



# Sonoma Water

Clean. Reliable. Essential. Every Day.

## Water Supply Workshop

September 30, 2019

    [sonomawater.org](http://sonomawater.org)



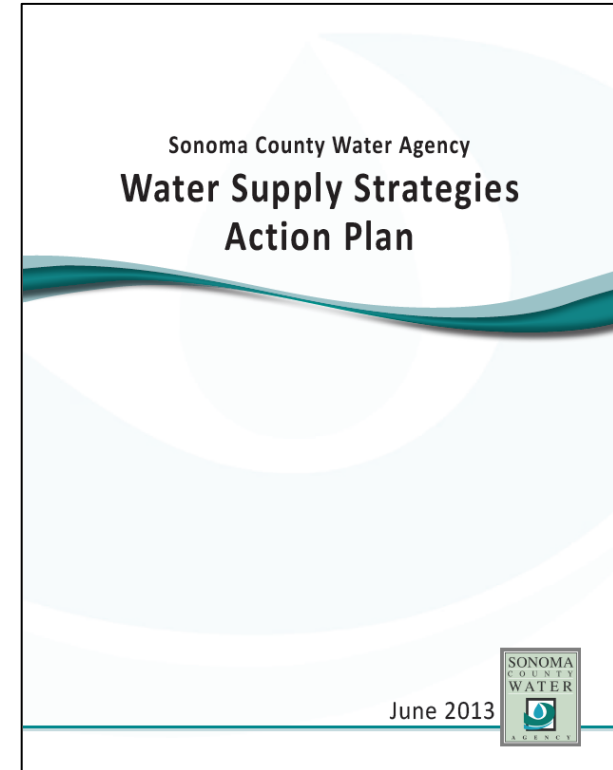
# Workshop Outline

- **Part 1: Overview of Water Supply Strategies Action Plan (Action Plan)**
- **Part 2: Key Water Supply Resiliency Programs**
  - Regional Water Supply Resiliency Study
  - Integrated Water Resource Management Programs
  - Climate Risk Resiliency Programs
  - Seismic Hazard Resiliency Programs & Asset Management



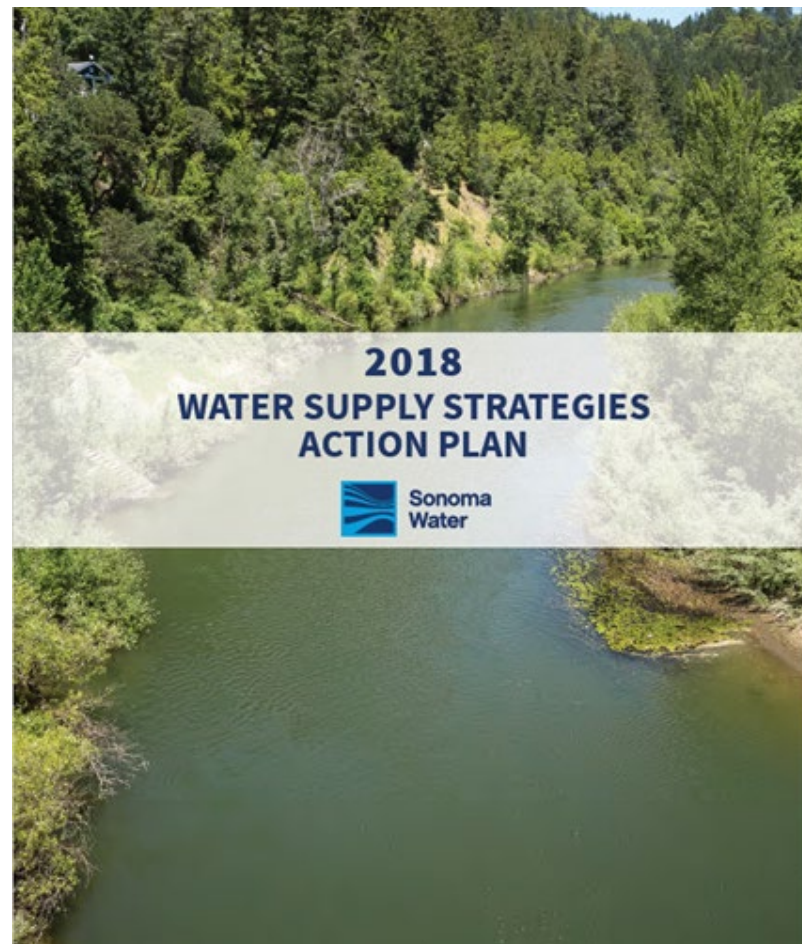
# Summary of Prior Action Plans

- **Board directed staff in 2009 to develop a Water Supply Strategies Action Plan**
- **Action Plans 2010-13**
  - 9 Strategies with prioritized Actions & Projects
  - Actively coordinated with Water Contractors
  - Successfully used as a regional planning and prioritization plan



# Updated Action Plan

- **Key Issues & Challenges**
  - Water Supply Reliability
  - Resiliency of Water Supply Facilities
  - Meeting Customer Demands
  - Economic Limitations
  - Organizational Fragmentation
- **Import Considerations**
  - Partnerships Are Essential
  - Strategies are Interconnected
  - Action Plan is a living document
  - Align with 2017 Strategic Plan Update





# 2018 Water Supply Strategies

**Strategy 1: Protect Drinking Water**

**Strategy 2: Maintain and Improve Reliability**

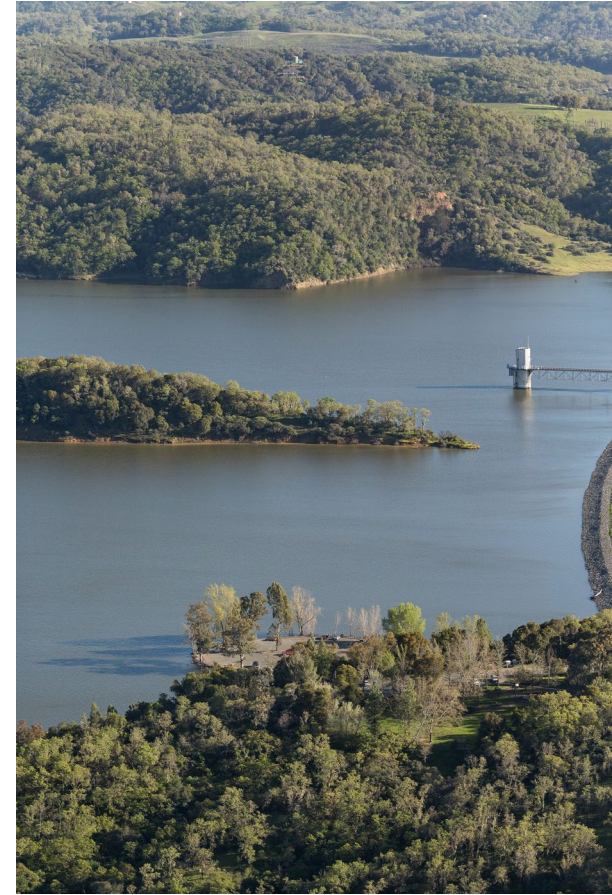
**Strategy 3: Utilize Regional Planning**

**Strategy 4: Respond & Adapt to Climate Change**

**Strategy 5: Improve Energy Efficiency**

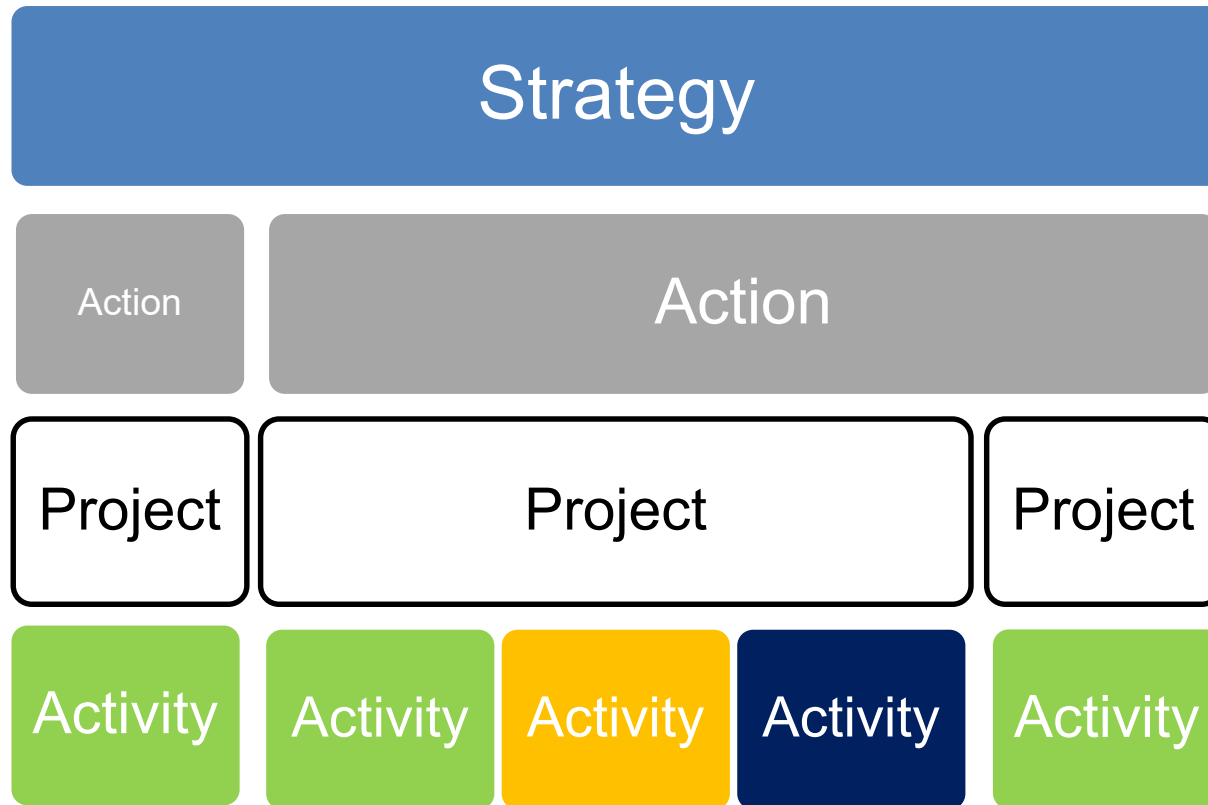
**Strategy 6: Increase Emergency Preparation**

