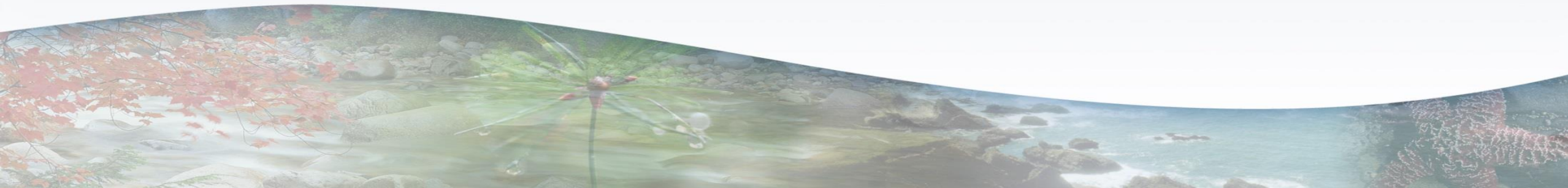
CALIFORNIA WATER BOARDS San Francisco Bay - R2

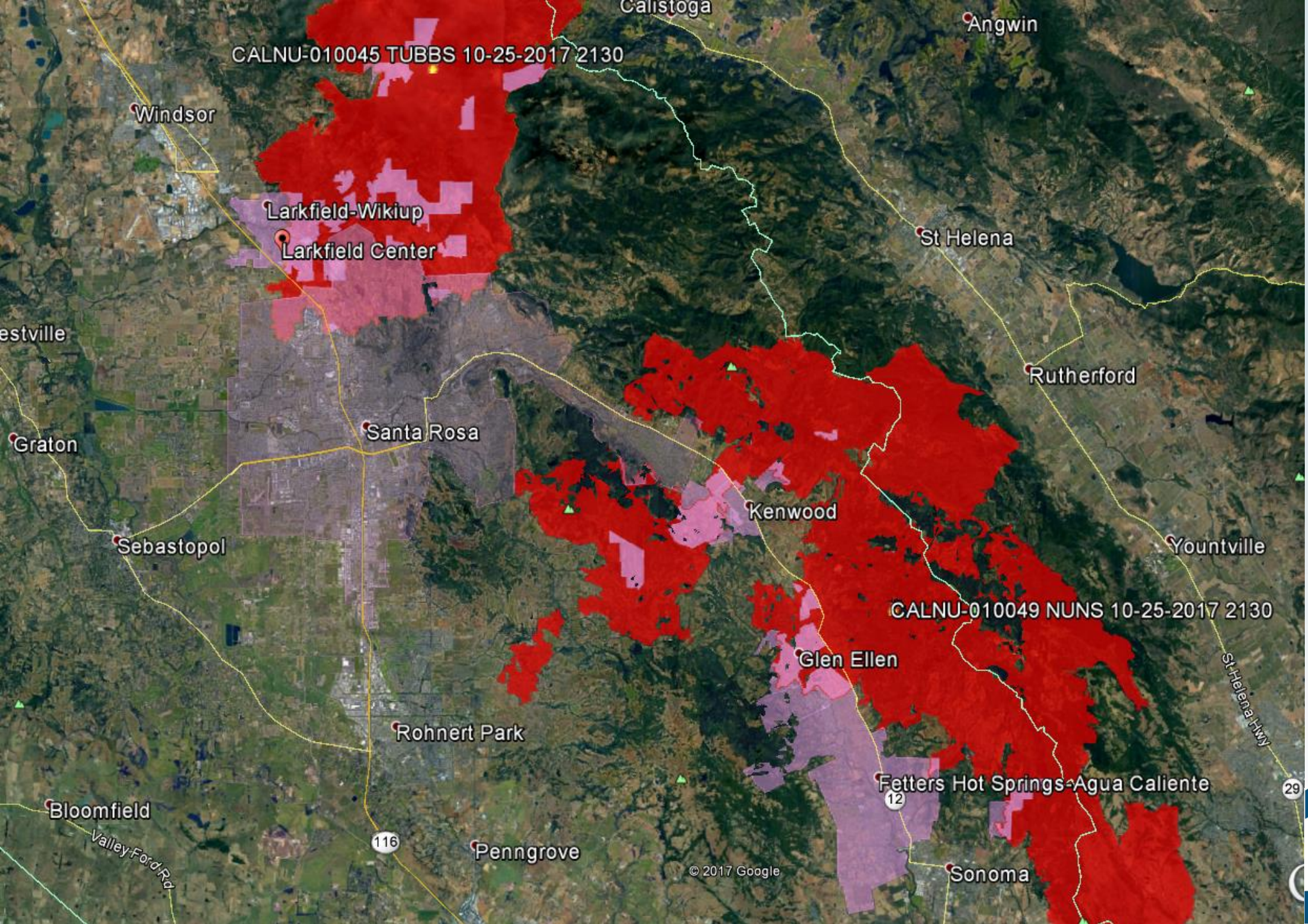
Future Monitoring Plans

- Preparing to sample one storm
- Target large storm (2-4 inches)
- Use existing funding
- Coordinate with North Coast

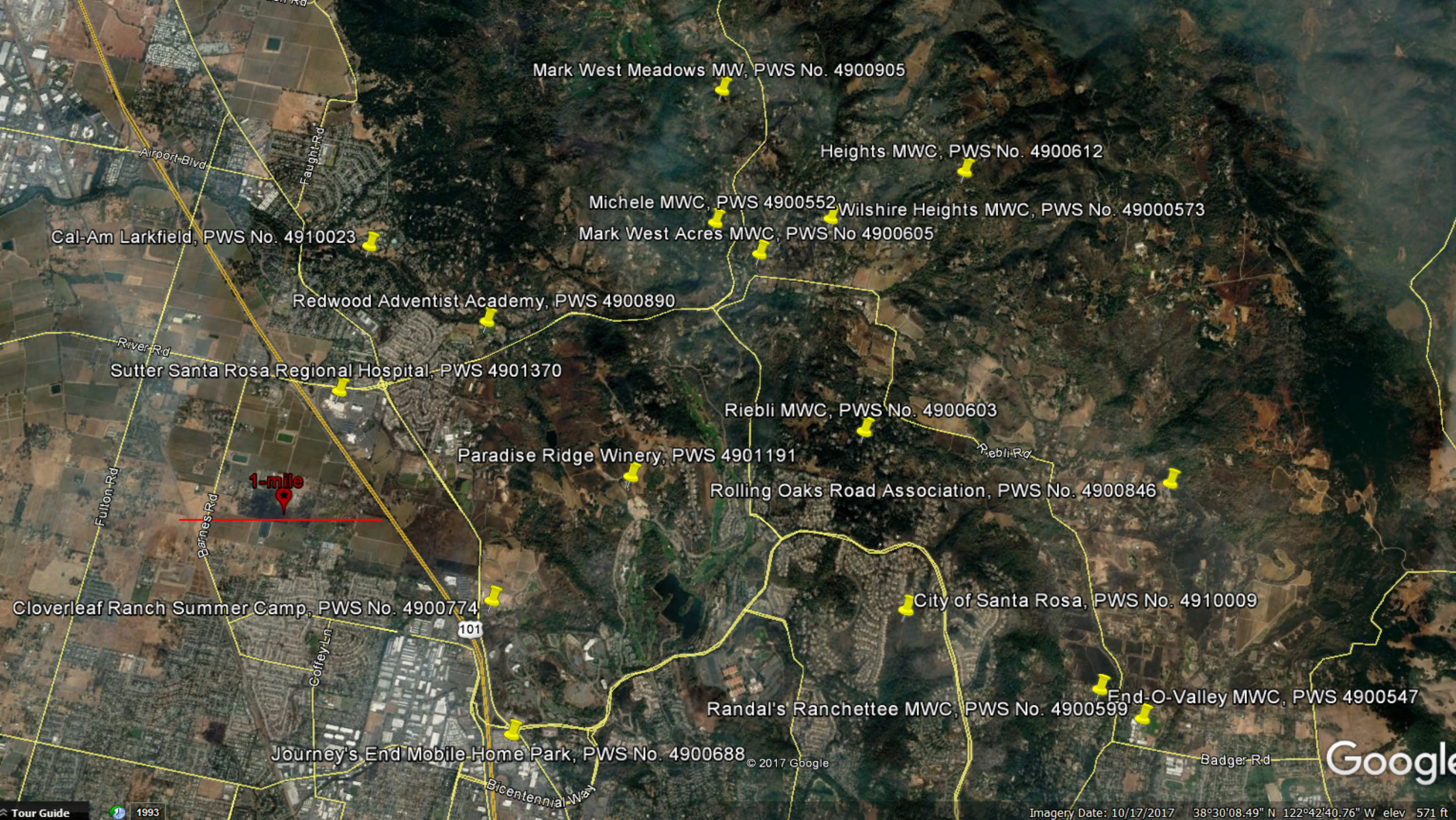
CALIFORNIA
WATER BOARDS
San Francisco Bay - R2

State Water Resources Control Board
Division of Drinking Water
Janice Thomas





CALIFORNIA
WATER BOARDS
State Water Resources Control Board


Mark West Meadows MW, PWS No. 4900905
Heights MWC, PWS No. 4900612
Michele MWC, PWS 4900552
Wilshire Heights MWC, PWS No. 49000573
Mark West Acres MWC, PWS No 4900605
Cal-Am Larkfield, PWS No. 4910023
Redwood Adventist Academy, PWS 4900890
Sutter Santa Rosa Regional Hospital, PWS 4901370
Riebli MWC, PWS No. 4900603
Paradise Ridge Winery, PWS 4901191
Rolling Oaks Road Association, PWS No. 4900846
1-mile
Cloverleaf Ranch Summer Camp, PWS No. 4900774
City of Santa Rosa, PWS No. 4910009
End-O-Valley MWC, PWS 4900547
Randal's Ranchettee MWC, PWS No. 4900599
Journey's End Mobile Home Park, PWS No. 4900688
Airport Blvd
Faught Rd
River Rd
Fulton Rd
Barnes Rd
Coffey Ln
Riebli Rd
Badger Rd
Bicentennial Way
101
© 2017 Google
Google
Tour Guide
1993
Imagery Date: 10/17/2017 38°30'08.49" N 122°42'40.76" W elev 571 ft

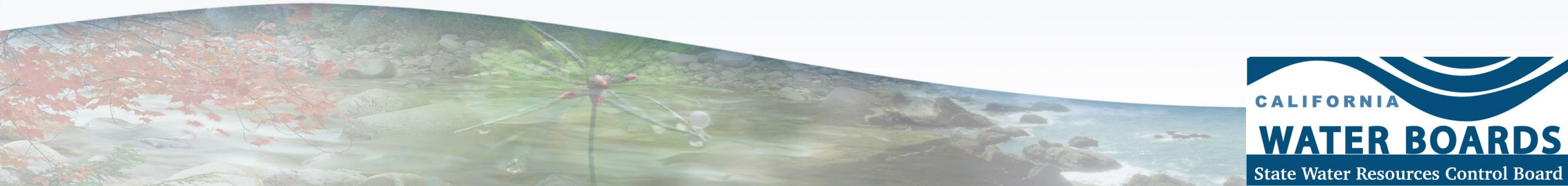
DDW Impacts

- 35 Public Water Systems affected
  - 33 Groundwater systems
  - 2 Surface water systems
- Debris Flow/R1 Analysis


CALIFORNIA
WATER BOARDS
State Water Resources Control Board

Type of Sampling

- Sources
  - Groundwater
  - Watershed
- Tanks
- Distribution



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State Water Resources Control Board

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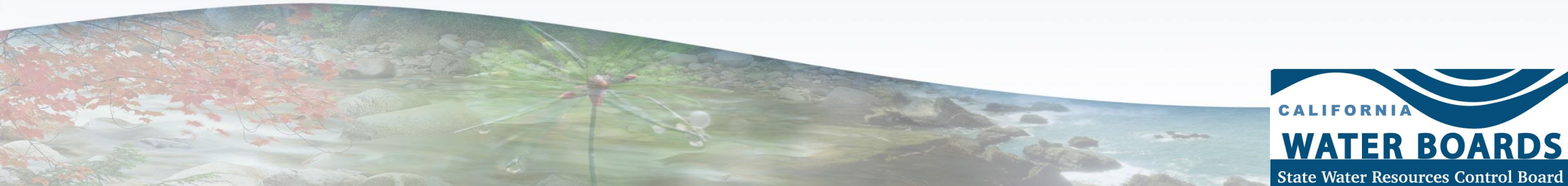
State Water Resources Control Board