**Strategy 7: Seek Federal and State Funding**



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# Action Plan Format



## Each Activity includes:

- Status
- Involved Parties
- Timing: Immediate, Near Term, Long Term



# Strategy 1: Protect drinking water supply & promote water-use efficiency

**Action:** Increase water supply reliability of Lake Mendocino and Lake Sonoma

**Action:** Ensure compliance with the Russian River Biological Opinion

**Action:** Support science-based management of groundwater and surface water resources

**Action:** Monitor and protect Sonoma Water's water rights

**Action:** Improve the efficient use of water in Sonoma Water's service area

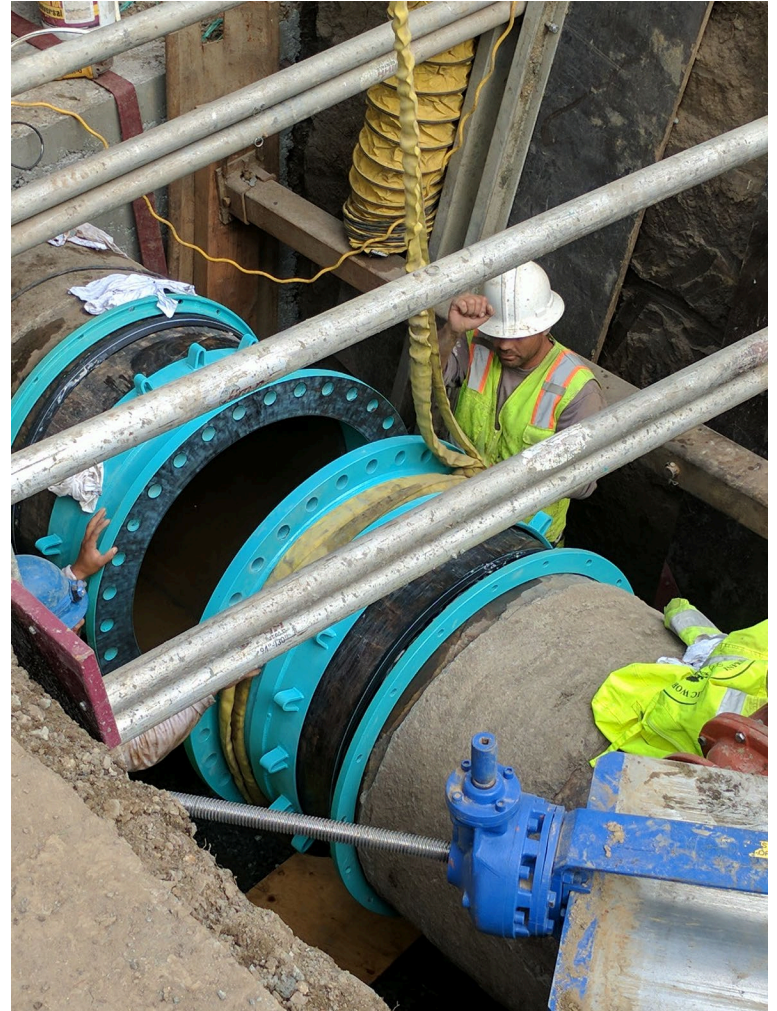




# Strategy 2: Maintain and improve the reliability of the Water Transmission System

**Action:** Assess, maintain and upgrade Water Transmission System infrastructure

**Action:** Plan for funding improvements to ensure Water Transmission System is maintained and reliable





# Strategy 3: Utilize regional planning to increase water supply resiliency

**Action:** Strengthen an integrated watershed management approach



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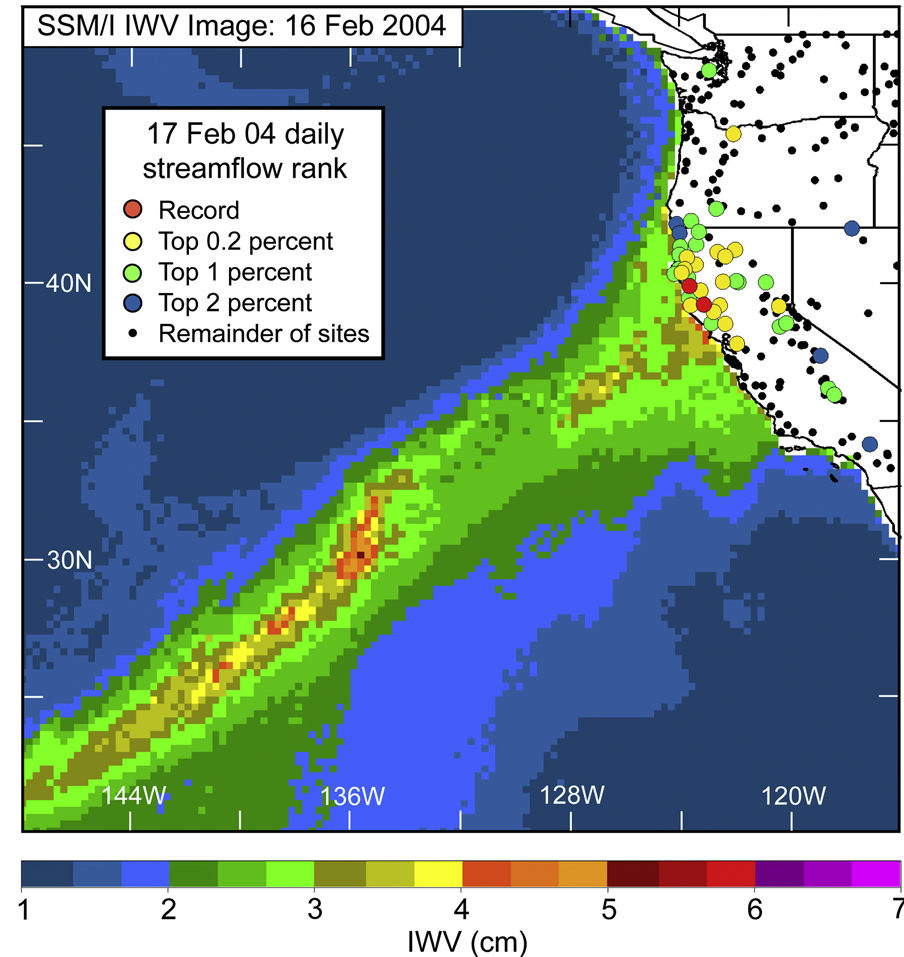
# Strategy 4: Respond and adapt to climate change

**Action:** Invest in climate science and technology

**Action:** Evaluate climate risk and vulnerabilities

**Action:** Implement climate adaptation strategies

**Action:** Participate in collaborative partnerships focused on climate science and adaptation



# **Strategy 5 : Improve energy efficiency of Water Transmission System, increase renewable power use**

**Action:** Reduce electricity costs

**Action:** Pursue regional collaboration to sequester carbon, reduce GHG emissions





# Strategy 6: Increase emergency preparation and improve response to natural disasters

**Action:** Update or create critical emergency preparedness planning documents

**Action:** Update Local Hazard Mitigation Plan and implement natural hazard mitigation projects

**Action:** Improve emergency management implementation skills





# Strategy 7: Seek federal and state funding

**Action:** Proactively pursue sustainable funding to support water supply projects and programs to offset impacts to ratepayers





# Questions & Discussion



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# Key Water Supply Resiliency Programs

Jay Jasperse  
*Water Agency Chief Engineer*

- **Regional Water Supply Resiliency Study**
- **Integrated Water Resource Management Programs**
- **Climate Risk Resiliency Programs**
- **Seismic Hazard Resiliency Programs & Asset Management**

# Regional Resiliency Study Overview:

## **Better Understanding a Complex System**

- Evaluate regional resiliency of collective infrastructure & water sources under “stress tests”
- Systems & infrastructure are connected, but not managed in a coordinated or strategic manner
- Evaluate strategies for region to be more resilient to short and long-term water shortages
- Identify regional projects to improve resiliency





# Resiliency Study Project Overview

**PHASE 1:**  
Work Plan and  
Scoping Document

**PHASE 2:**  
Development and Implementation  
of Decision Support Tool

**PHASE 3:**  
Modification and Maintenance  
of Decision Support Tool

6 -9 months

18 months

24 months



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# Anticipated Outcomes

- **Understand regional vulnerabilities due to water shortages**
- **New strategies & projects to improve resiliency**
- **Improved grant funding opportunities**
- **Develop regional water supply resiliency planning**
- **Increase coordination between Sonoma Water & Water Contractors**



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# Integrated Water Resource Management Programs

## Recycled Water

Wendy Gjestland

*Water Agency Principal Engineer*

## Demand Management

Greg Plumb

*Senior Programs Specialist*

*Water Use Efficiency*

## Conjunctive Management of Surface Water & Groundwater

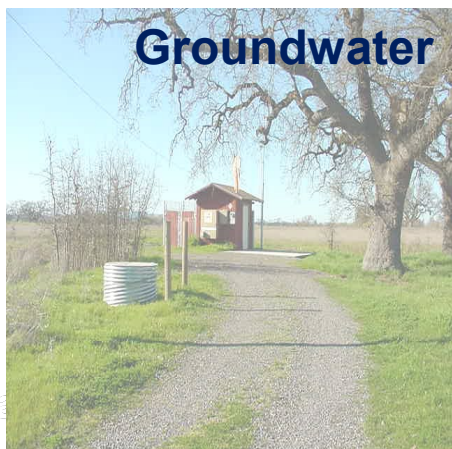
Marcus Trotta

*Principal Hydrogeologist*

Susan Haydon

*Project Specialist*

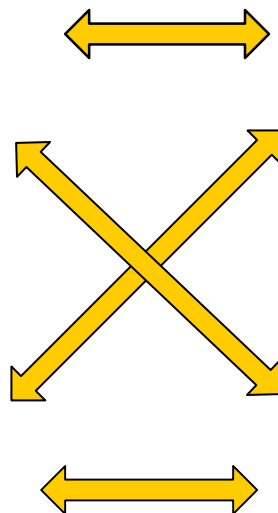
# Integrated Water Resource Management Strategies



**Balance**



**Maximize**



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# Integrated Water Resource Management Programs: **Recycled Water**

Wendy Gjestland  
*Water Agency Principal Engineer*

## **Recycled Water – Now and in the Future**



# Airport/Larkfield/Wikiup Sanitation Zone

## Today

- Non-discharge facility
- Secondary and Tertiary treatment
- Usage summary
- Agreements

## Future

- Full tertiary treatment
- Trucking Program
- Completion of Wastewater System Facilities Plan
- Closer partnerships
- Expansion of recycled water



# Sonoma Valley County Sanitation District

## Today

- **Users and Usage**
- **Current pay structure**
- **Partnership with NBWRA**
- **SGMA and decline in groundwater levels**

## Future

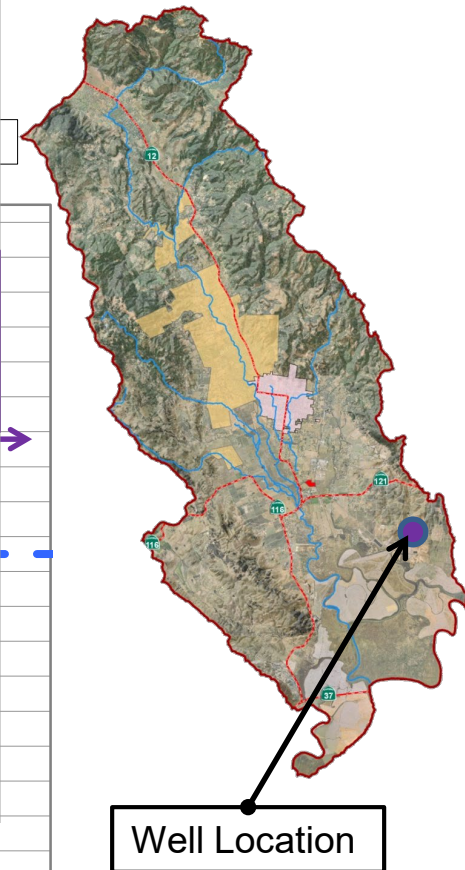
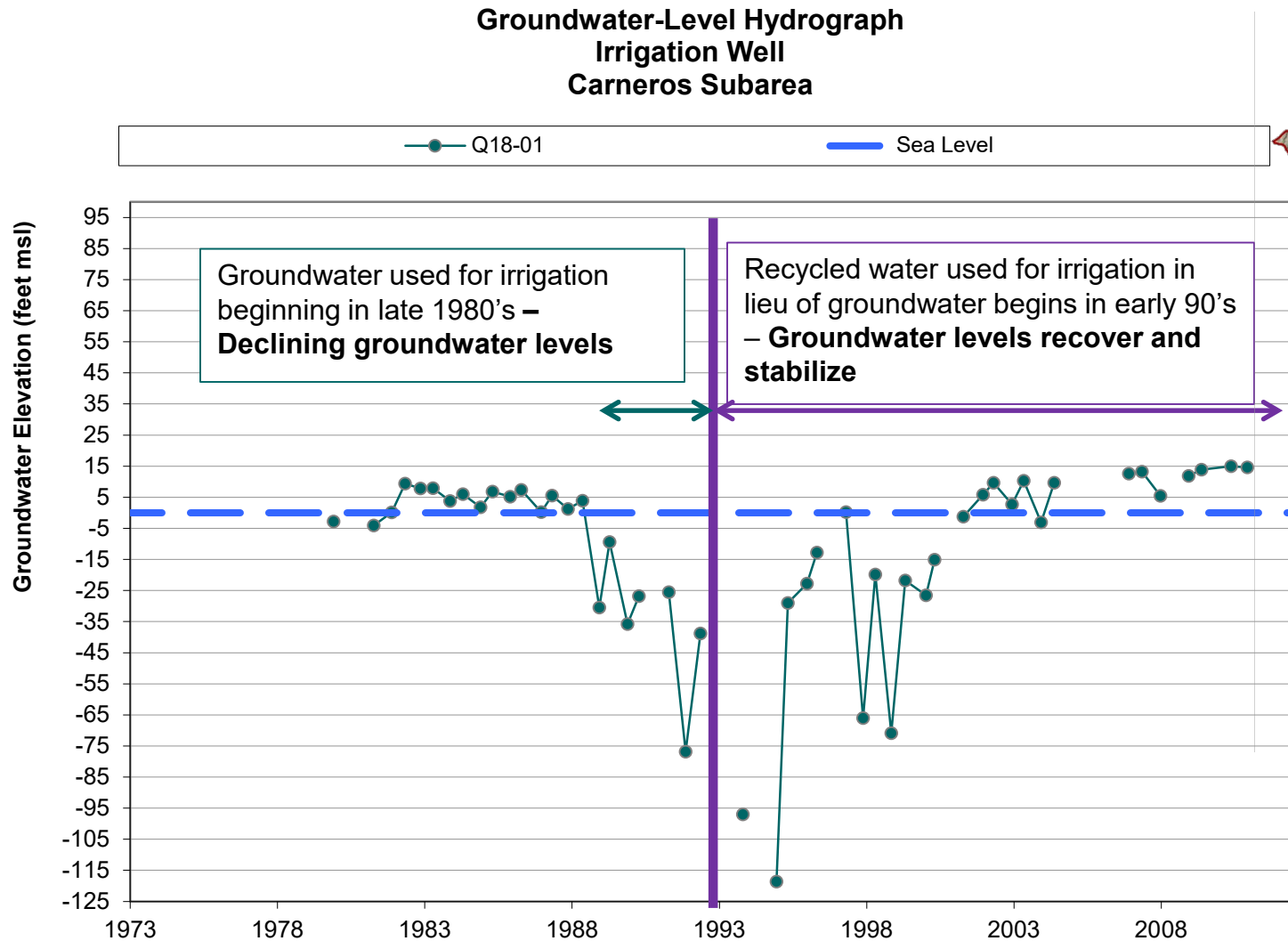
- **RW Plan completion in 2018**
- **New rate structure with all new agreements and timeframe**
- **First project to serve residential users**



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# Irrigation with Recycled Water Offsets Groundwater Pumping



# North Bay Water Reuse Authority

## Phase 1 Achievements

- **Phase 1: \$104M, 75% Complete**
- **3,800 AFY for irrigation**
- **1,700 AFY for habitat**
- **46 miles of pipeline**
- **100 AF storage capacity**
- **American Recovery and Reinvestment Act - \$7.33M**
- **Title XVI Funding - \$17.7M**
- **Prop 84 Bay Area IRWMP Funding over \$6 million**
- **Local cost share – \$73 million**





# Integrated Water Resource Management Programs: Conservation and Demand Management

Greg Plumb

*Senior Programs Specialist*

*Water Use Efficiency*



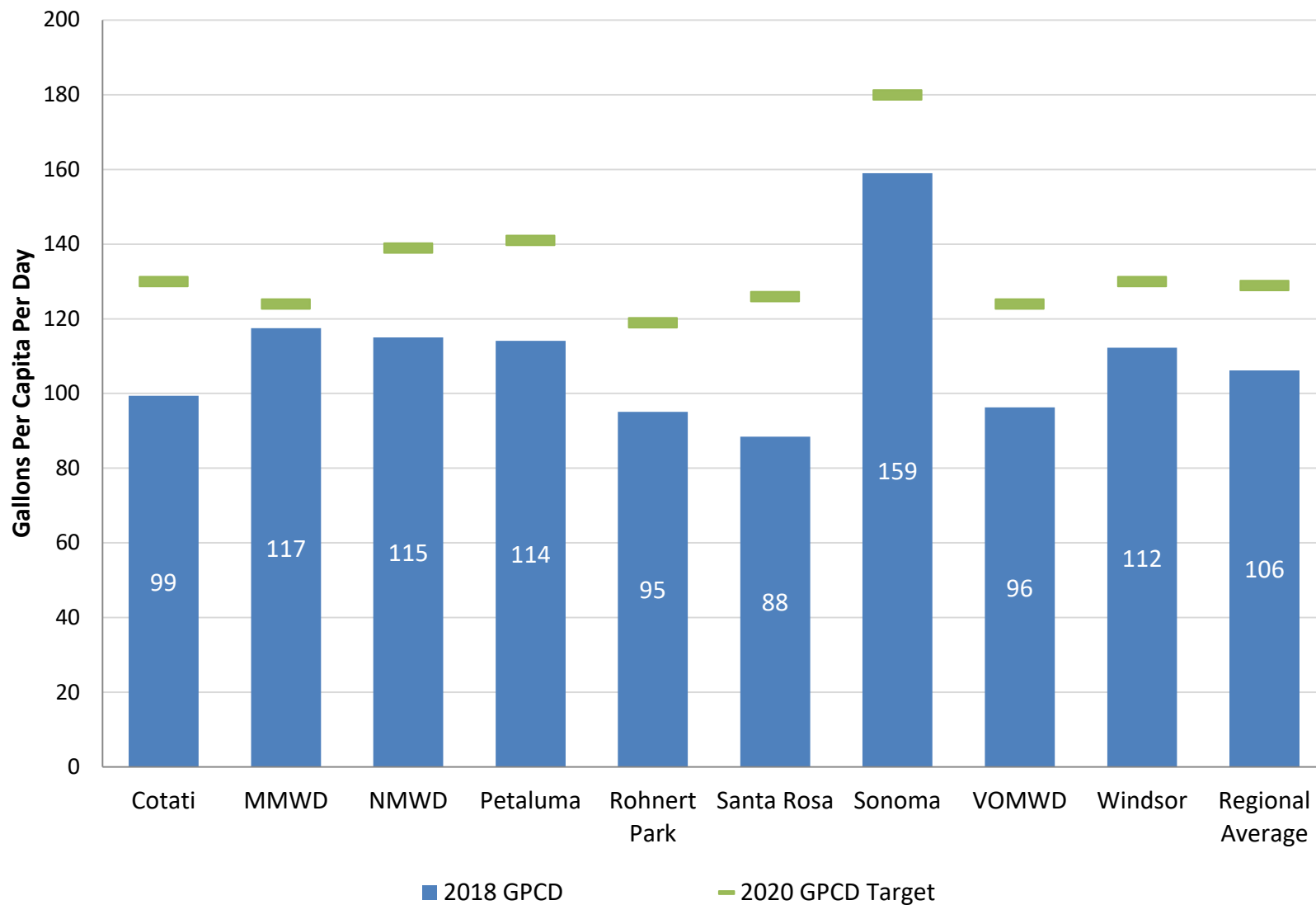


# Demand Management

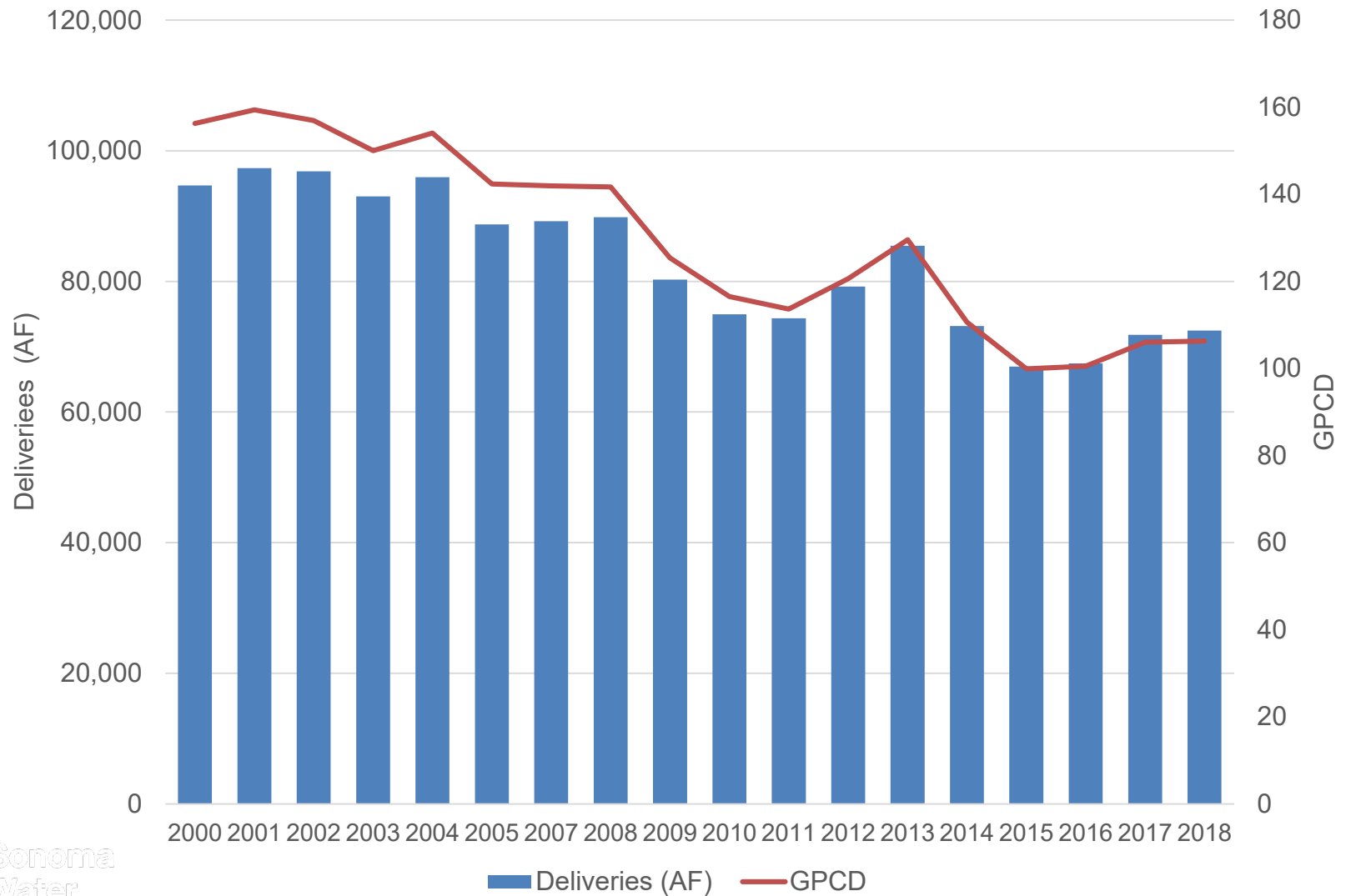
- **Sonoma-Marín Saving Water Partnership**
  - Formed to maximize cost effectiveness of water conservation and identify water-use efficiency programs
  - Regional and coordinated approach
  - Qualified Water Efficient Landscaper
- **Urban Water Management Plan**
  - Every 5 years plan developed with 20 year planning horizon to evaluate water supply, water demands & drought planning



# 2018 GPCD and 20 x 2020 Goals



# Total Potable Deliveries and GPCD



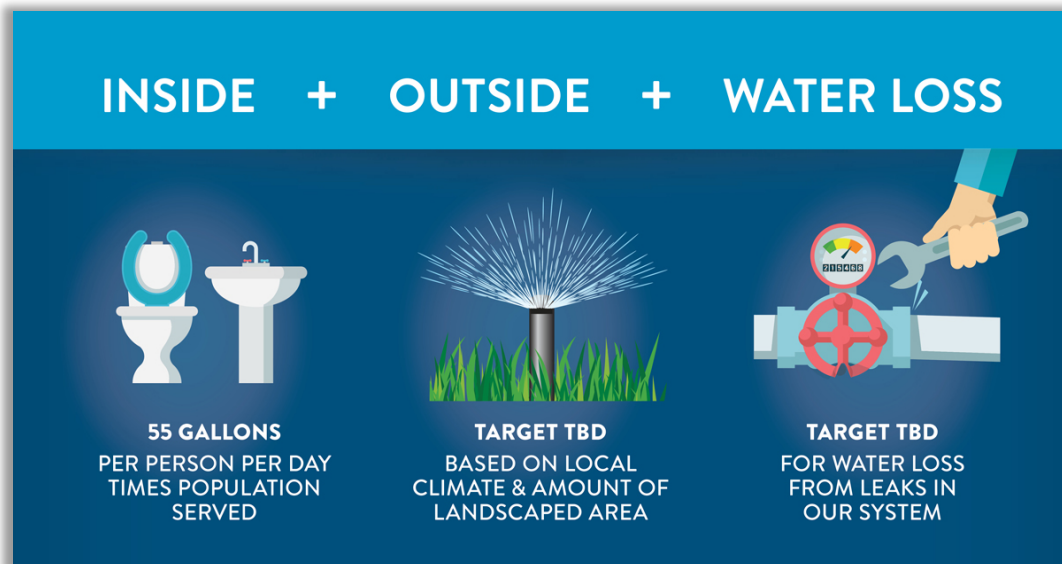
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# Making Conservation a California Way of Life

## Four Primary Goals:

1. Use water wisely with water budget-based targets
2. Eliminate water waste
3. Strengthen local drought resilience
4. Improve agricultural water use efficiency & drought planning



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# Integrated Water Resource Management Programs: Conjunctive Management of Surface Water & Groundwater

Marcus Trotta

*Principal Hydrogeologist*

Susan Haydon

*Project Specialist*



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# Balancing Surface and Groundwater Management

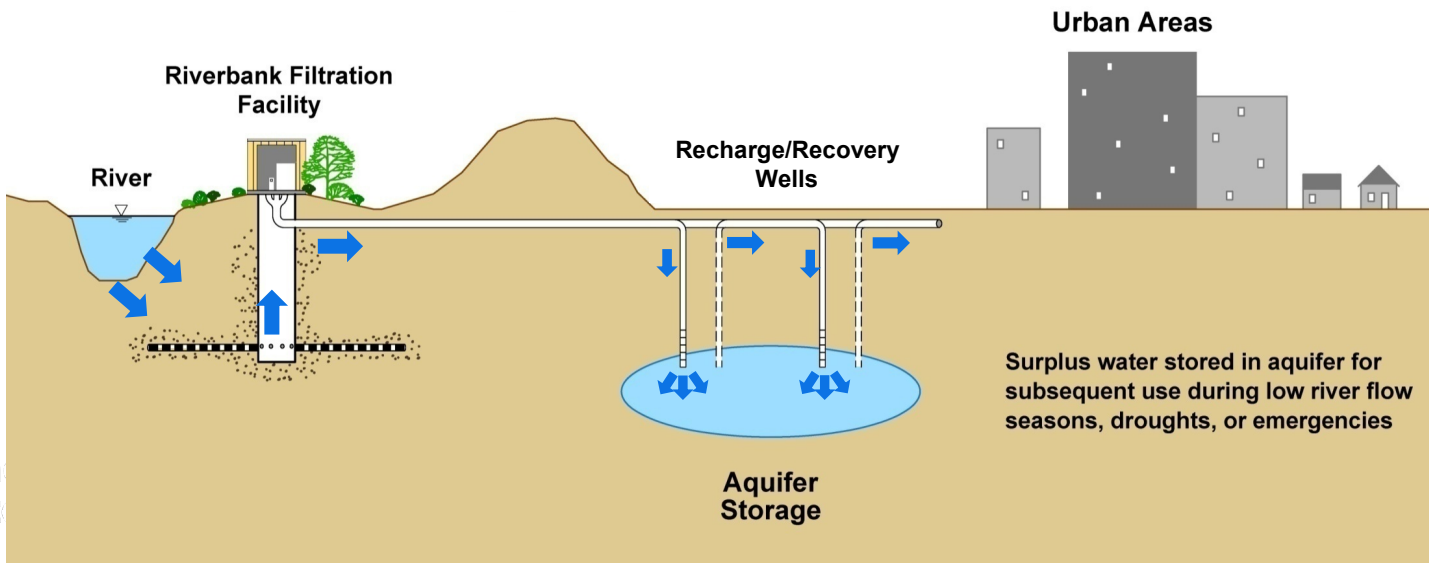
**Conjunctive use:** Coordinated use of surface water & groundwater to increase reliability

- Two types of conjunctive management recharge:
  - **Aquifer storage** via recharge wells
  - **Stormwater Recharge** via surface infiltration
- Multi-benefit approach addresses local needs & resource concerns



# Aquifer Storage & Recovery: City of Sonoma Pilot Study

- **Assess** aquifer and well capacity for recharge and recovery
- **Evaluate** water quality during and following testing
- **Gather** data to assess feasibility of full-scale systems
- **Test** viability in incremental steps and costs



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# Pilot Study Preliminary Findings

## Findings

- Aquifer has capacity for storage & recovery
- Water quality remained high & very little evidence of well or aquifer clogging
- Short-term water quality changes can be monitored & tracked