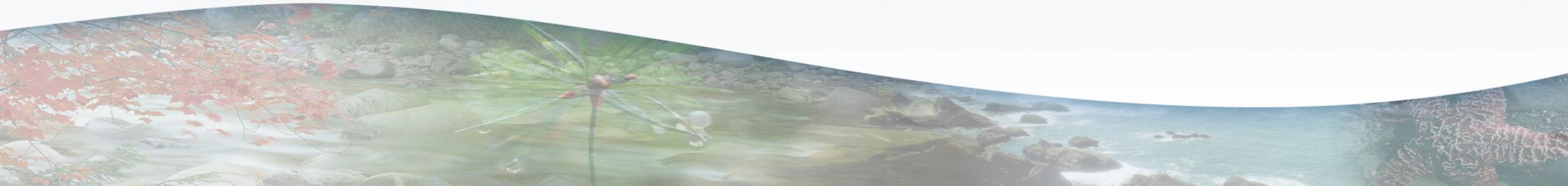
Findings

- Groundwater
- Surface Water
- Tanks
- Distribution System



CALIFORNIA WATER BOARDS
State Water Resources Control Board

City of Santa Rosa
Heaven Moore



City of Santa Rosa

Post Fire Monitoring in the Burn Scar

- First Flush Monitoring and BMP Effectiveness Study
  - Conducted in coordination with in-stream sampling by Regional Board and SCWA
  - November 8, 2017
  - Grab samples

City of Santa Rosa

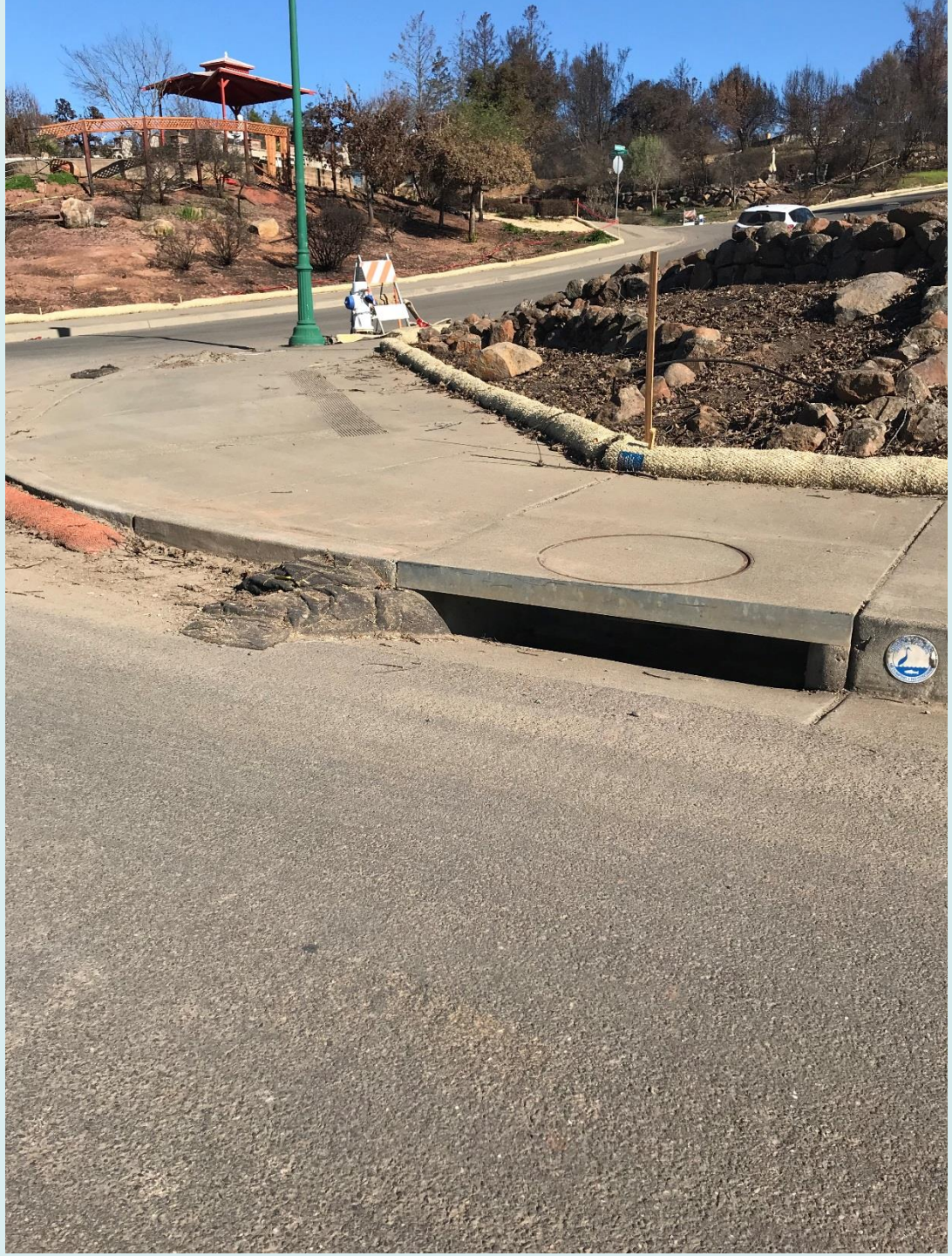
Post Fire Monitoring in the Burn Scar

- First Flush Monitoring
  - Grab samples from five locations in the storm drain system in Coffey Park
  - *Constituent levels were found to be consistent with typical first flush levels and consistent with Regional Board findings in receiving water*

City of Santa Rosa

Post Fire Monitoring in the Burn Scar

- BMP Effectiveness Study
  - Evaluated effectiveness of three different configurations of gravel bag and wattle configurations
  - Grab samples from upstream and downstream of installed BMPs in different configurations
  - *All three BMP configurations functioned similarly.*
  - *BMPs reduced constituent levels by approximately an order of magnitude*



City of Santa Rosa

Post Fire Monitoring in the Burn Scar

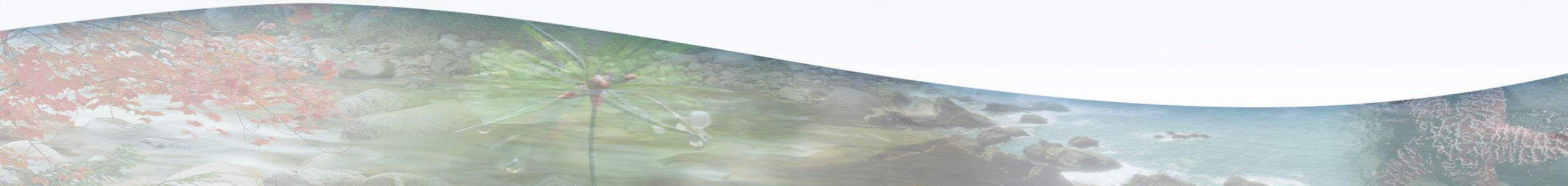
- Post Debris Removal Sampling
  - Conducted in coordination with in-stream sampling by Regional Board on March 22, 2018
  - Grab samples from five locations in the storm drain system in Coffey Park
  - *Constituent levels shifted to those generally consistent with transport in sediment and consistent with Regional Board findings in receiving water*

City of Santa Rosa

Upcoming Sampling and Storm Water Quality Efforts

- Additional sampling planned in the burn scar area
  - To be conducted in coordination with in-stream sampling by Regional Board
  - Research shows years 2-5 tend to have higher constituent loads after wildland fires.
  - Winter Preparedness Planning- multiple efforts to protect storm water including outreach, inspection, storm patrols, and rebuild support.

Questions?



Presentation Overview

Panelists

Todd Schram- Sonoma Water *(formerly Sonoma County Water Agency)*

- Study to understand water quality changes and potential impacts on treatment efficacy of riverbank filtration at Wohler-Mirabel Production Facilities from wildfire disturbances in Russian River watershed

Lisa Micheli- Pepperwood Preserve

- Infiltration and sedimentation monitoring

Virginia Mahacek- Watershed Task Force (Sonoma County Office of Recovery and Resiliency)

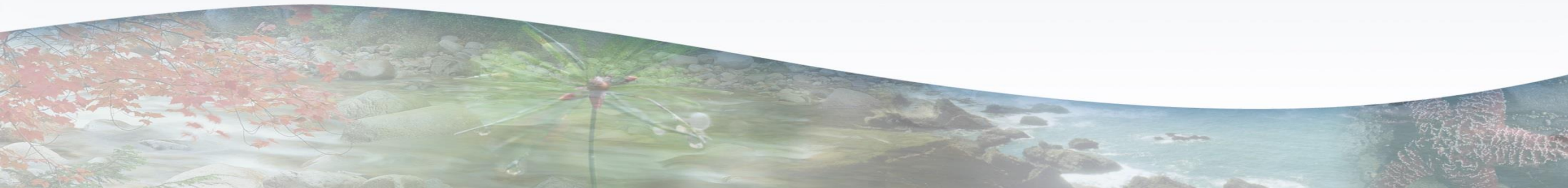
- Overview of Watershed Task Force purpose & activities

Charles Striplen - North Coast Regional Water Quality Control Board

- Post-fire long term planning & monitoring

Break for Questions

Sonoma Water
Todd Schram



Post-Fire Surface Water Quality Monitoring Program

- Purpose
  - Understand water quality changes and potential impacts on treatment efficacy of riverbank filtration at Wohler-Mirabel Production Facilities from wildfire disturbances in Russian River watershed

Sonoma Water

Post-Fire Surface Water Quality Monitoring Program

- Extension of ongoing collaborative research project at Wohler and Mirabel Production Facilities since 2008
  - Sonoma Water
  - Lawrence Berkeley National Lab
  - USGS
    - CA Water Science Center
    - Subsurface Microbiology Lab (Boulder, CO)

Sonoma Water

Sampling Program Components

- Surface Water Samples
  - Aqueous
  - Microorganisms
- Sediment Samples
  - Sediment Collected w/ Aqueous Samples
  - Wohler / Mirabel Bulk Sediment Sample (Annually)
  - Cryocores
- Ash Samples
  - Conduct ash leachate column study experiments

Sonoma Water

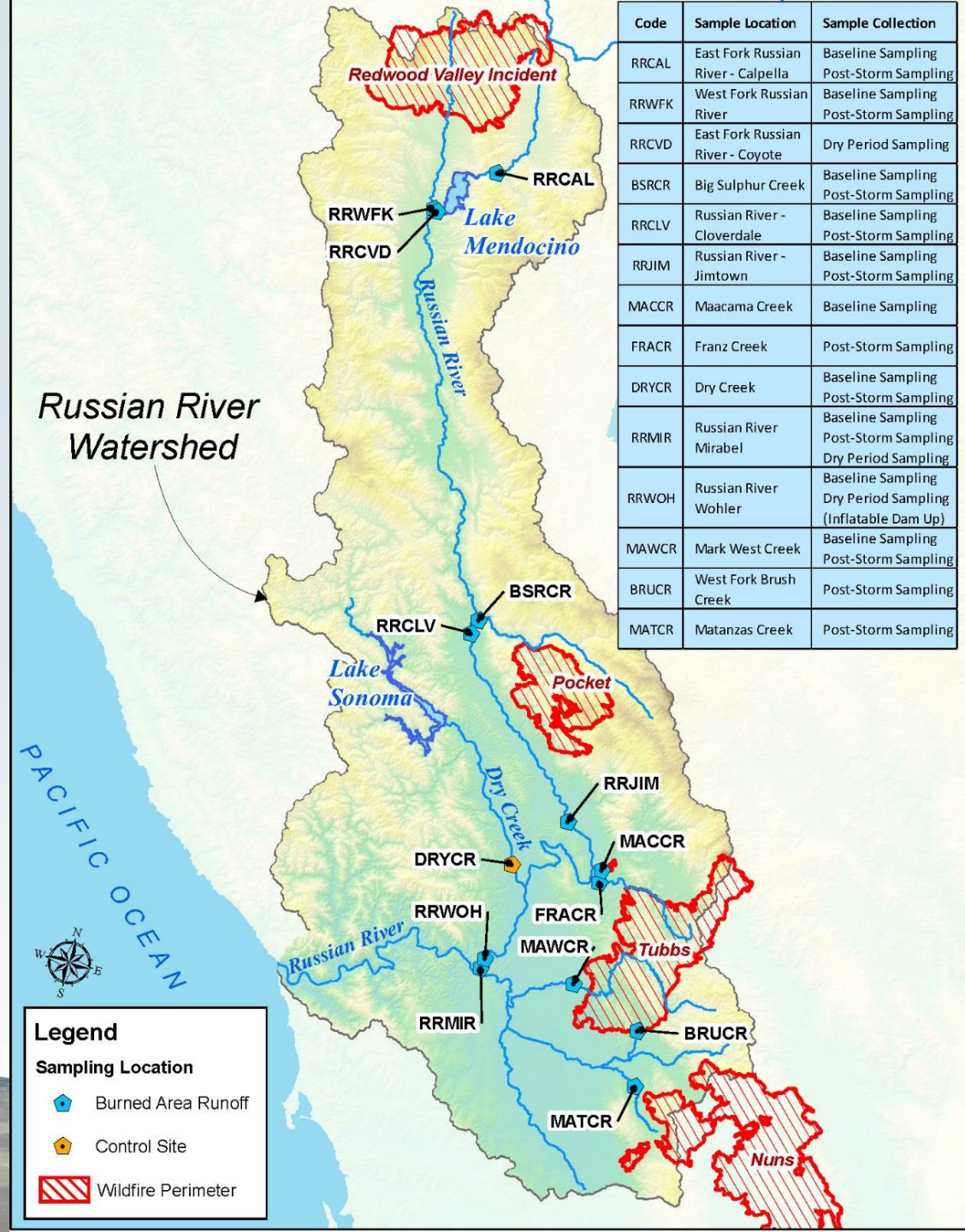
Surface Water Sampling Protocol

- Baseline
  - Ten locations sampled on October 19, 2017
- Wet Season
  - Post-Storm Events (4) – Eleven locations
  - Dry Conditions (5) – Wohler / Mirabel
- Dry Season
  - Monthly (4) – Five locations
  - Biweekly (3)– Two locations