## Next Steps:

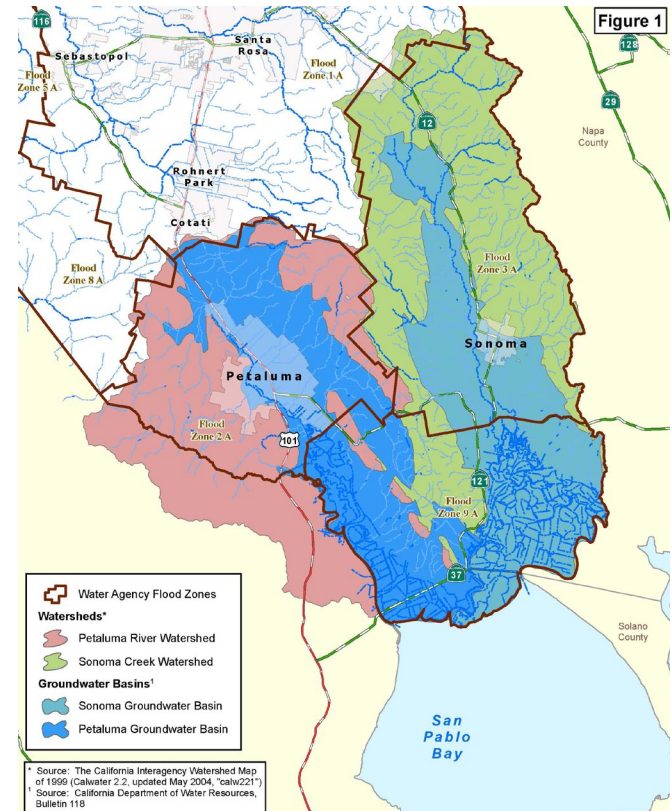
- Additional evaluation of pilot test results.
- Further assess feasibility of potential for full-scale programs
- Assess potential for additional pilot studies in other areas



# Storm Water Resource Plans

Storm water is a resource rather than a nuisance

- Stormwater resource plans:
  - Improve water quality
  - Reduce localized flooding
  - Increase water supplies
- Plan and implement multi-benefit storm water projects
- State funding leverages local investment



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**SWGRP**  
STORM WATER GRANT PROGRAM



# Project Concepts – Multi-Benefit Approach



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# Stormwater Infiltration Opportunities

- **Areas of opportunity**
  - Alexander Valley Basin
  - Laguna Mark West Watershed and SR Plain Groundwater Basin
  - Sonoma Creek Watershed, and Sonoma Valley Groundwater Basin
  - Upper Petaluma River Watershed, Petaluma Valley Groundwater Basin
- **Feasibility studies and partnerships continuing, pursuing funding**





# Climate Risk Resiliency Programs

## Climate Adaptation Plan

Dale Roberts

*Water Agency Principal Engineer*

## FIRO

Chris Delaney

*Water Agency Engineer*

## Wildfire Response

Anne Crealock

*Sr. Environmental Specialist*

## Riverbank Operations

Don Seymour

*Water Agency Principal Engineer*

## Sonoma One Rain Network & AQPI

Jake Spalding

*Grants and Funded Projects Manager*



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# Climate Risk Resiliency: Climate Adaptation Plan

Dale Roberts  
*Water Agency Principal Engineer*



**The Climate Adaptation Plan**  
is an initiative to promote  
resiliency for Sonoma Water's  
facilities & operations in an  
increasingly variable climate



# Climate Adaptation Plan – Key Elements

- Latest Climate Science
- Adaptation Implementation Strategy
- Monitoring and Update Strategy
- Funding Strategy
- Regional Partnership and Leadership Strategy
- Public Awareness and Outreach Strategy



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## Hazard Understanding and Mapping

# Projected Climatic & Hydrologic Changes for the Region



### Temperature

- Increases up to 1.3 – 3.1°C by mid-century
- Increased frequency of temperature extremes (days > 30°C or 86°F)



### Sea Level Rise

- MSL increases by 0.1-0.6 m (0.3-2 ft) by mid-century
- Storm surge will cause additional increases



### Precipitation

- Extreme precipitation increases (ARs) by 15%
- Increased winter, decreased summer precipitation (more variability)



### Drought

- Increasing intensity of drought conditions
- Increasing frequency and duration of dry weather conditions



### Wildfire

- More frequent and intense wildfires due to warmer temperatures and drier conditions
- Increase in probability of wildfires by 15-33%



### River Flooding

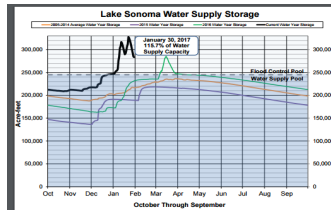
- Potential increase in AR-driven floods on Russian River
- 100-year flood magnitudes could increase by 10-20%



# How we will use Climate Adaption Plan



Asset Level  
Adaptations



System Level  
Adaptations



Operational and  
Management Policies



Regional  
Partnerships

## Prioritize:

- Early, Low Regret Actions
- Long Term, Robust Actions
- Long Term, Contingent Actions



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# Climate Risk Resiliency: Forecast Informed Reservoir Operations (FIRO)

Chris Delaney  
*Water Agency Engineer*

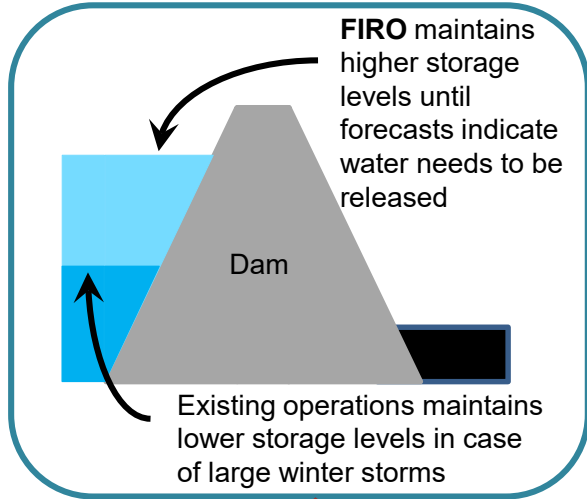


**Forecast Informed  
Reservoir Operations  
(FIRO)** is the innovative use  
of science & technology to  
improve water supply,  
environmental flows, & flood  
management



# Concept of FIRO

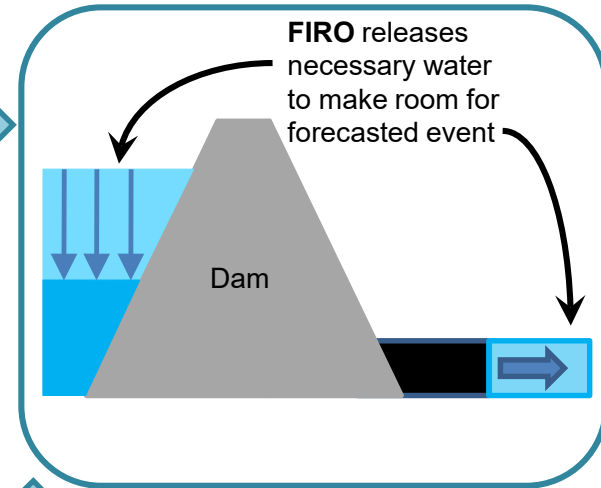
## Pre-Storm Event



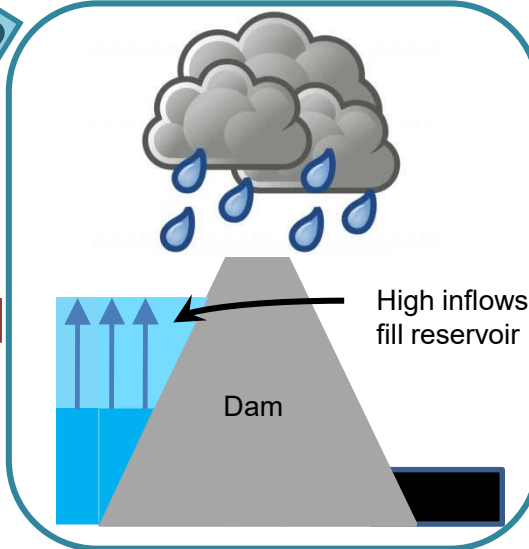
## Forecasted Storm



## FIRO Pre-Release Before Storm



## Storm Event



## Existing Operations Release



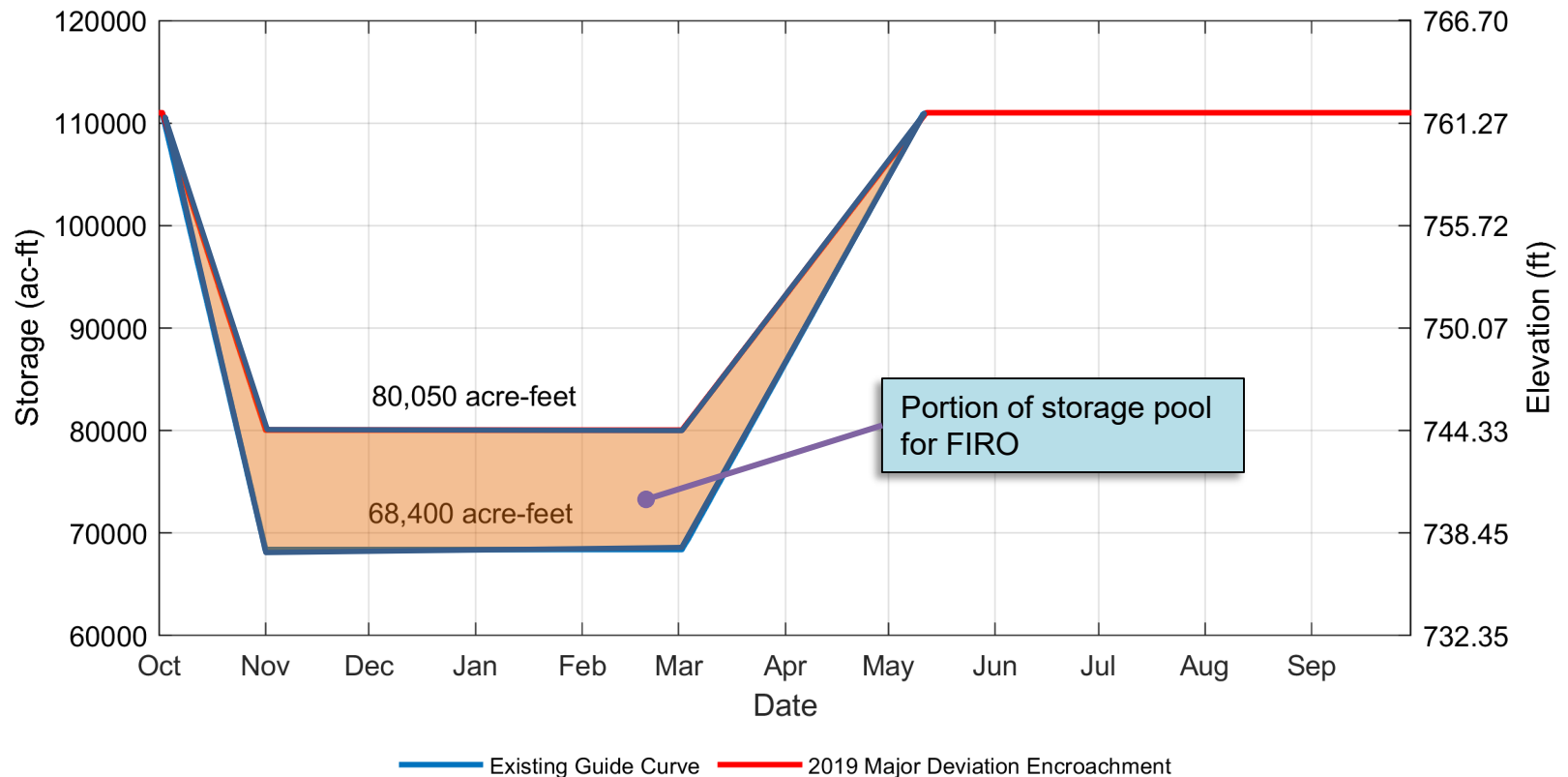
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# 2019 Major Deviation

## Major Deviation to Water Control Manual

- Approved by USACE in November 2018 for 2018/2019 winter and spring season



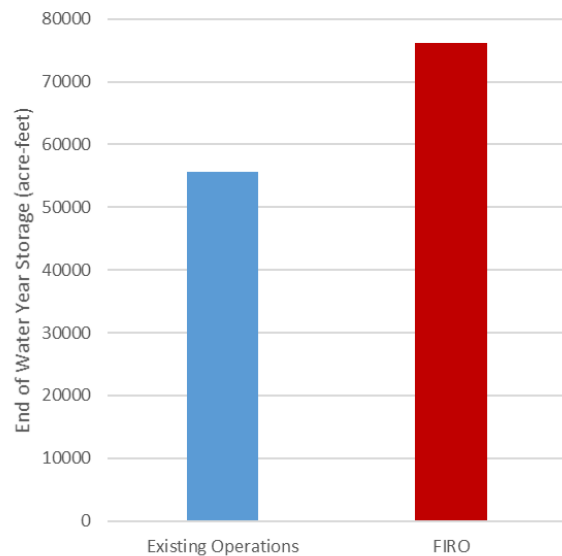
# Lake Mendocino

## Improved Reservoir Performance

### Hindcast Simulation 1985-2010

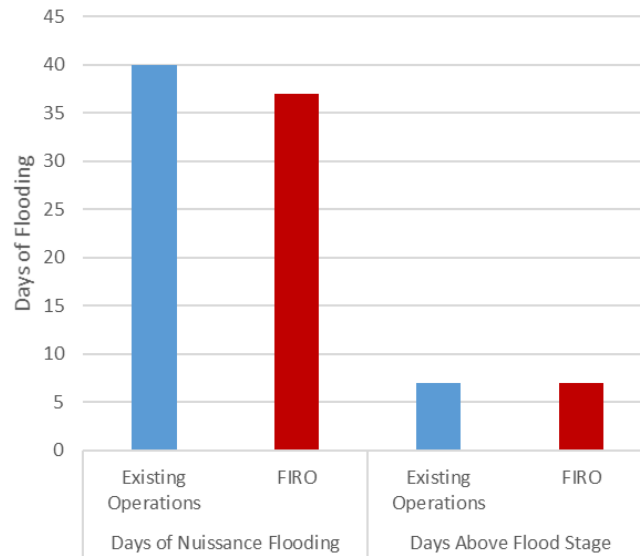
**Year End Water Storage**

Median End of Water Year Storage (Sep 30)  
Hindcast Simulation 1985 - 2010



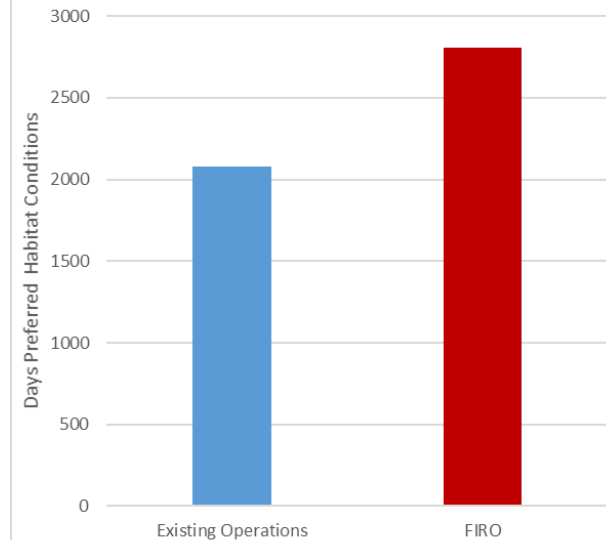
**Number Days Flooding**

Simulated Hopland Flooding  
Hindcast Simulation 1985-2010



**Number Days Ecologically Beneficial Summer River Flows**

Days from June to September  
Above Biological Opinion Flows (125 cfs)  
Hindcast Simulation 1985 - 2010



**Blue** = Existing Operations **Red** = Forecast Informed Reservoir Operations



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# Lake Mendocino FIRO: Next Steps

- **2020 Major Deviation**
- **Final Viability Assessment**
  - Which FIRO strategy should be implemented?
  - How can the Water Control Plan be automatically updated to leverage new forecast skill & technology advances?
  - Water Control Manual Update



# Climate Risk Resiliency: Wildfire

## Wildfire Resiliency

Multiple actions to characterize impacts of wildfires on Sonoma Water's operations & implement measures to improve resiliency against threats from future wildfires

Anne Crealock  
*Senior Environmental Specialist*

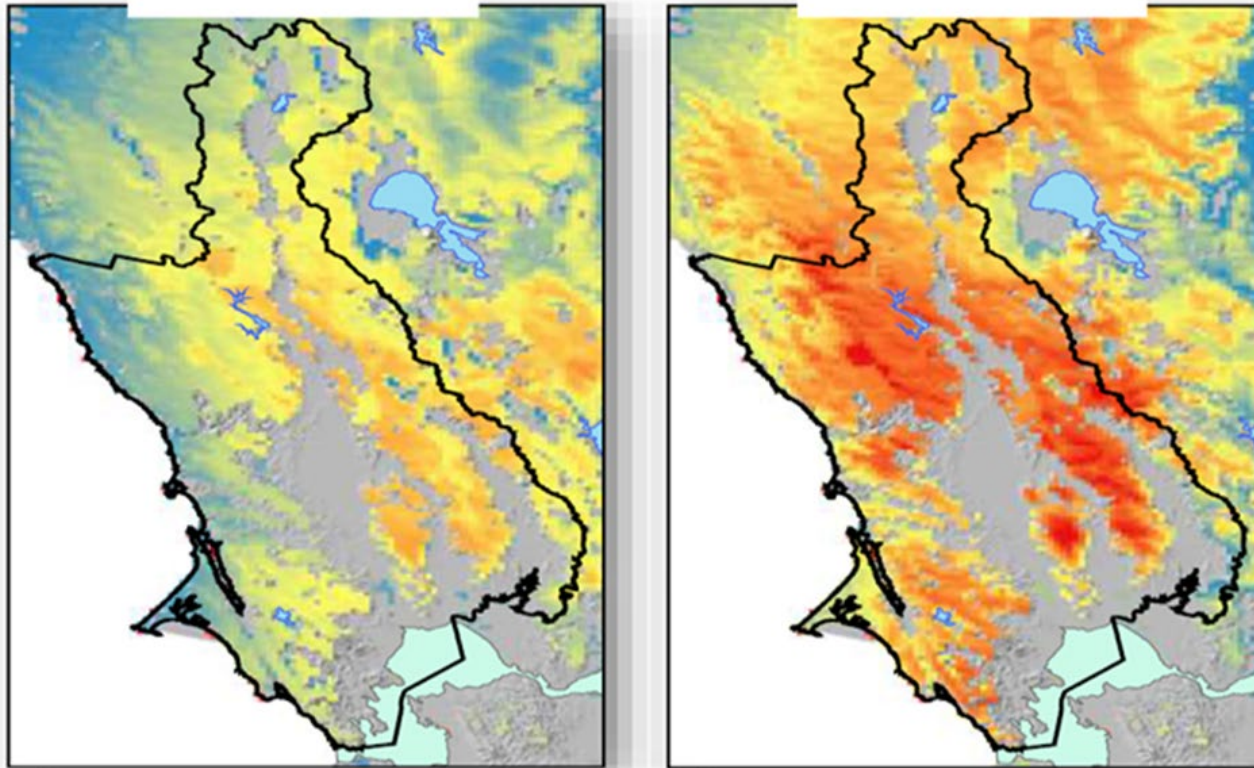


# Adapting to Increasing Wildfire Risk

## Probability of Burning Two or More Times

1970-2000

2070-2100



**Probability**



Source: North Bay Climate Ready Natural Resource Managers User Group Meeting, August 26, 2014)



# Climate Risk Resiliency: Wildfire

- Reducing wildfire risk is key to protecting region's water supply
- The Lake Sonoma watershed can serve as a model for promoting landscape-scale resilience



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# Fire Camera Alert System

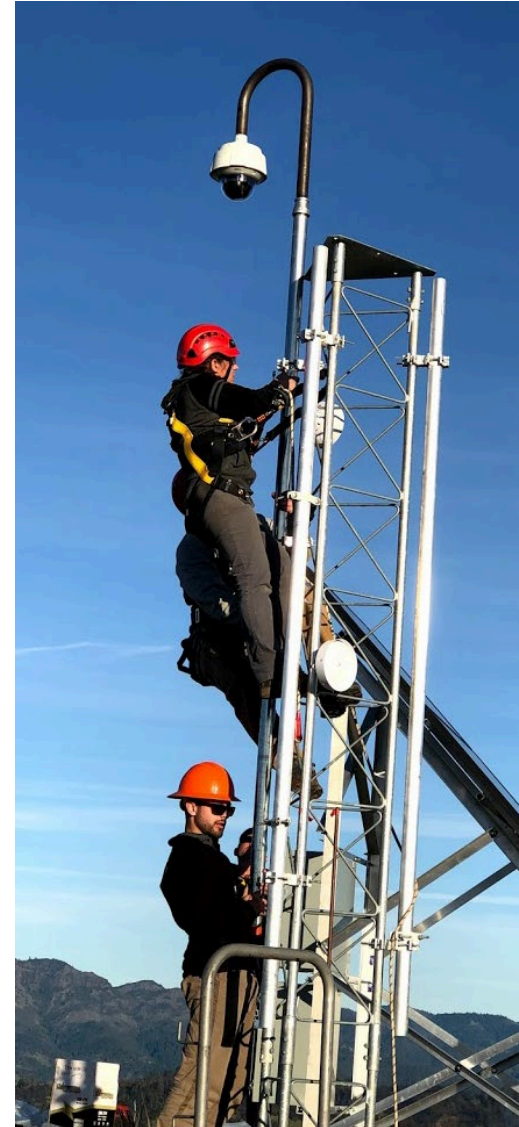
## High-Definition cameras help firefighters and emergency responders

- Collaboration between Sonoma Water, universities, and several partners
- Focus on protecting the Lake Sonoma Watershed and surrounding areas
- Sonoma Water installed eight cameras
- PG&E funded additional cameras to build North Bay network
- Monitored by local public safety agencies and public

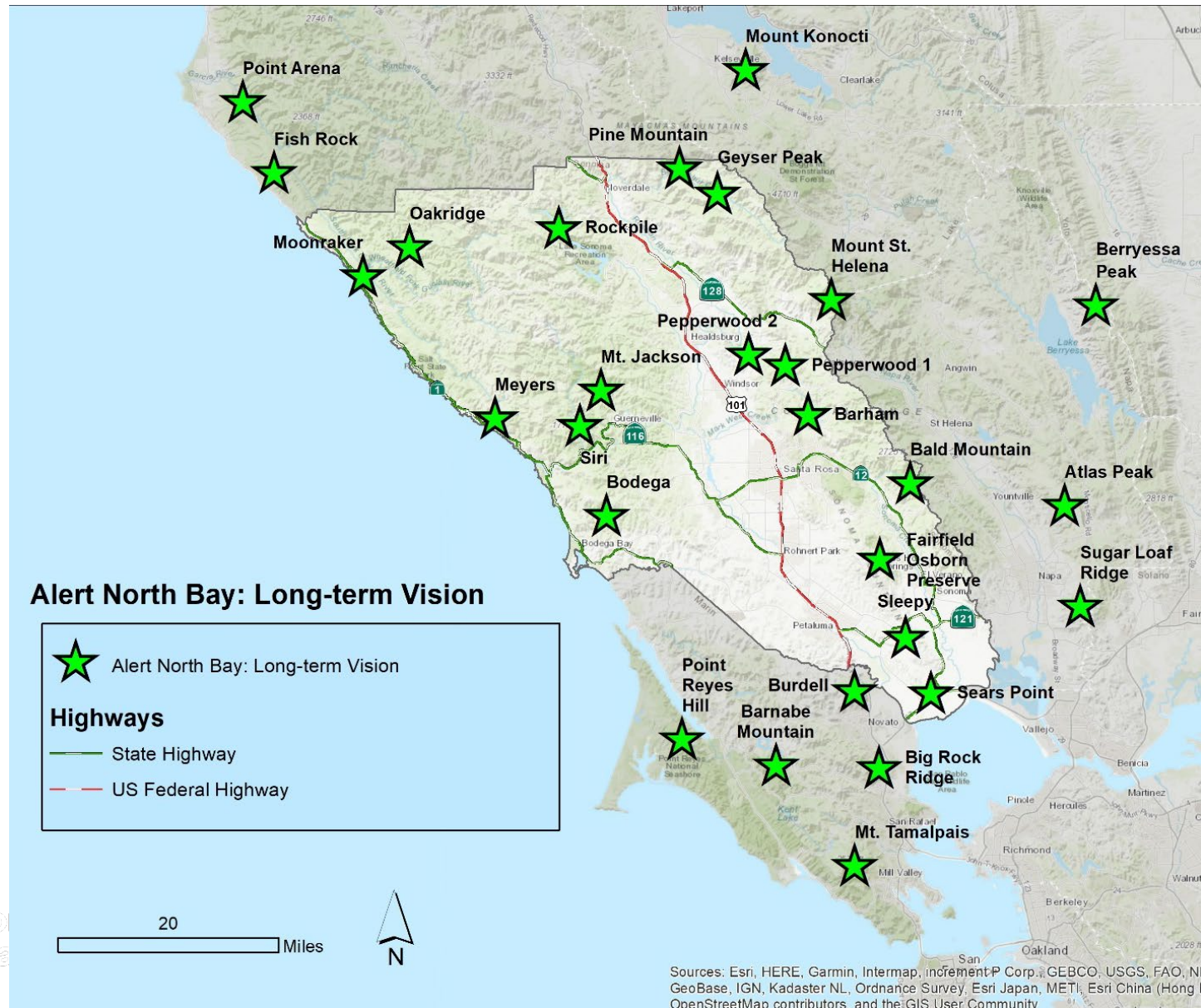
[www.alertwildfire.org/northbay](http://www.alertwildfire.org/northbay)