Sonoma Water

Sampling Program Sites

- Wet Season
  - Mainstem (3 sites)
  - Tributaries (8 sites)
- Dry Season
  - East Fork & Dry Creek
  - Wohler & Mirabel



Code	Sample Location	Sample Collection
RRCAL	East Fork Russian River - Calpella	Baseline Sampling Post-Storm Sampling
RRWFK	West Fork Russian River	Baseline Sampling Post-Storm Sampling
RRCVD	East Fork Russian River - Coyote	Dry Period Sampling
BSRCR	Big Sulphur Creek	Baseline Sampling Post-Storm Sampling
RRCLV	Russian River - Cloverdale	Baseline Sampling Post-Storm Sampling
RRJIM	Russian River - Jimtown	Baseline Sampling Post-Storm Sampling
MACCR	Maacama Creek	Baseline Sampling
FRACR	Franz Creek	Post-Storm Sampling
DRYCR	Dry Creek	Baseline Sampling Post-Storm Sampling
RRMIR	Russian River Mirabel	Baseline Sampling Post-Storm Sampling Dry Period Sampling
RRWOH	Russian River Wohler	Baseline Sampling Dry Period Sampling (Inflatable Dam Up)
MAWCR	Mark West Creek	Baseline Sampling Post-Storm Sampling
BRUCR	West Fork Brush Creek	Post-Storm Sampling
MATCR	Matanzas Creek	Post-Storm Sampling

Sonoma Water

Aqueous Sample Parameters

- Wet and Dry Season
  - Dissolved Organic Carbon
    - SUVA-254
  - Anions
  - Cations
  - Total Dissolved Nitrogen
  - Dissolved and Whole Water
    - Iron Speciation
    - Mercury
  - Aquatic Microbiome DNA
- Wet Season
  - Trace Metals
  - PFAS
  - Sugars

Sonoma Water

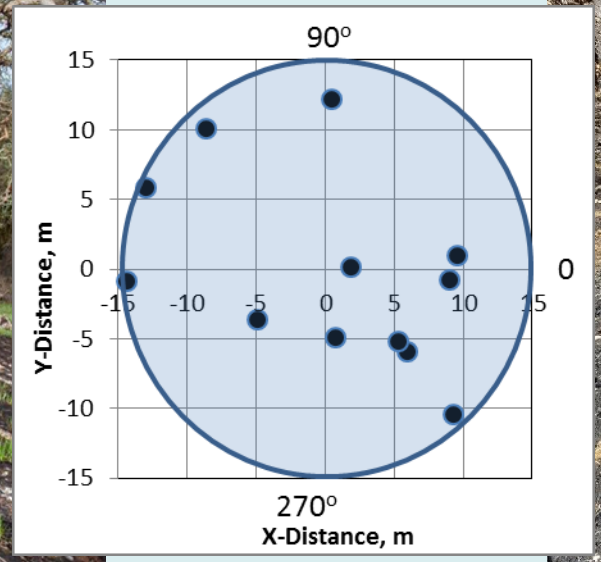
Sediment Sampling

- Characterize changes in microbial populations at streambed
- Parameters
  - Sediment Microbiome DNA
  - Carbon
  - Nitrogen
  - Mercury

Sonoma Water

Ash Sampling and Characterization

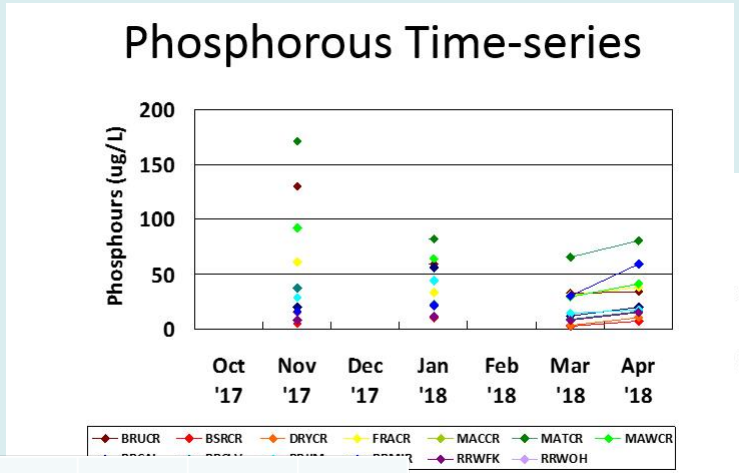
- Collect bulk ash samples
  - Pepperwood Preserve, McCullough Ranch, Shiloh Regional Park
  - Ash leachate experiments
  - DOC and mercury release concerns

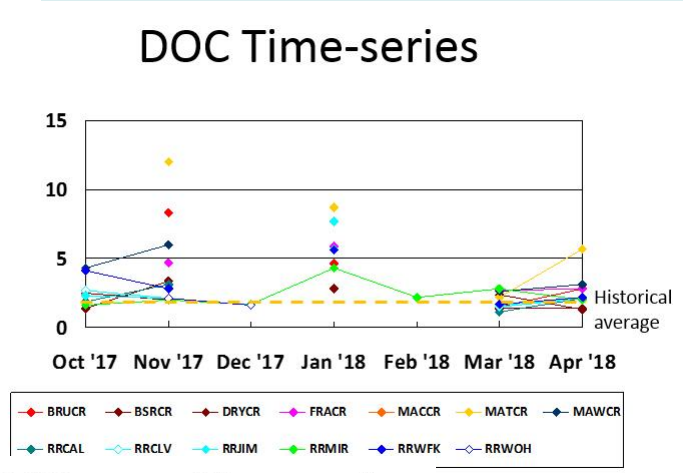


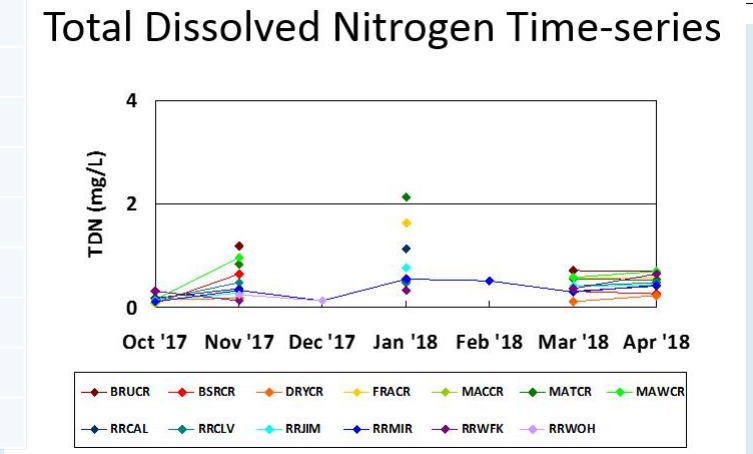
Analytical Results

- Approved data available on ScienceBase
- Data Review & Interpretation

✓ = *Completed* *o = Pending Analysis*	Oct. 19 2017	Nov. 2 2017	Nov. 14 2017	Nov. 20 2017	Dec. 12 2017	Jan. 9 2018	Feb. 5 2018	Feb. 26 2018	Mar. 6 2018	Apr. 10 2018
Dissolved Trace Elements	-	-	✓	✓	-	✓	-	-	*o*	*o*
Total Trace Elements	-	-	✓	*o*	-	*o*	-	-	*o*	*o*
Cations	✓	*o*	✓	✓	✓	✓	*o*	*o*	*o*	*o*
Anions	✓	✓	✓	✓	✓	✓	*o*	*o*	*o*	*o*
Iron Speciation (Fe II & III)	-	-	✓	✓	✓	✓	*o*	*o*	*o*	*o*
Mercury	-	-	✓	*o*	-	*o*	*o*	*o*	*o*	*o*
Dissolved Organic Carbon (DOC)	✓	✓	✓	✓	✓	✓	*o*	*o*	*o*	*o*
Total Dissolved Nitrogen (TDN)	✓	✓	✓	*o*	✓	*o*	*o*	*o*	*o*	*o*
Sugars	-	✓	*o*	*o*	-	*o*	-	-	*o*	*o*
Per- & Polyfluoroalkyl Substances (PFAS)	-	-	*o*	*o*	-	*o*	-	-	*o*	*o*
Aquatic Microbiome DNA	*o*	*o*	*o*	*o*	*o*	*o*	*o*	*o*	*o*	*o*





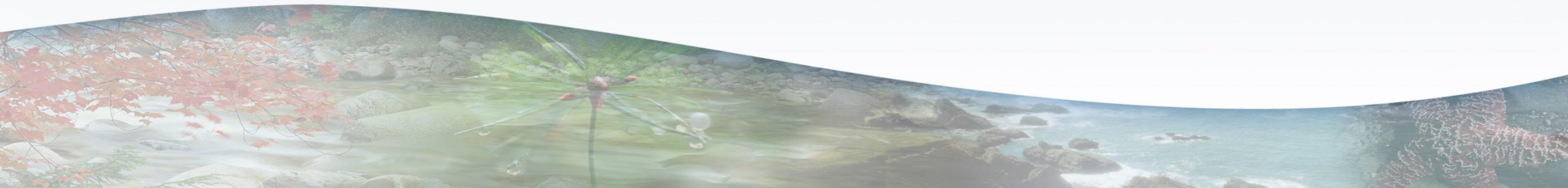


Next Steps

- Sampling on-going
- Evaluate additional potential sites downstream of Mendocino Complex fire
- Flow & Reactive Transport Model
- Ash leachate column experiments

Sonoma Water

Pepperwood Preserve
Lisa Micheli



Monitoring infiltration and sedimentation in Wine Country fire zone uplands

North Coast Regional Water Quality Control Board

Lisa Micheli, PhD
Pepperwood's Dwight Center for Conservation Science

September 6, 2019

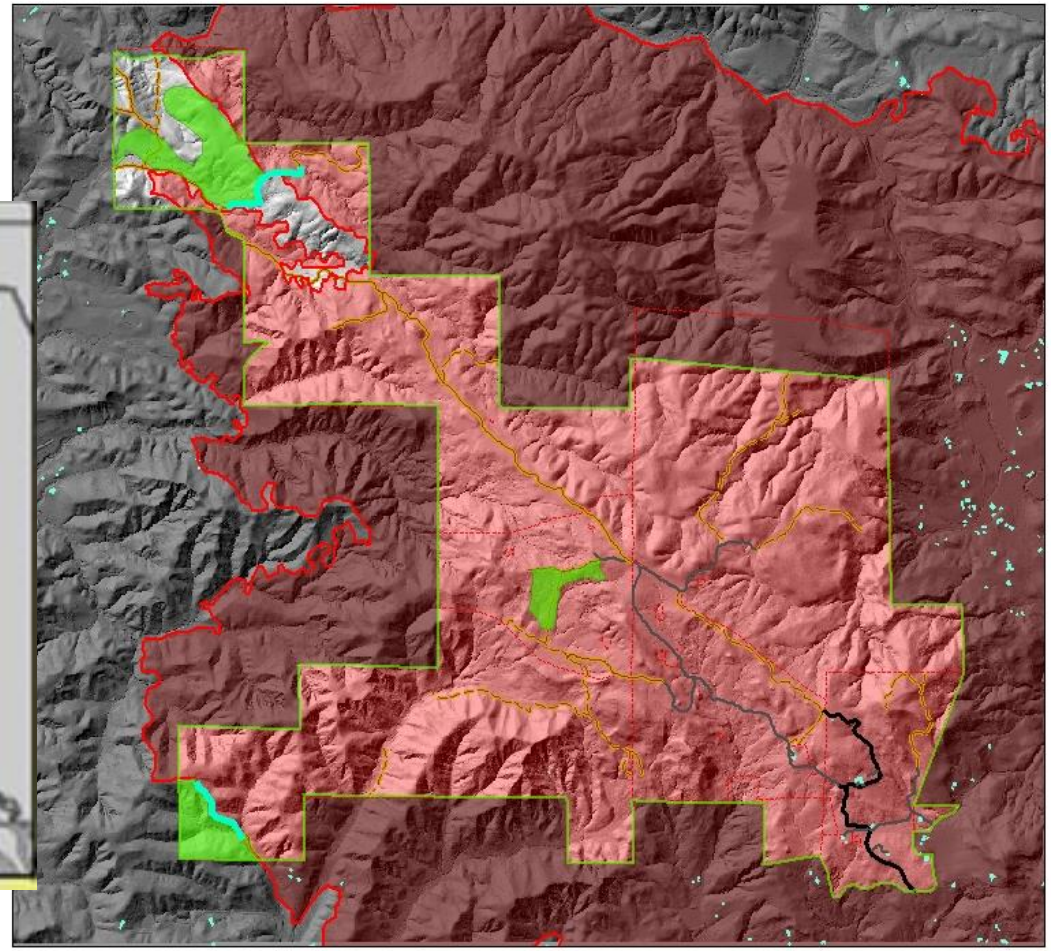
Pepperwood PRESERVE
Inspiring conservation through science

USGS
science for a changing world

SONOMA COUNTY WATER AGENCY

Pepperwood Mission: advance science-based conservation science across our region and beyond

Tubbs Fire Official Perimeter, preliminary dozer lines and unburned regions October 2017



0 0.25 0.5 1 Miles

TubbsFireOfficial_171023
TubbsFireOfficial_171023
PWD_BASE_Jursd_Boundaries_PepperwoodPreserve
PWD_BASE_Infstr_Buildings_LiDAR_2013

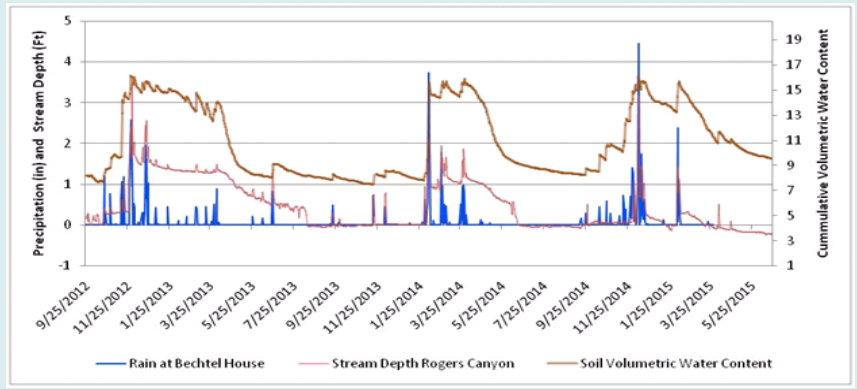
Supression

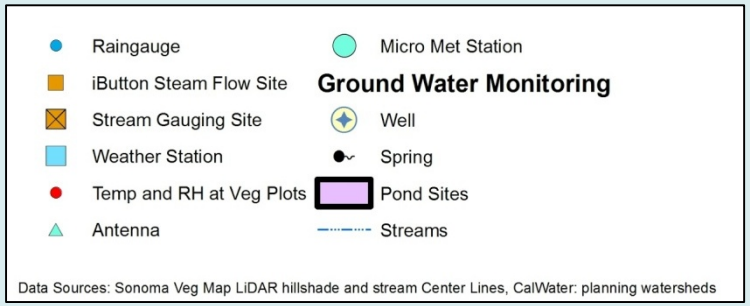
Observed Dozer Lines

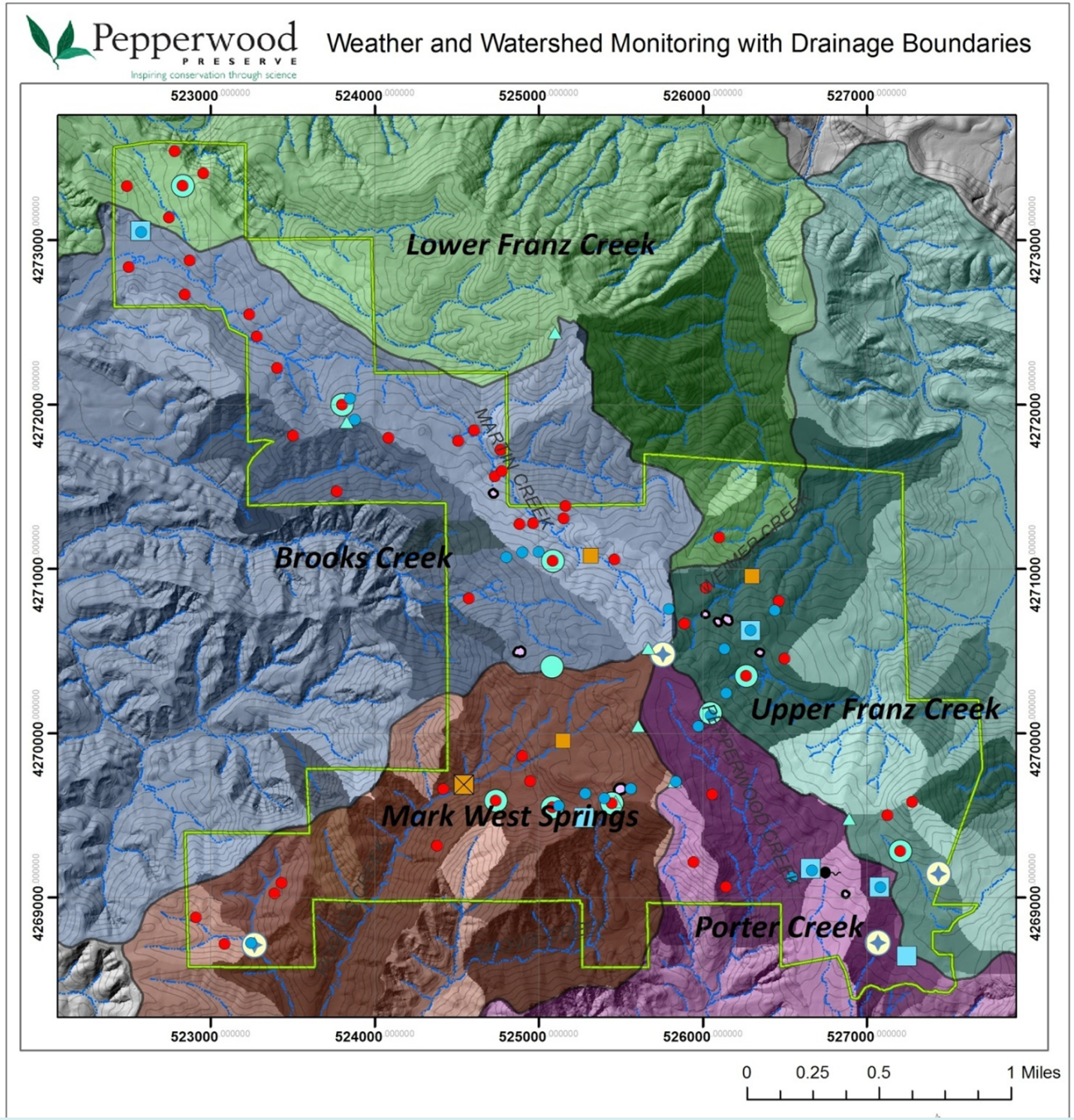
Preliminary Satellite Observations

Unburned regions

Baseline Data: Sentinel Site hydrology







How are our watersheds projected to respond in terms of runoff and erosion?

TUBBS FIRE

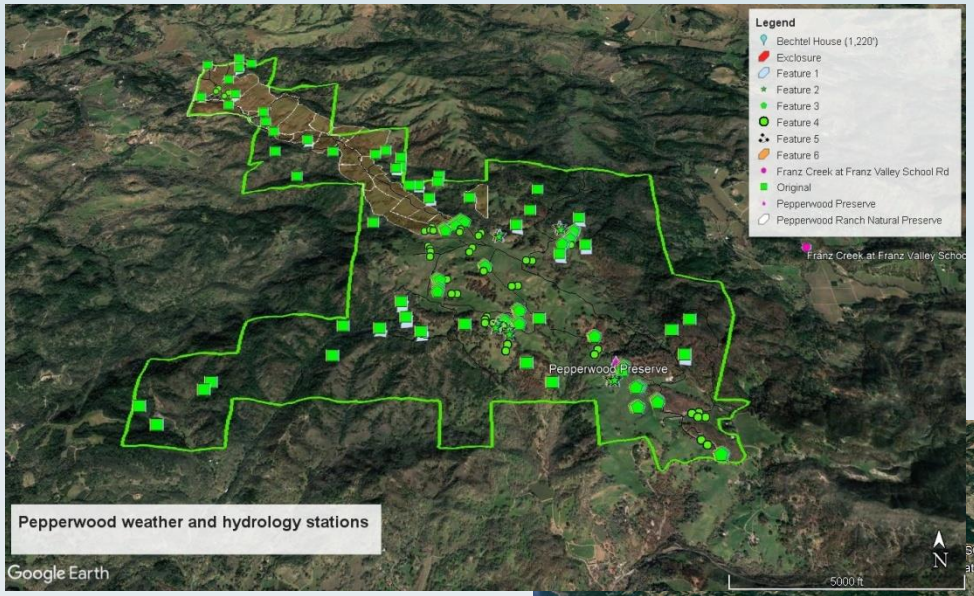
Watershed Emergency Response Team

FINAL REPORT

CA-LNU-010104

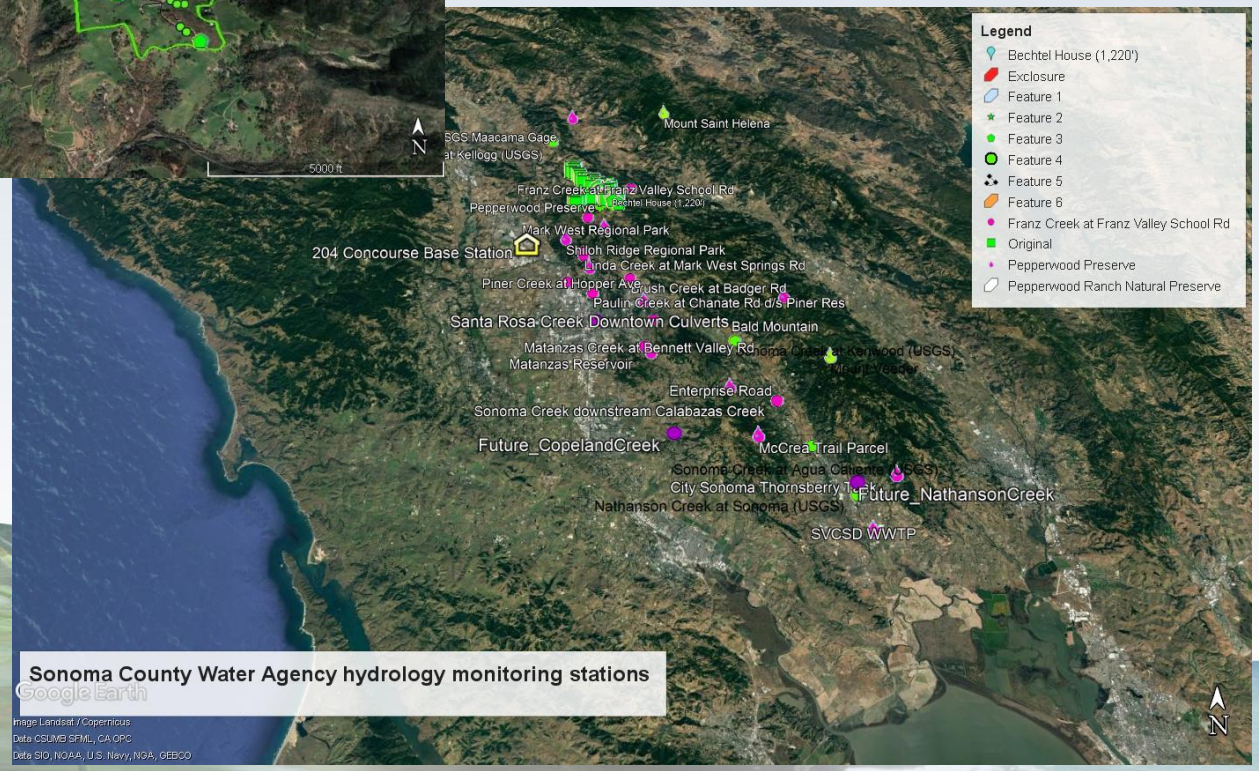
November 15, 2017

Quantifying Watershed Response to Northern California Wildfires



Pepperwood weather and hydrology stations

Rain gages, stream gages, soil moisture probes, sedimentation assessments, complementary flood warning system



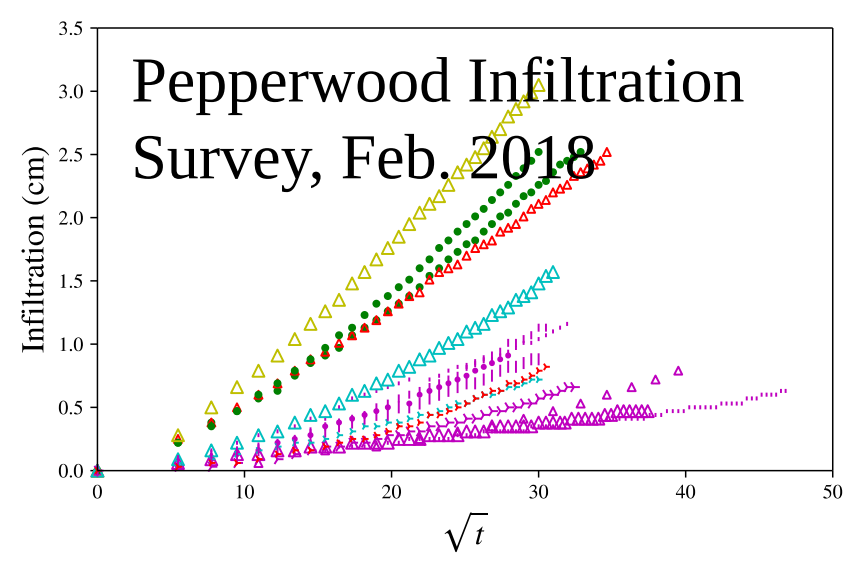
Sonoma County Water Agency hydrology monitoring stations

SONOMA COUNTY WATER AGENCY

USGS science for a changing world

Pepperwood PRESERVE
Inspiring conservation through science

Quantifying Watershed Response to Northern California Wildfires: Key Questions



1 – How severely did the 2017 Northern CA fires affect soil hydrologic properties?