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# Fire Camera Alert System

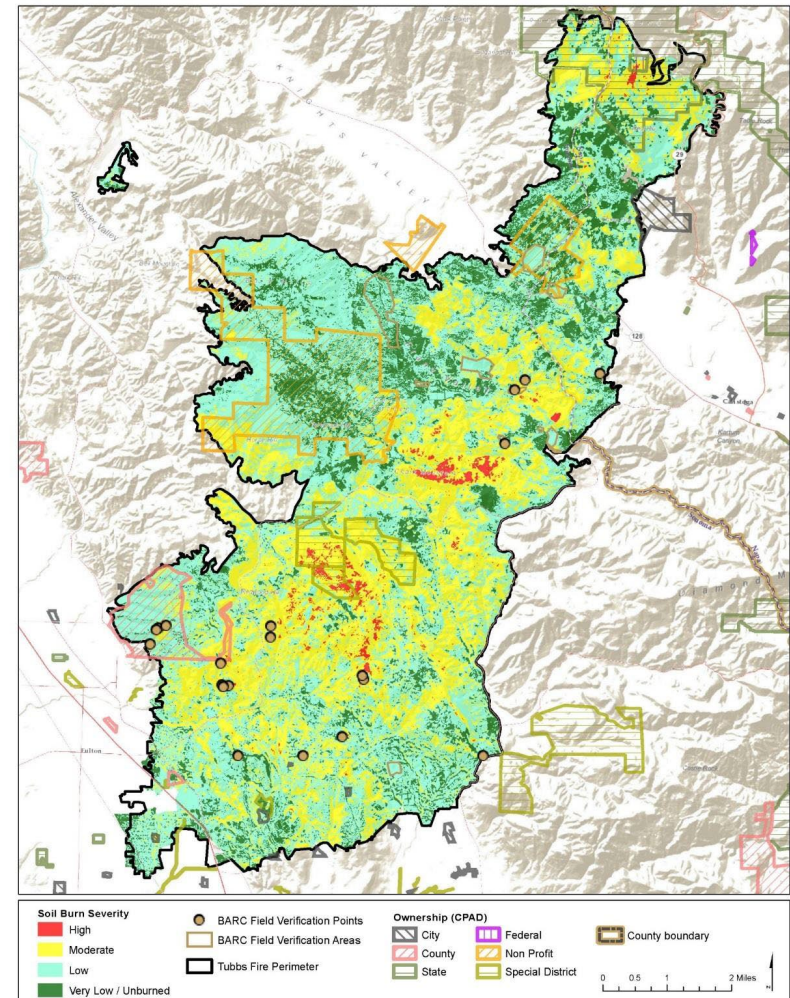




# Post Burn Soil Properties & Hazards

## Increased Flood Risk

- Fires reduced ground cover & canopy, burned soils
- Reduced infiltration rates & increase sediment yield
- Research results to be used for hazard modeling & assessments
- Potential for increase in floods & debris flows
- Research shows infiltration rates returning to pre-burn conditions





# Post-Fire Surface Water Quality Monitoring Program

- **Continuation of a collaborative research project at Russian River production facilities ongoing since 2008**
  - Sonoma Water
  - Lawrence Berkeley National Lab
  - USGS
  - CA Water Science Center
  - Subsurface Microbiology Lab



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# Water Quality Sampling Locations

## Baseline Sampling in October 2017

- Collected samples at 10 locations prior to first post-fire storm runoff event

## Wet Season Storm Event Sampling

- Collected samples following storm events
- 2018 – 11 locations
- 2019 – 12 locations

## Dry Season Sampling

- Collected samples on a monthly basis at 5 locations on the Russian River and Dry Creek



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# FireSmart Lake Sonoma

- 83,000-acre watershed, mostly private land
- Runoff fills our largest water supply reservoir
- Fire represents major threat to water supply
- Hosted workshops and home/property site visits
- Many local partners; fire districts, NGOs, Tribes, Army Corps, landowners
- Grant funding from PG&E

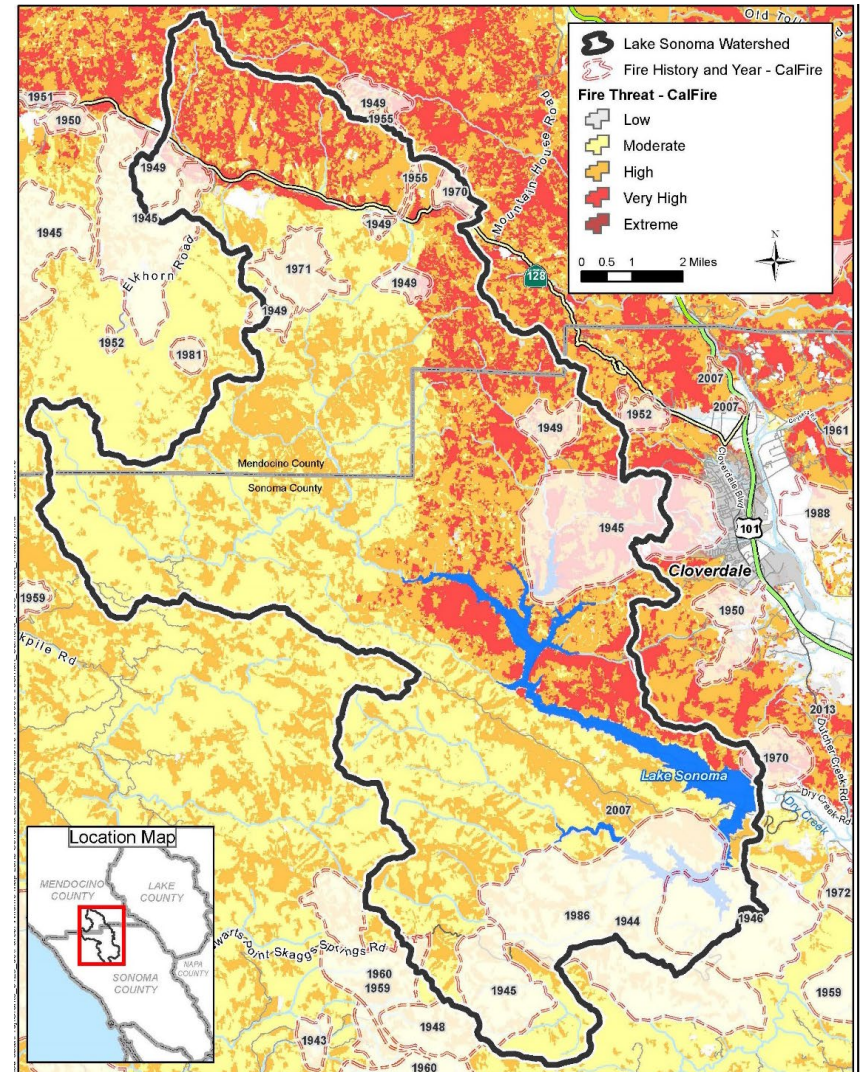


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# FireSmart Lake Sonoma

- **Goal:** Develop strategic recommendations for fire risk reduction to protect homes, forest health, and source water
- **Challenge:** Work with partners and landowners in the watershed to reduce the risk of catastrophic wildfire and protect our water supply



# What did we learn, what's next

## Lessons:

- Landowners need help - we have a lot of shared goals
- Many land management options and resources available
- Importance of collaboration

## Next Steps:

- \$540k in CAL FIRE funding
- Community Wildfire Protection Plans
- Roadside fuel management
- Home inspections
- Education/outreach
- Defensible space projects



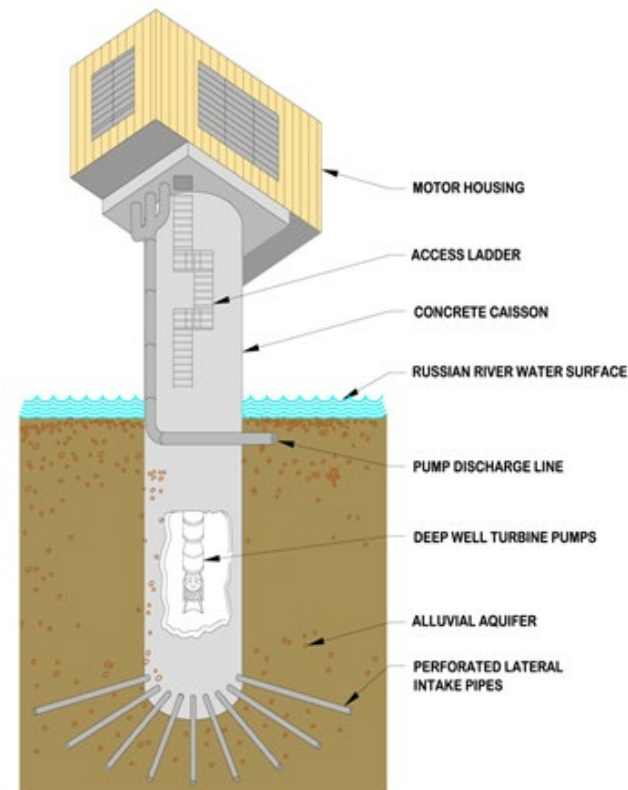
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# Climate Risk Resiliency: Riverbank Filtration Research Program

Don Seymour  
*Water Agency Principal Engineer*

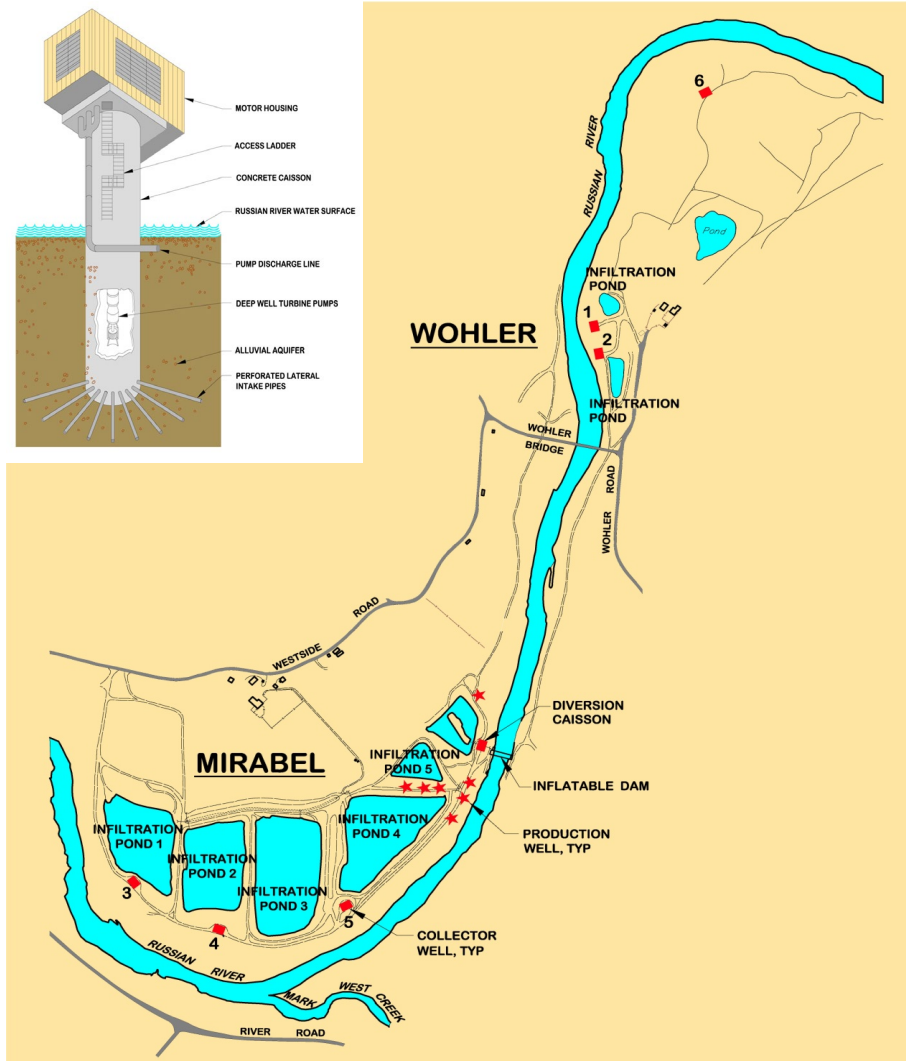
**Riverbank Filtration Research Program** – Research investments have resulted in improved understanding of how our facilities provide high quality water & how to make them more resilient moving forward





# A Unique System: Russian River Riverbank Filtration System

- One of the largest riverbank filtration systems in the world
- Treatment accomplished via natural filtration
- Production Capacity of up to 92 million gallons per day
- 6 Radial Collector Wells
- 5 Infiltration Ponds
- Inflatable Dam



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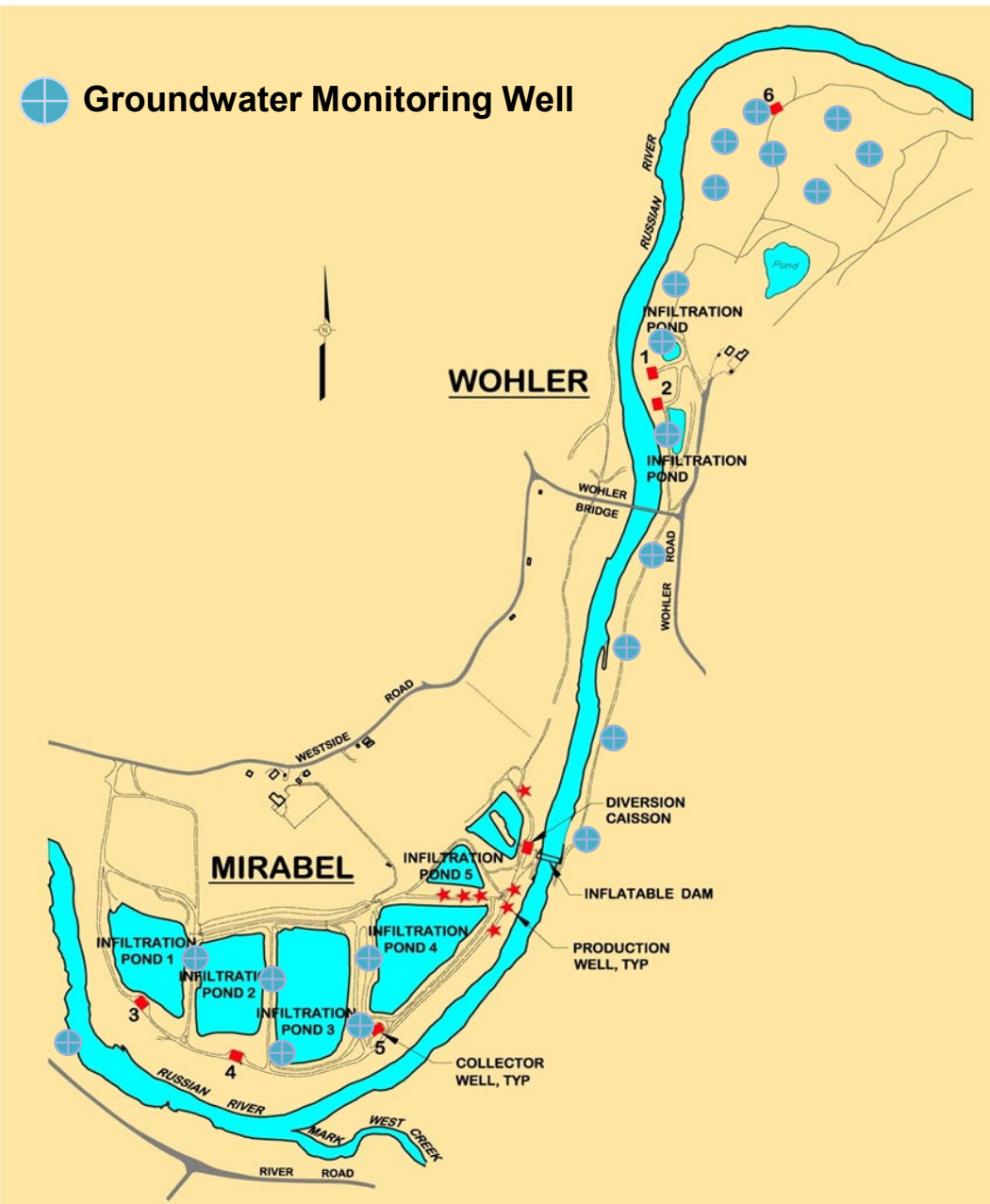
# Research Motivations

- **Sonoma Water's Riverbank Filtration facilities have been shown to be a reliable method of providing high quality potable water from the Russian River since the late 1950s**
- **Monitor facility and environmental parameters to ensure continued performance of collector wells**
- **Conduct studies/research to enhance knowledge:**
  - Surface water & groundwater interactions
  - Natural filtration processes
- **Research and data needed to continue demonstrating the effectiveness of natural filtration processes in meeting regulatory requirements for water quality**



# Wohler/Mirabel Monitoring Well Network

- 19 Permanent Monitoring Wells
- Equipped with instrumentation that measures and records hourly water level and temperature data
- Monitoring program has been in place for nearly two decades





# Use of Methods to Evaluate Surface Water/Groundwater Interactions & Streambed Permeability

- Develop geophysical methods to better characterize surface water/groundwater interactions near RBF facilities
- Quantify permeability spatially & temporally in response to:
  - Inflatable Dam operation
  - Pumping schedule
  - Season

Methods	Information Acquired
<b>Seepage Meter</b>	Vertical flow rates
<b>Soil Cryocore</b>	Grain size diameter & microbial ecology
<b>Sediment Trap</b>	Abiotic & biotic media



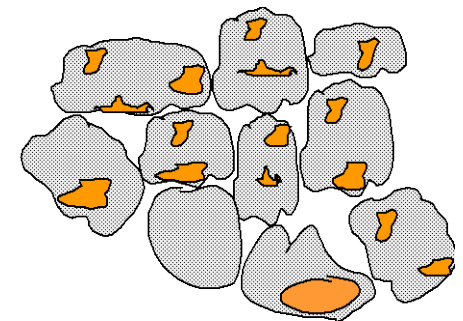
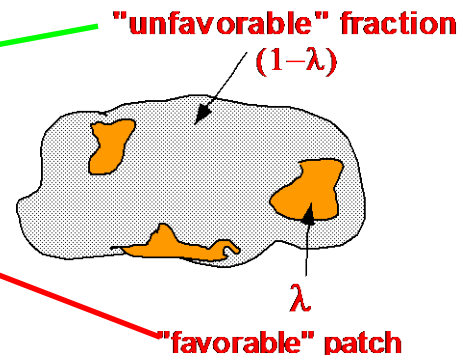
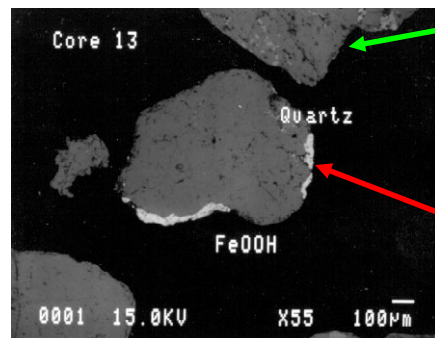
# Water Quality Study Findings

## Results of in-situ & laboratory studies

- High capacity for cryptosporidium removal in shallow sediments
- ~1 to 7 log removal/meter

## Key factors promoting favorable cryptosporidium removal

- Grain size distribution - poorly sorted
- Metal oxides – High concentration of iron & aluminum oxides
- Low concentrations of dissolved organic matter in surface water & groundwater



**Chemically heterogeneous porous medium**



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# Ongoing & Next Steps

- Update Numerical Model with new data and jointly analyze geophysical and hydrologic data
- Perform sensitivity analysis to help optimize collector well operations and prioritize future data collection and monitoring
- Conduct additional studies on role of organic carbon in pathogen transport and removal
- Continue to assess potential effects from 2017 Wildfires





# Climate Risk Resiliency: Sonoma OneRain Network & AQPI

Jake Spaulding  
*Grants and Funded Projects Manager*



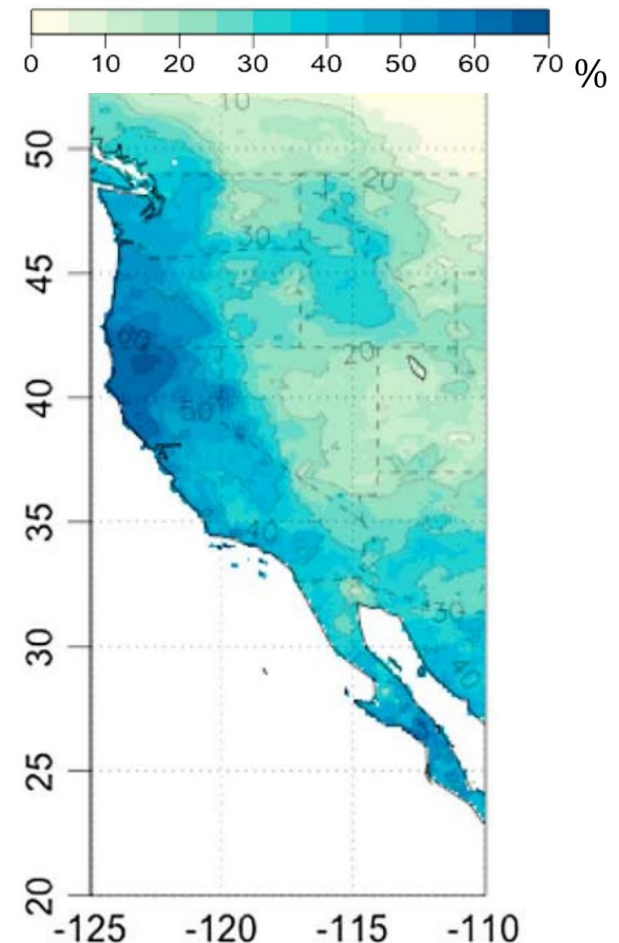
**OneRain** and **AQPI** are programs to enhance early warning systems for public safety & resource management to respond to extreme precipitation events



# Sonoma OneRain & Advanced Quantitative Precipitation Information (AQPI) System

- **Importance of atmospheric rivers on water supply & public safety (flooding)**
- **OneRain Network provides critical rainfall data for forecast models, AQPI system**
- **AQPI Regional Partnership**
  - \$19.8 million grant from DWR
- **AQPI is aimed at**
  - Improving radar coverage
  - Assimilating radar in forecast models
  - Improving AR forecast skills and operations

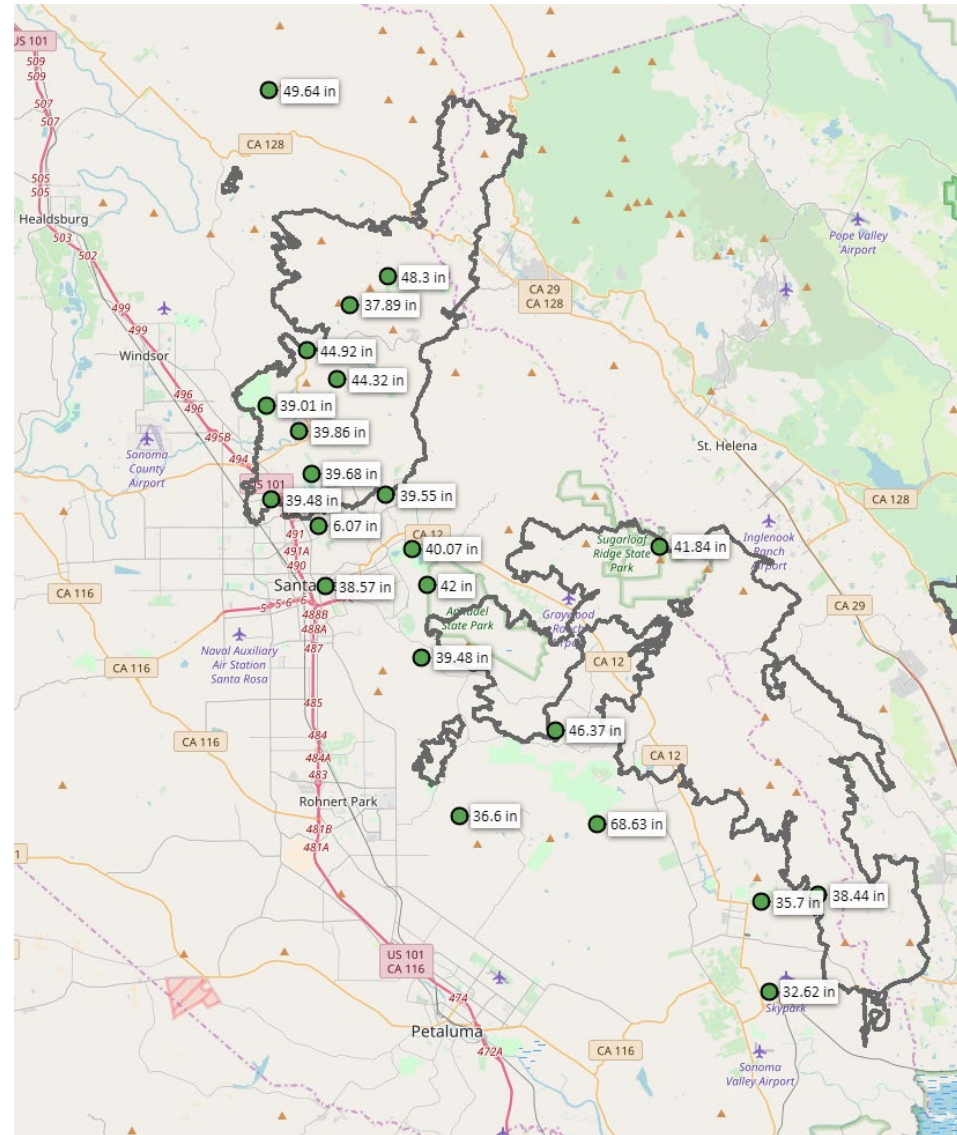
Contribution (%) of ARs to total annual precipitation (1950-2013)



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# OneRain System – In Response to 2017 Fires

- Informs National Weather Service on Watch & Warning Notifications
- Supports planning, hydrologic, and water balance models
- Improves AQPI forecast models
- Real-time data with alert capabilities

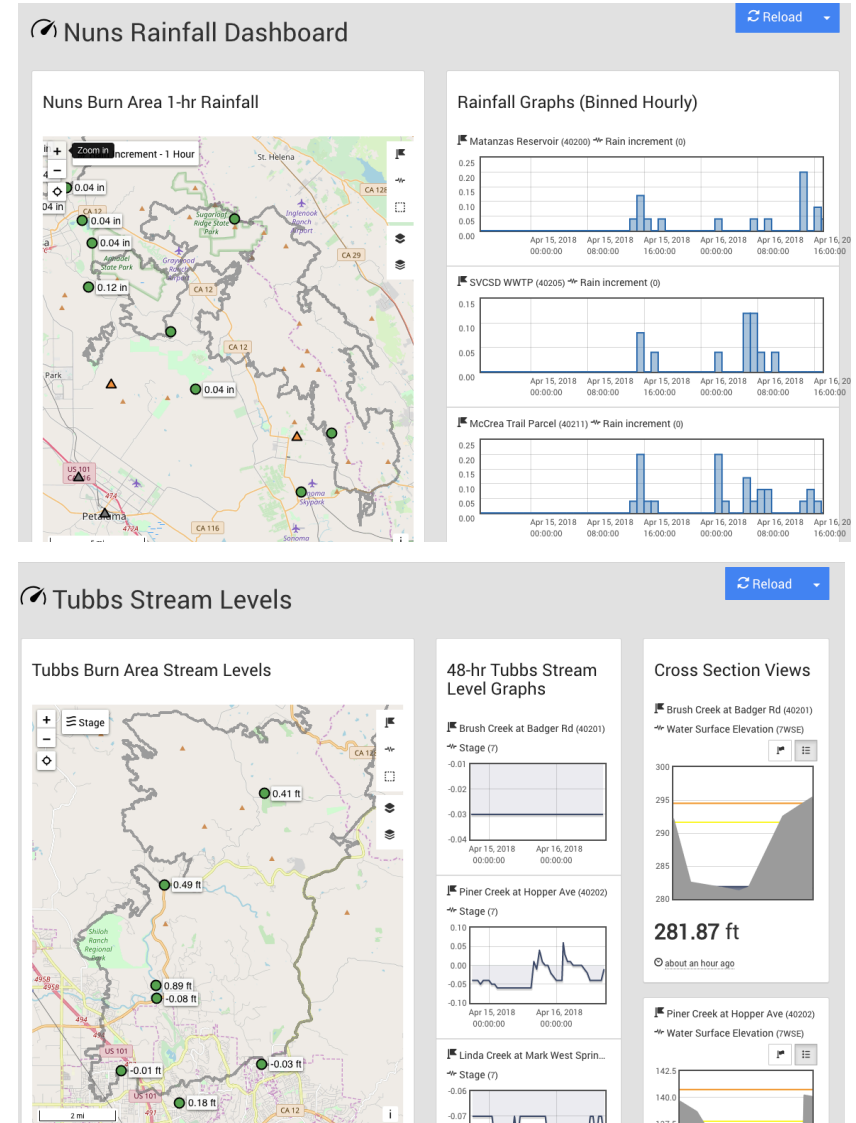




# Public Engagement: Situational Awareness

- Outreach to vulnerable at-risk communities
- Public access to Web portal
- Text & Email alarm notification capabilities
- Over **2.3 million** views to date