2 - When do burned watersheds return to their reference runoff conditions? How does this vary with ecologic community/parent material?

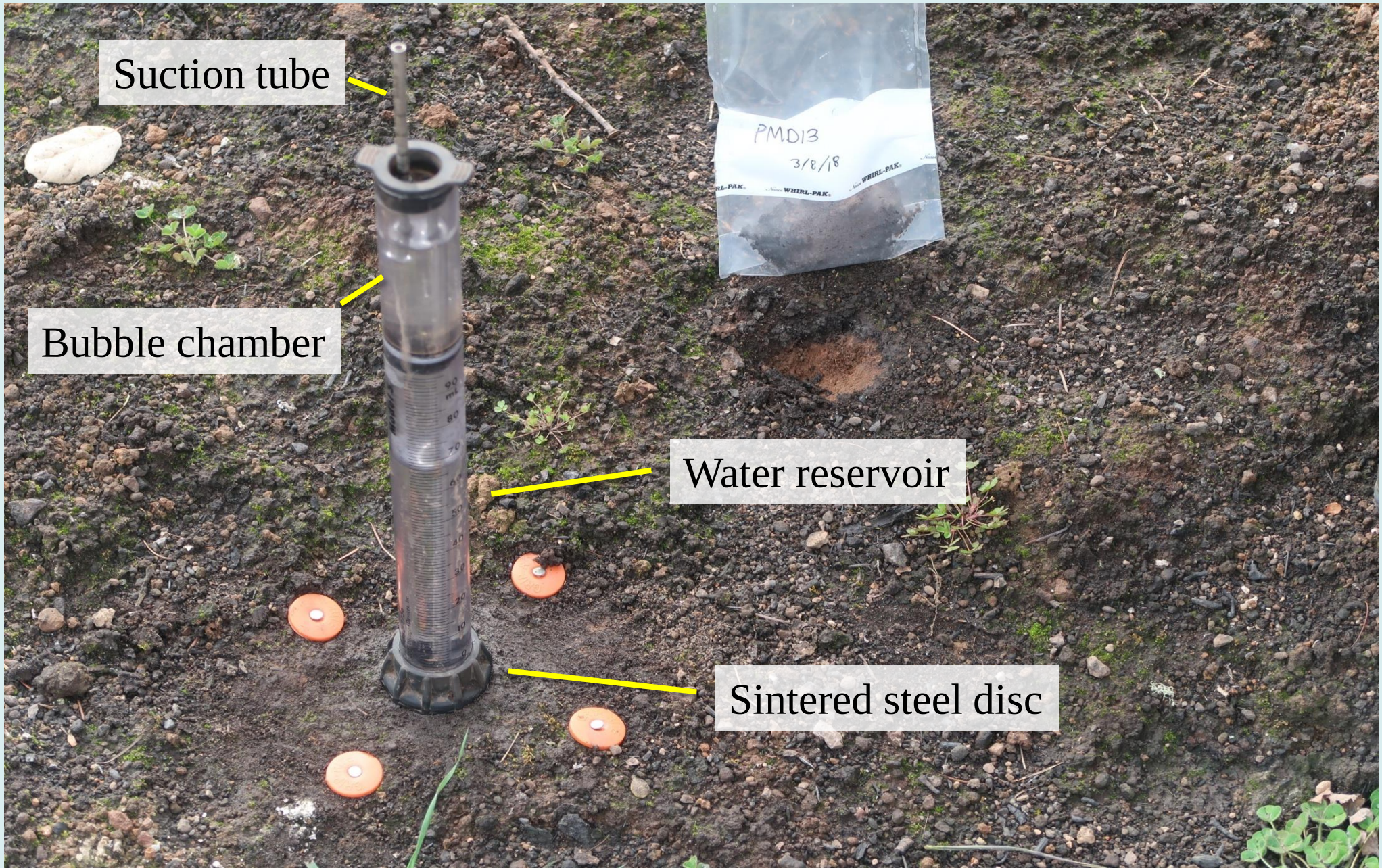
3 – What are the rainfall thresholds for processes that transport sediment, and what are the expected hillslope sediment loads to streams?

How fire affects soil characteristics: sealing and **hydrophobicity**

Figure 2.8—The "tin roof" effect on burned chaparral watersheds as described by earlier watershed researchers include (A) the wettable ash and carbon surface layer, (B) the discontinuous water repellent layer, and (C) the wettable subsoil. (After DeBano 1969).

Franciscan mélange, deciduous Oak forest

Infiltration monitoring: tension-disc infiltrometers



Infiltration sampling across the 2017 wine country burn zone

	Evergreen	Broadleaf	shrubland/chaparral	herbaceous	*soil burn severity*
Franciscan	PMD06, PMD07, SMD05	PMD12, PMD13	PMD05, SMD04	PMD01, PMD03, SMD03, PMD14	very low
Volcanic	AMD01, AMD03, AMD05, AMD08, AMD09, AMD11, PMD04	AMD06, PMD15	AMD02, AMD04	AMD07,AMD10	low
Sedimentary	AMD16, AMD17, PMD11	AMD18, AMD19, PMD10	AMD12, AMD14	AMD13, AMD15	moderate
Serpentinite	SMD06		PMD02, PMD08, SMD02, SMD07	SMD01	high
Silica Carbonate	PMD09				

40 sites total

~75 including Pepperwood Grassland surveys

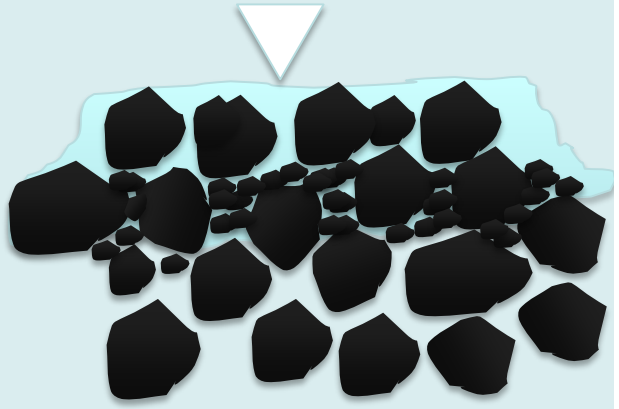
What does soil hydrologic recovery look like?

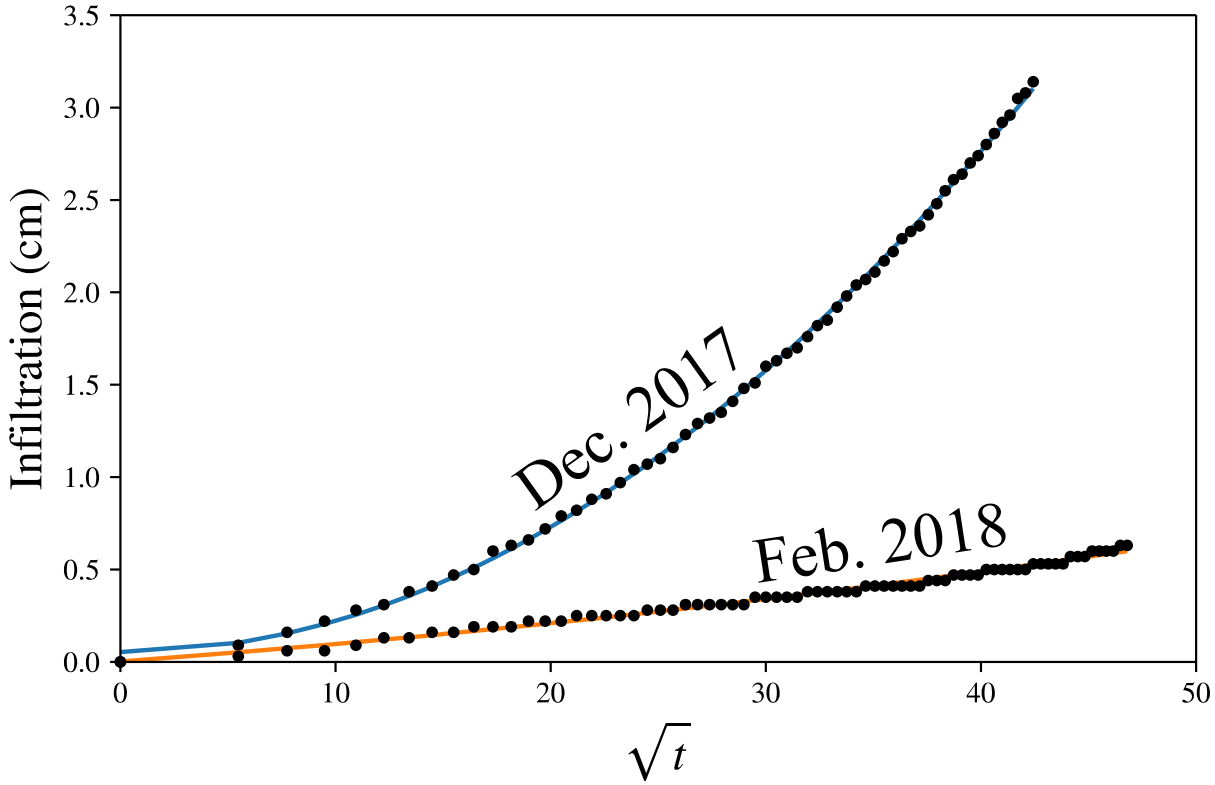
Revisit monitoring sites monthly during wet months, less often during dry months

Potential soil sealing after 2017/2018 rainy season

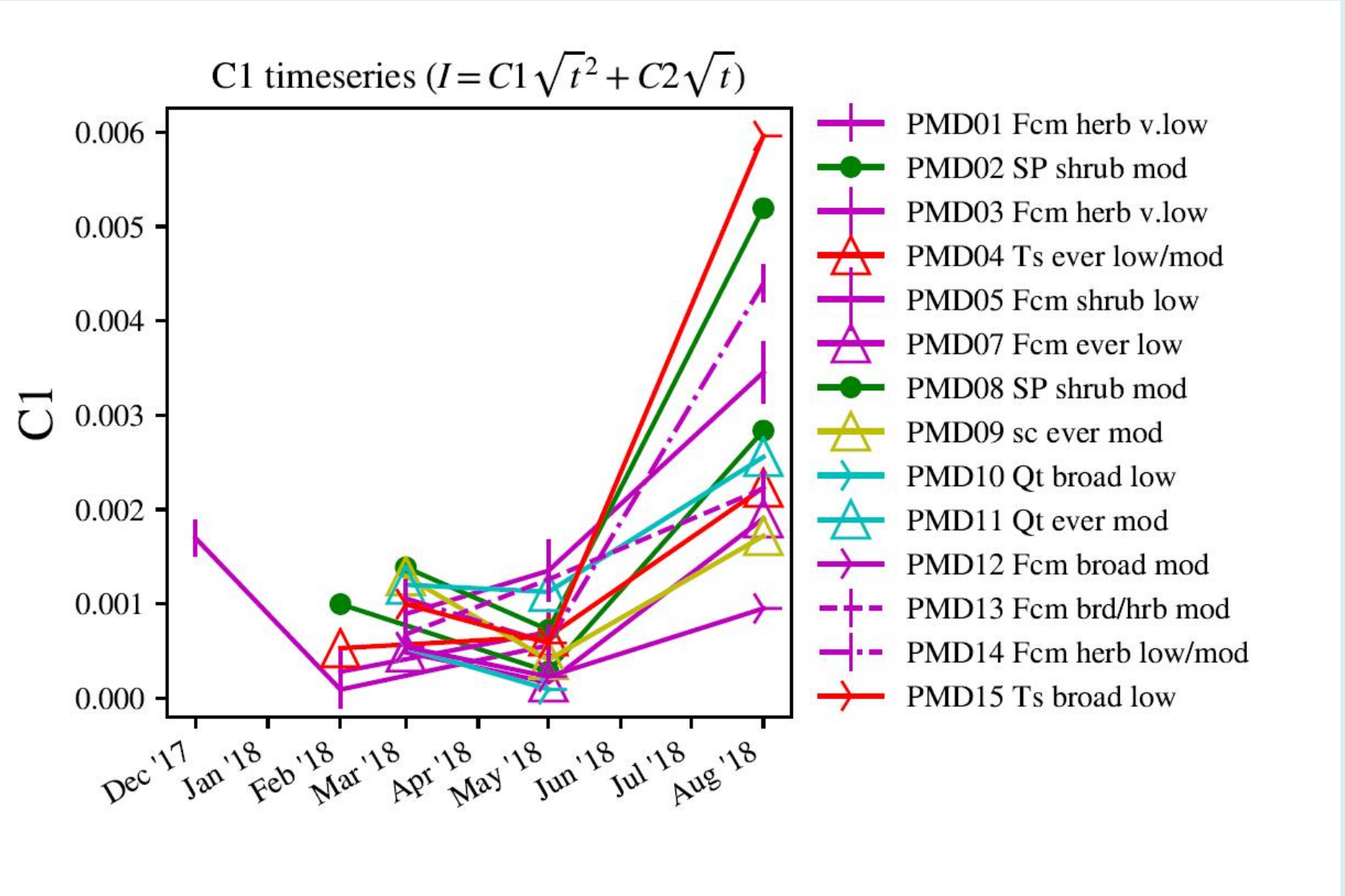
How do soil macro-pores (cracking, etc) impact recovery?

Site PMD01 (Franciscan mélange grassland) changes over time





Measures of infiltration already showing a rebound since fire and soil sealing



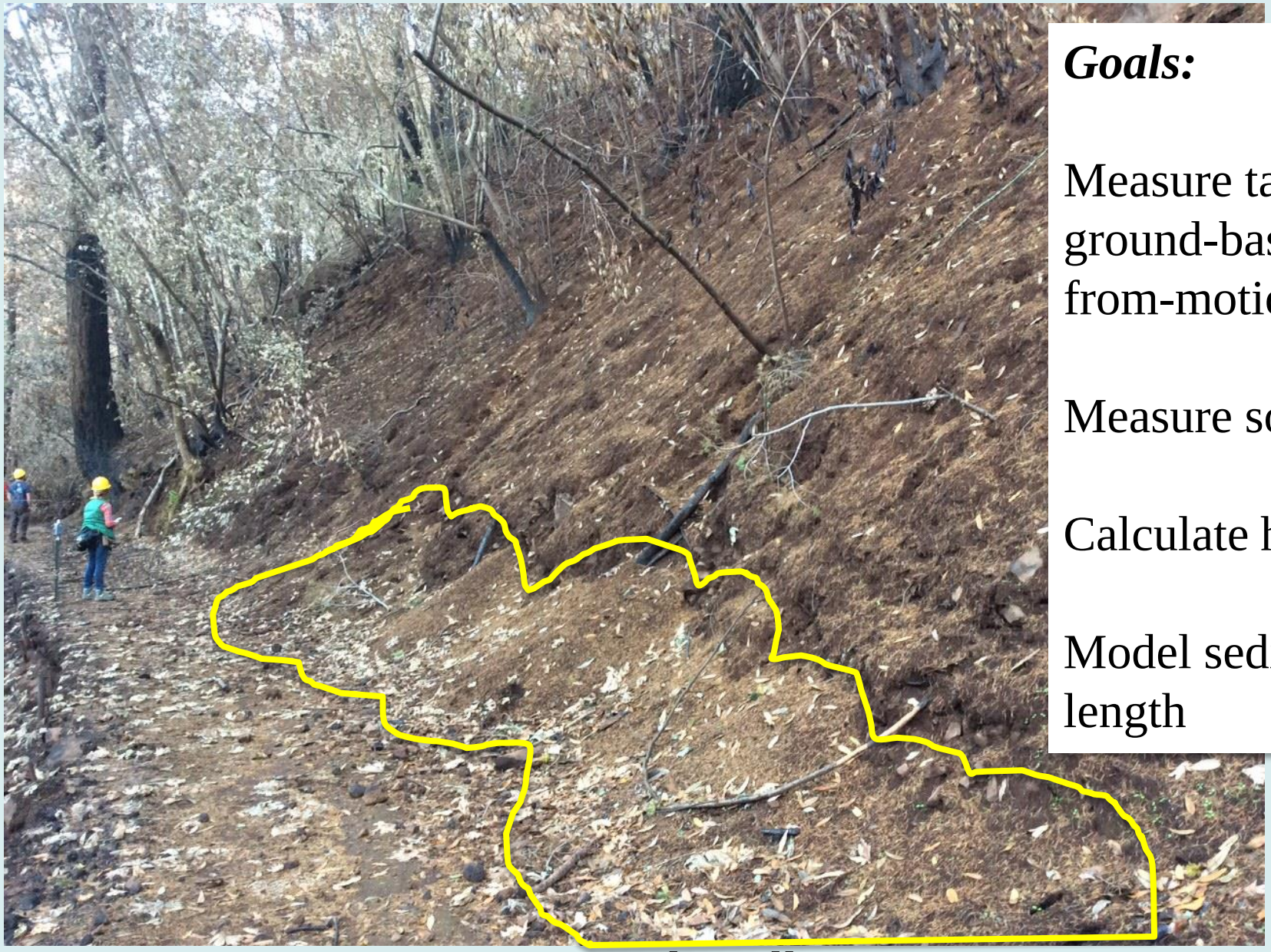
Objective 2: *Geomorphic process mapping*

***Goal:* Geomorphic process map for subset of burned watersheds to detect change over seasons**

Utilize:

- Monthly (Digital Globe, sub-m-resolution) and daily (Planet labs smallsats, ~6 m resolution) satellite imagery
- Pre- and (hopefully) post-fire Lidar
- Correlate Pit2Pixel measurements to extrapolate over greater areas

Calculating hillslope sediment flux and stream loading



Bouverie Preserve, Glen Ellen, CA

Goals:

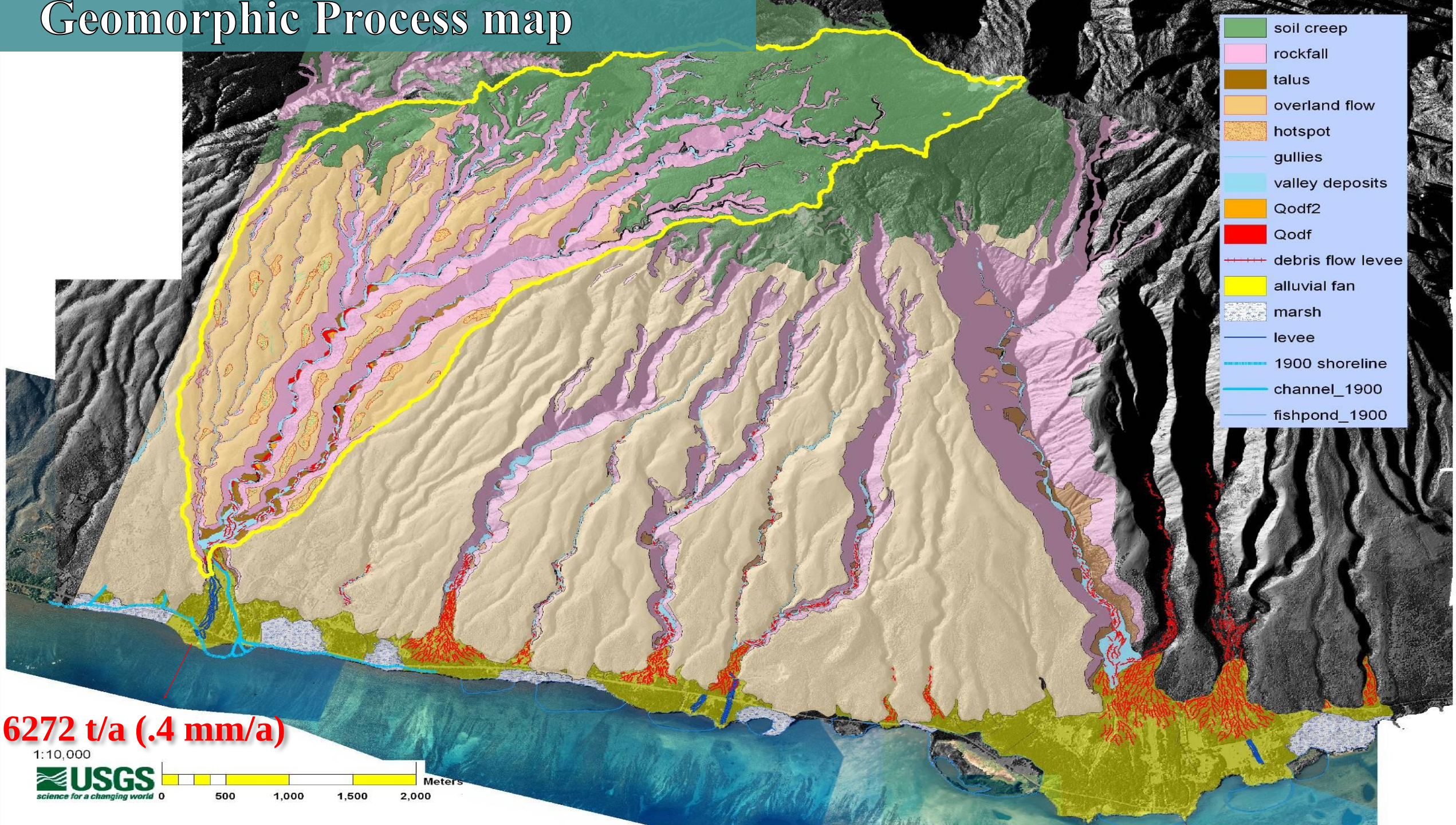
Measure talus cone volumes using ground-based LiDAR or structure-from-motion

Measure source area and slope

Calculate hillslope sediment flux law

Model sediment loading per stream length

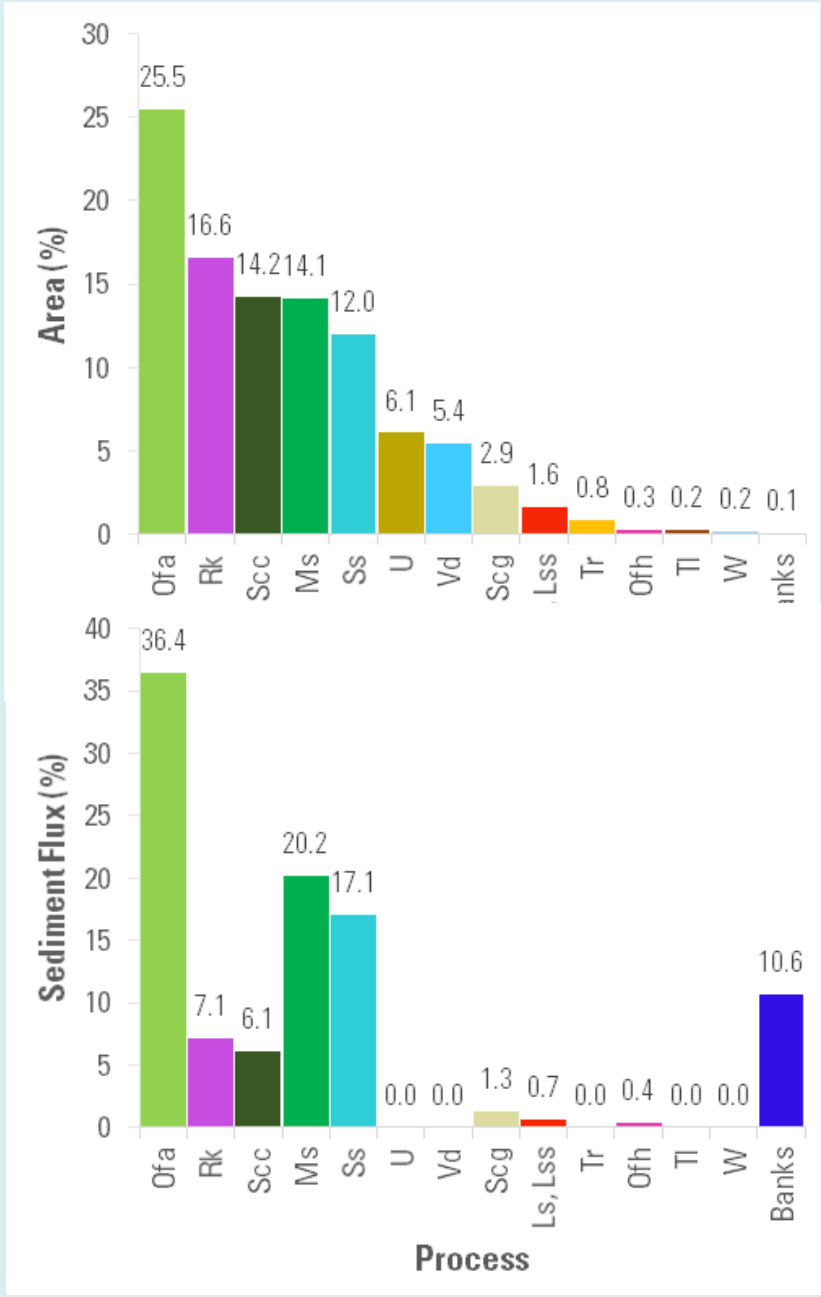
Geomorphic Process map



Modeling Example

- We will be calculating sediment flux: erosion rate x process area

Ls	Landslide
Lss	Landslide Scarp
Ms	Modified Soil
Ofa	Agricultural Field
Ofh	Hot Spots
Rk	Rockfall
Scc	Soil Creep, canopy
Scg	Soil Creep, grass
Ss	Side Slope
Tl	Talus
Tr	Terrace
U	Urban
Vd	Valley Deposit
W	Waterways

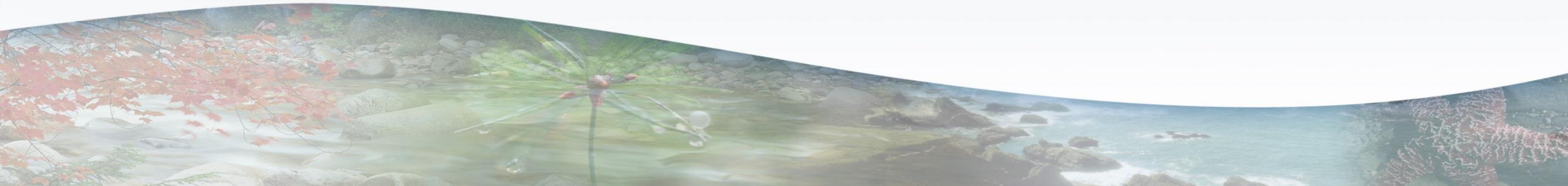


A living laboratory for demonstrating land management : forest thinning, conservation grazing, and returning prescribed to the landscape

Thank you!
lmicheli@pepperwoodpreserve.org

Pepperwood
PRESERVE
Inspiring conservation through science

Sonoma County Office of Recovery & Resiliency
Watershed Task Force
Virginia Mahacek



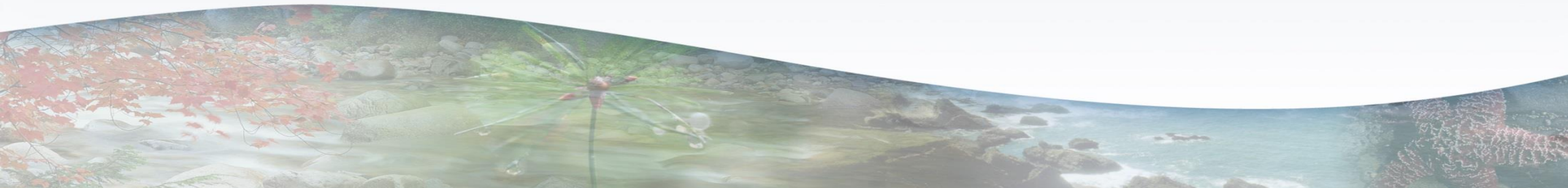
Watershed Task Force

- Overview
- 2017/18 Focus and Activities
  - Pre-winter storm drain protection and pollutant containment
  - Erosion and sediment control measures
  - Forecasts and alerts improvements and dashboard
  - Storm patrol coordination
  - Water quality sampling plans and data exchanges
  - Recovery funding proposals support

Watershed Task Force

- 2018/19 Focus and Activities
  - Burned watersheds assessment
  - Secondary hazards preparedness/warning
  - Storm patrol coordination
  - Erosion and sediment control outreach
  - Online incident submittal
  - Data sharing portal development
  - Post-fire monitoring & reporting cooperation

North Coast
Regional Water Quality Control Board
Chuck Striplen



Update on Post-Fire Monitoring

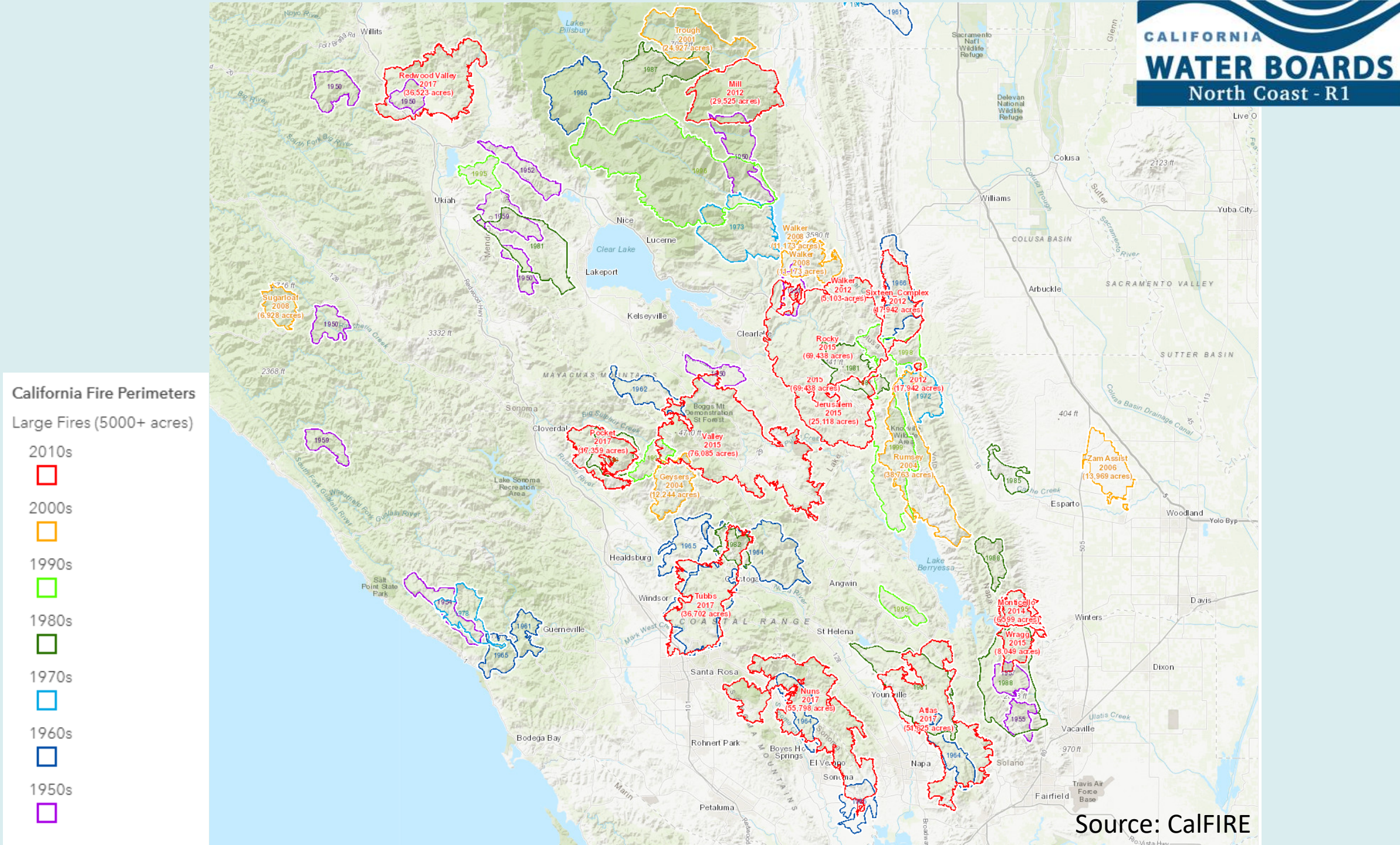
and the Russian River Regional Monitoring Program

CALIFORNIA WATER BOARDS North Coast - R1

Post-Fire Long Term Planning & Monitoring

- Good handle on near-term monitoring
- Rain event prediction improving
- Good channels of communication
- Need for coordinated basin-wide monitoring

Source: R3MP Watershed Atlas



Source: CalFIRE

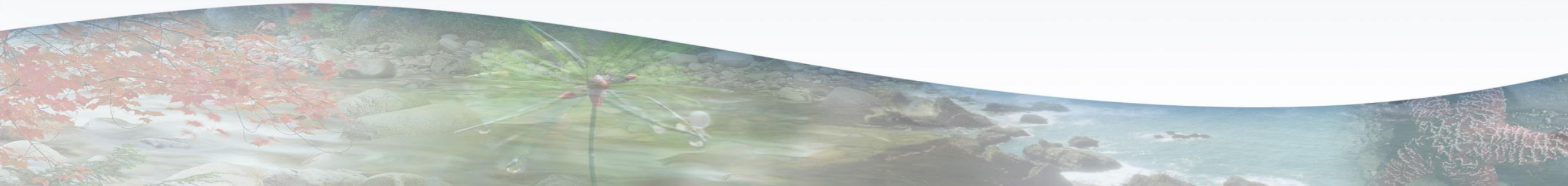
Confluence (Russian River Watershed Assn.)

Watershed Task Force (Sonoma County)

Watershed Collaborative (Sonoma County Ag + Open Space)

FireSmart Lake Sonoma (Sonoma Water)

Russian River Regional Monitoring Program (R3MP)



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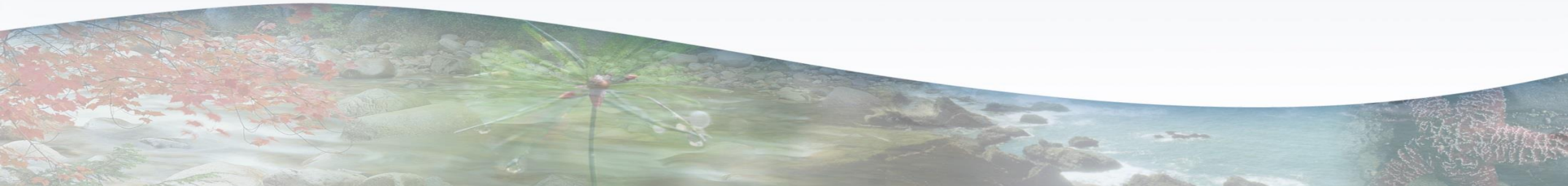
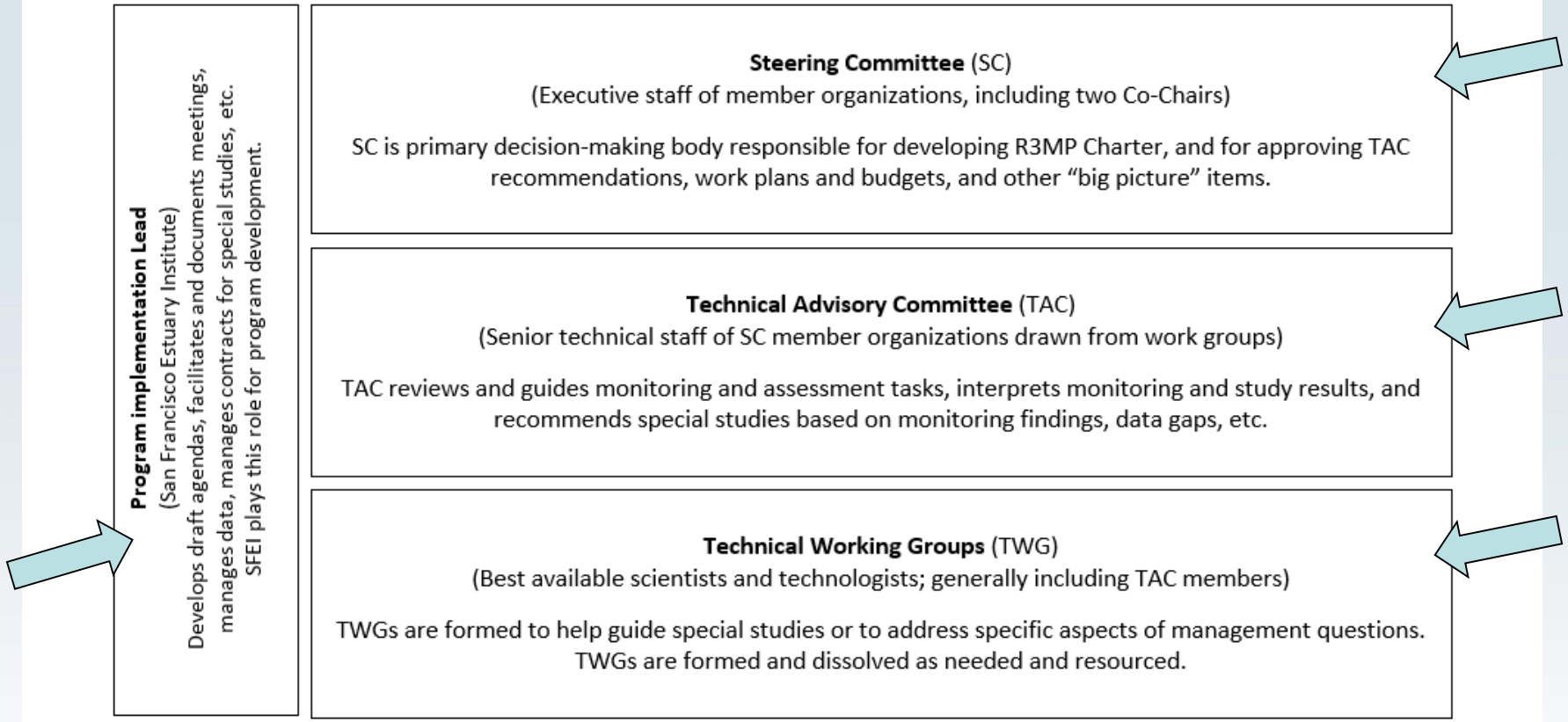


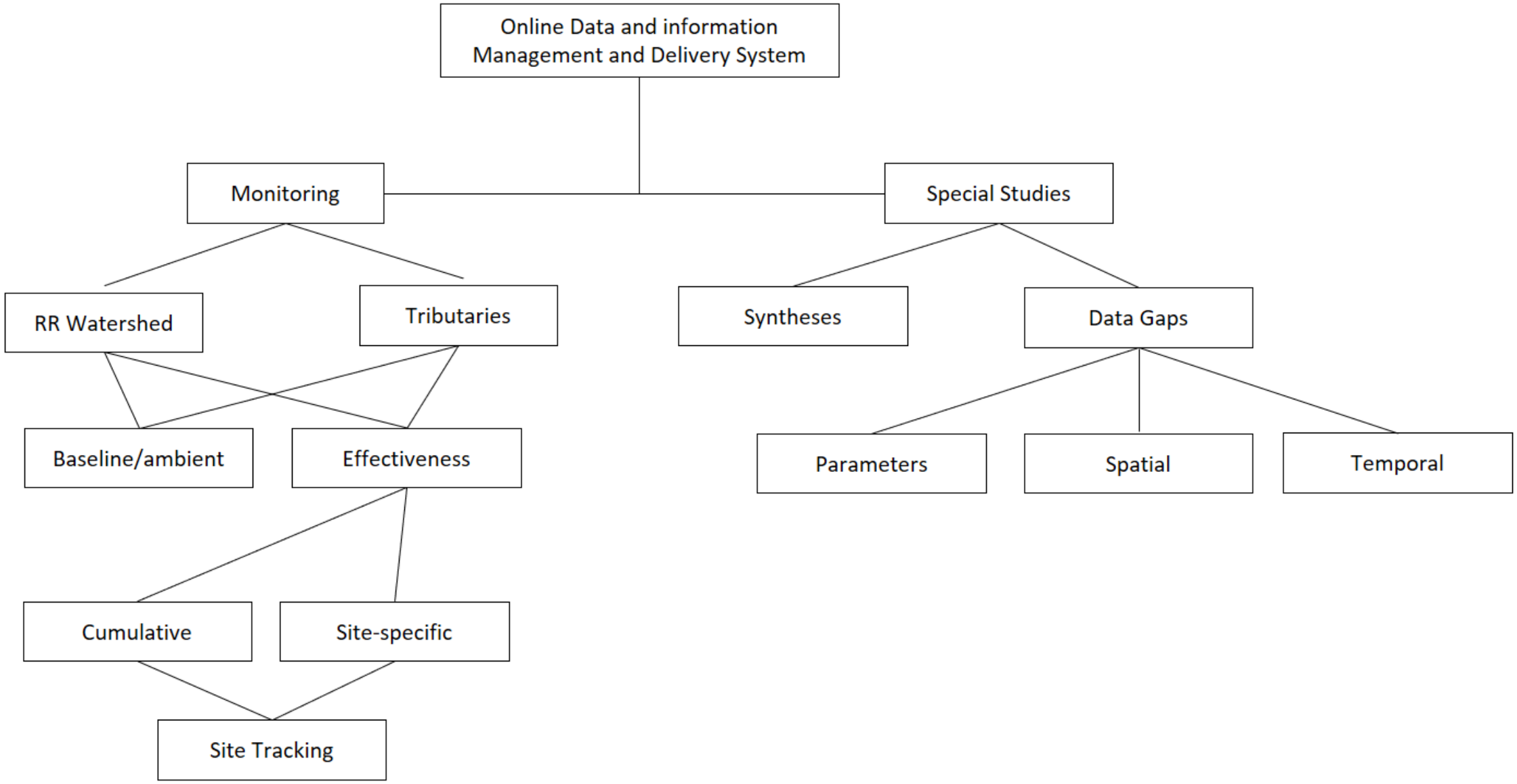
Governance Structure for the Russian River Regional Monitoring Program



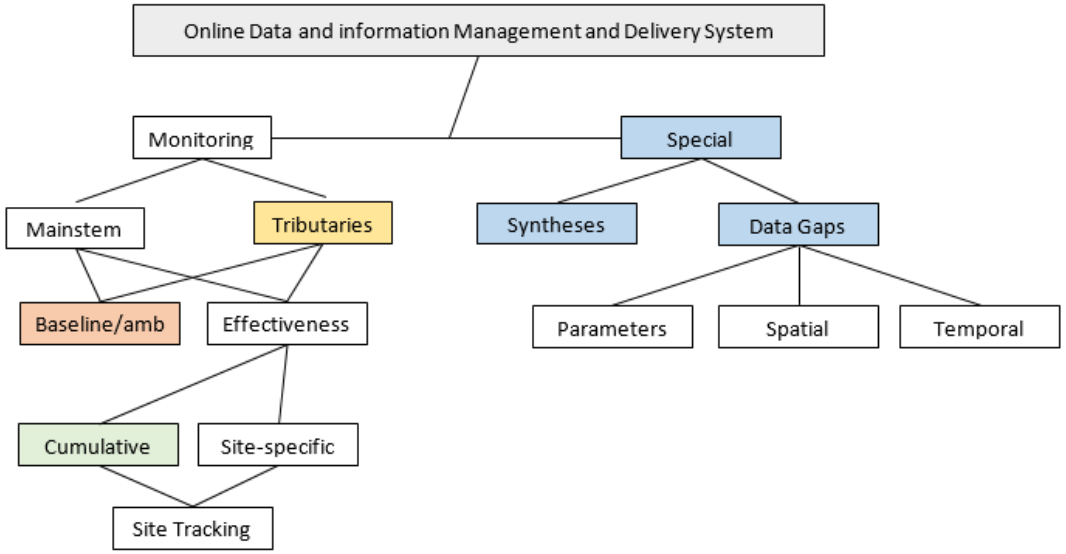
Public attendance is accommodated for meetings of the Steering Committee (SC), Technical Advisory Committee (TAC) and Technical Workgroups (TWG).

The R3MP Charter provides the goal and objectives of the R3MP, criteria for membership in any R3MP Committees or Workgroups, procedures for decision-making, and other directives by which the R3MP operates.

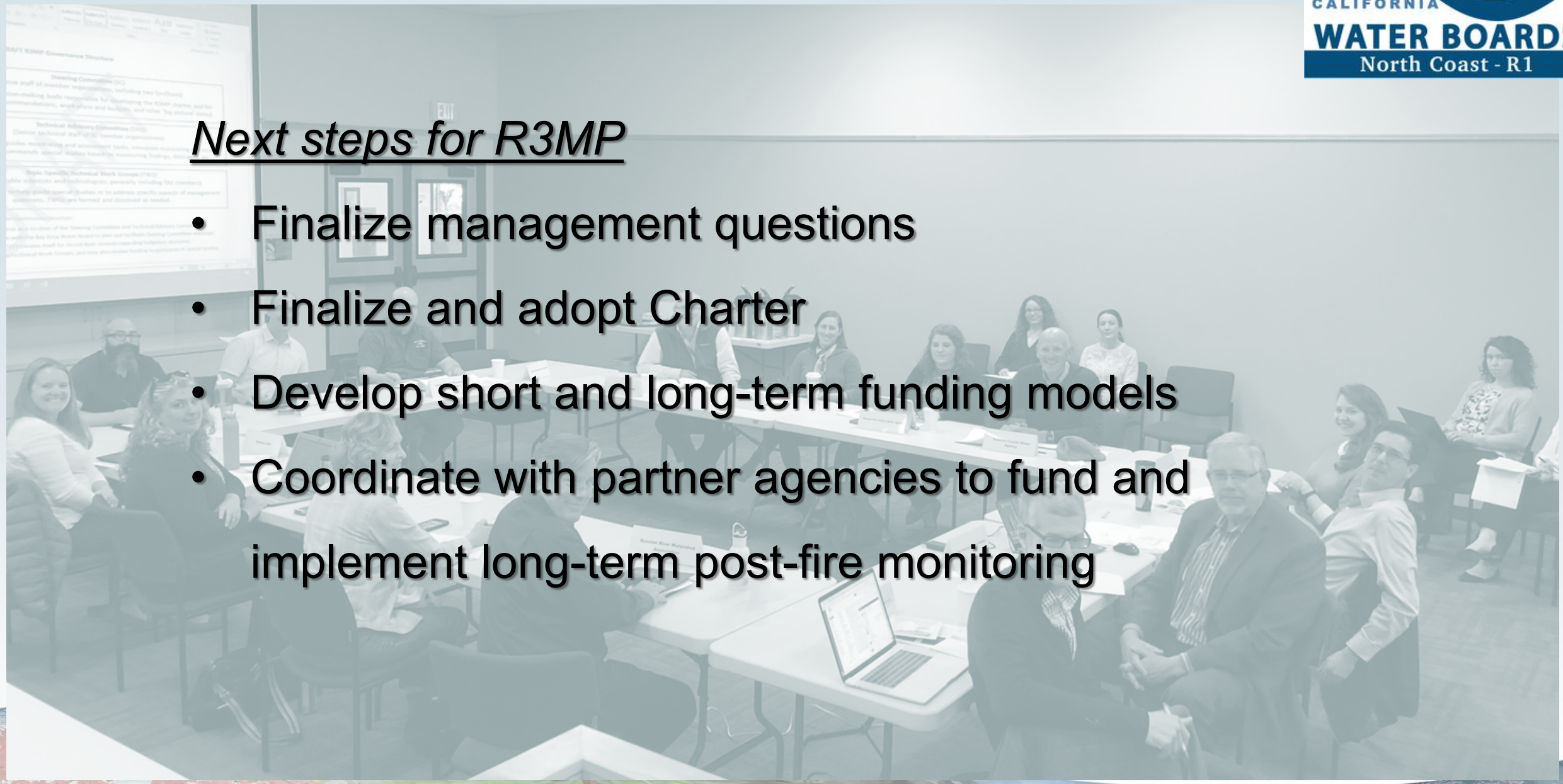
Management Questions Framework



Framework to Organize R3MP Management Questions and Related Concerns



21. Investment in collection of baseline information for the tributaries and the West Fork Russian, including instream flows, water quality, location of fish barriers, mapping of invasive plants, spawning and rearing studies, and habitat assessment.	MCRCD (Deborah Edelman 8-20-18)	
22. A compilation of existing available research into a central, easily accessible central database to determine data gaps.		Online data and information delivery system
23. What are the priority reaches for restoration in the upper Russian River? Where is the potential highest for improvements to aquatic habitat (focus on salmon)?		Special Studies, Synthesis and Data Gaps
24. Which restoration activities are needed in the priority areas to improve instream habitat for salmonids and other aquatic species? Which options are the most effective per time/dollar spent?		Special Studies, Synthesis and Data Gaps
25. What are the long-term impacts of the Oct 2017 fires on the West Fork Russian?		Cumulative effectiveness monitoring in selected tributaries
26. What are the effects of forest management on flows.		Cumulative effectiveness monitoring in selected tributaries
27. MS4 Program. Seems like low hanging fruit in terms of developing coordinated effort rather than individual Co-Permittee sampling. Lots of resources being expended already that could be reprioritized into integrated effort.	Permit Sonoma (John Mack 7-19-18)	Special Studies, Synthesis and Data Gaps
28. California Tiger Salamander (CTS) and condition of terrestrial and aquatic habitats on Santa Rosa Plains. CTS is arguably the canary in the coal mine for the health of the Santa Rosa Plains. Species is declining arguably do to loss or change in terrestrial and aquatic habitats due to ongoing land use changes. Integrated effort needed to arrest decline and find a new stable state for this species.		Cumulative effectiveness monitoring in selected tributaries
29. Stream Hydrology – Short interval flow, water level data. Characterize baseline, declining water table (ground water withdrawal), what is natural "flashiness" versus storm water "flashiness", changes in peak and total volume from LID, management, other measures. Need focused hydrology monitoring with USGS gages on key reaches combined with peak flow, water table, continuous flow in small streams (e.g. ISCO 2150) as well as continuous water chemistry (e.g. YSI sondes).		Baseline ambient monitoring within selected tributaries



Next steps for R3MP

- Finalize management questions
- Finalize and adopt Charter
- Develop short and long-term funding models
- Coordinate with partner agencies to fund and implement long-term post-fire monitoring


RAFT R3MP Governance Structure
Steering Committee (SC)
Technical Advisory Committee (TAC)
Topic-Specific Technical Work Groups (TWG)
EXIT
Russian River Watershed Association

Questions?