<https://Sonoma.onerain.com>



# AQPI Instrument Deployments

## Radars

X-Band (4)

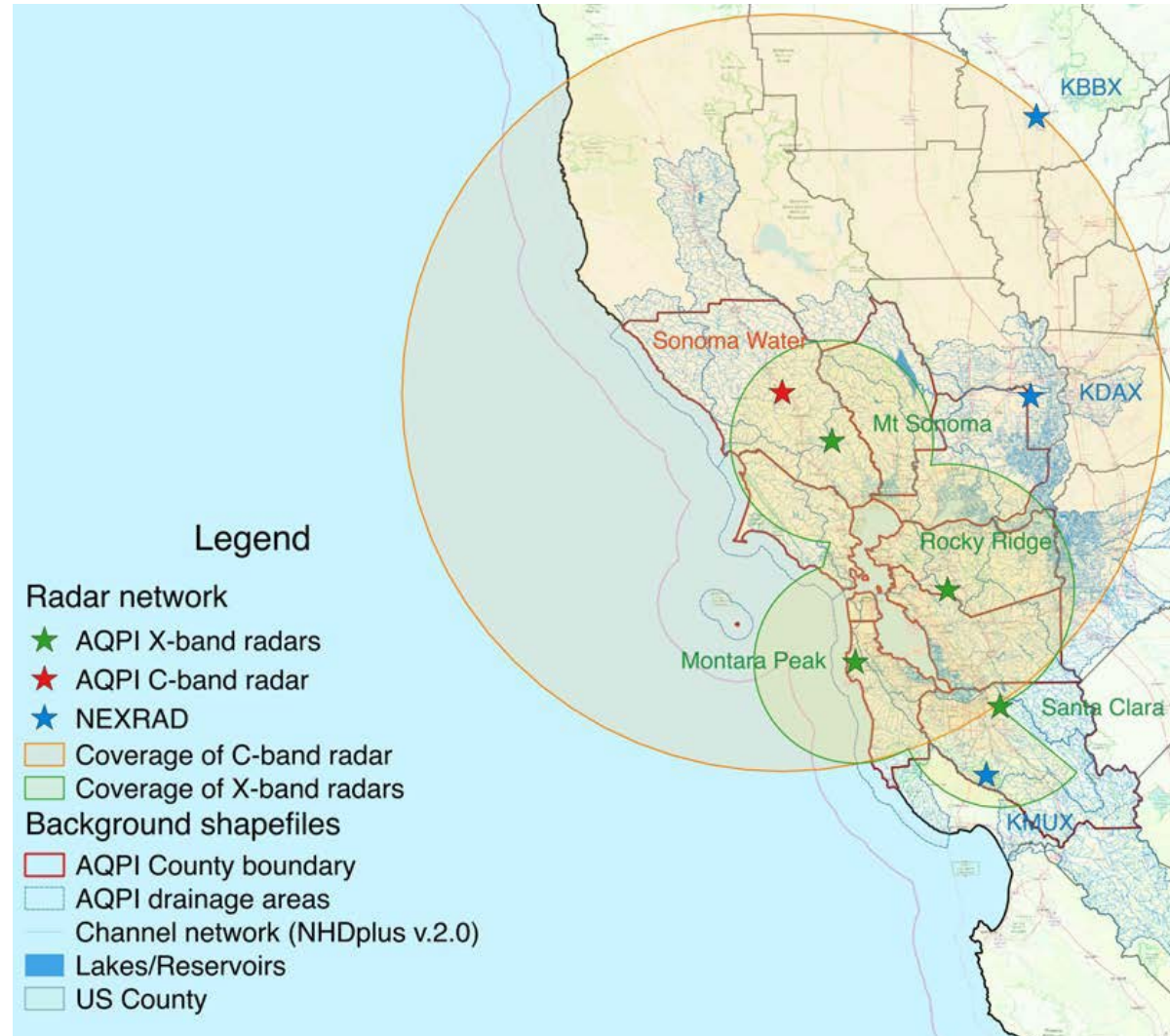


C-Band (1)



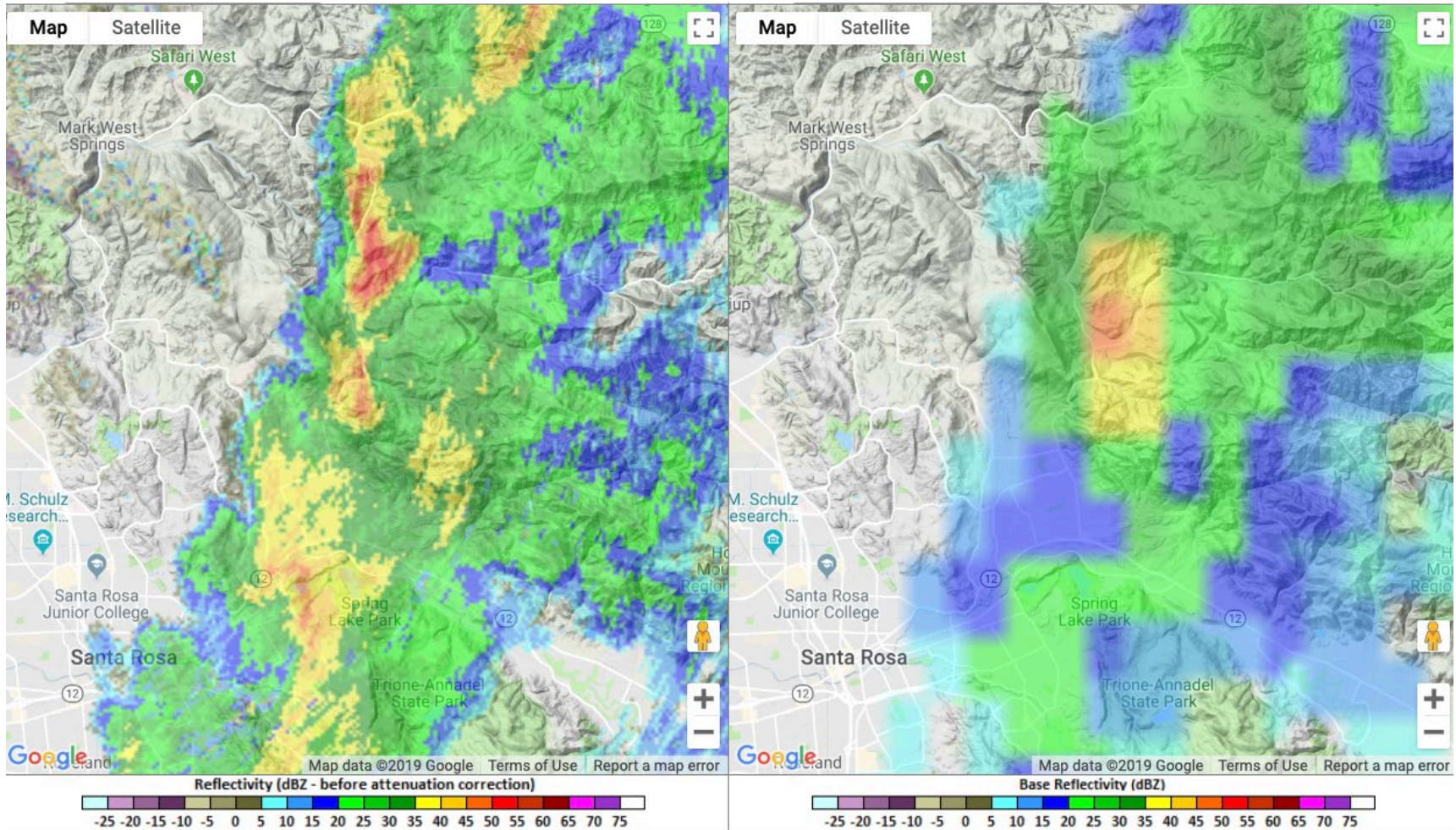
## Surface stations

- Rain gauges
- Surface meteorology
- Soil moisture
- Stream gauges





# AQPI Benefits - Radar Comparison



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# Seismic Hazard Resiliency Program

Kent Gylfe  
*Water Agency Principal Engineer*

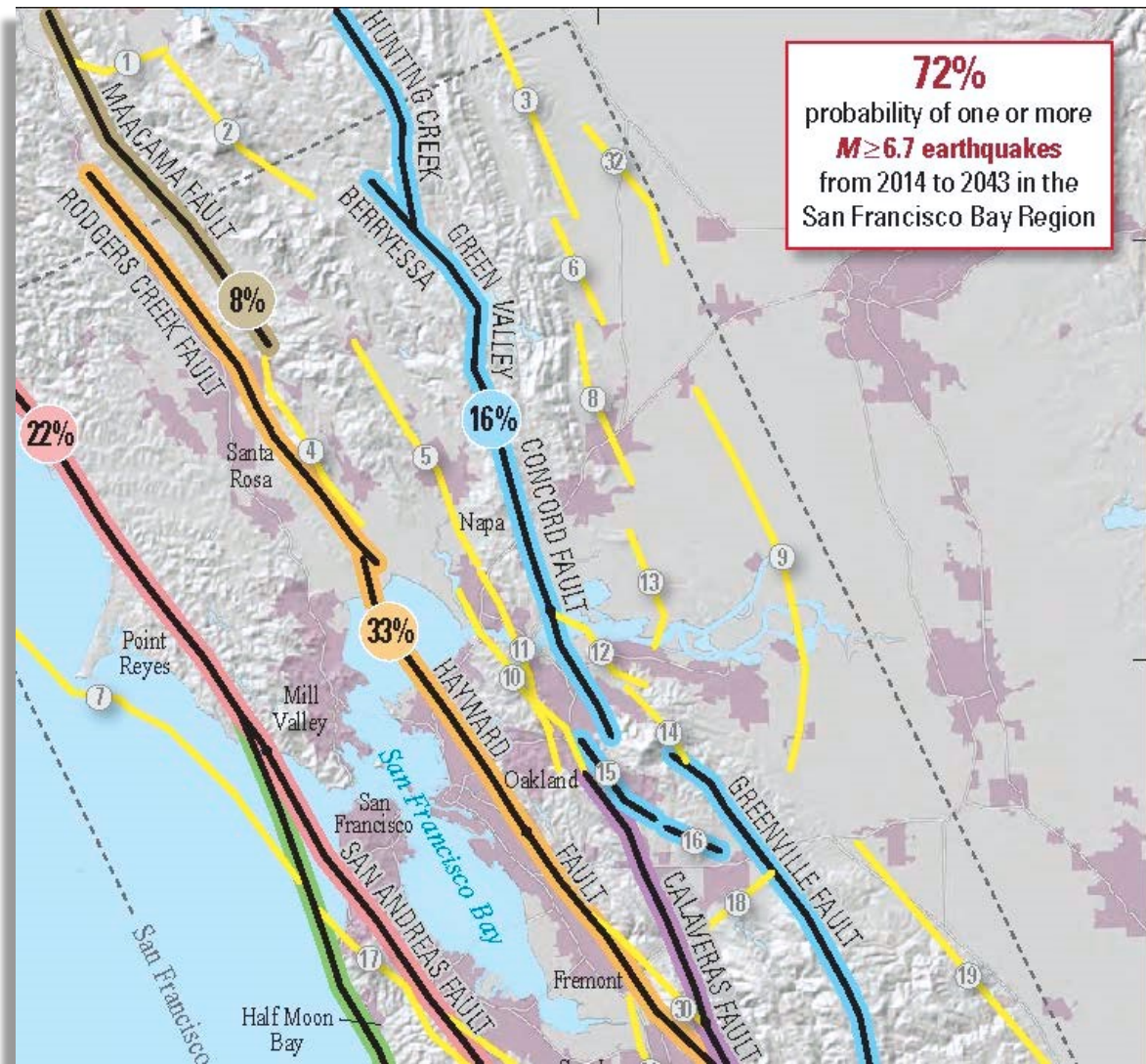
## Seismic Resilience

Many projects are being implemented to improve seismic hazard resiliency of Sonoma Water's facilities, however there is significant work still to be done



# Major Earthquake Probability

High probability of a major earthquake in San Francisco Bay Area between 2014 and 2043



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# Seismic Hazard Priorities

## Top 10 Priorities for Hazard Mitigation (2008)

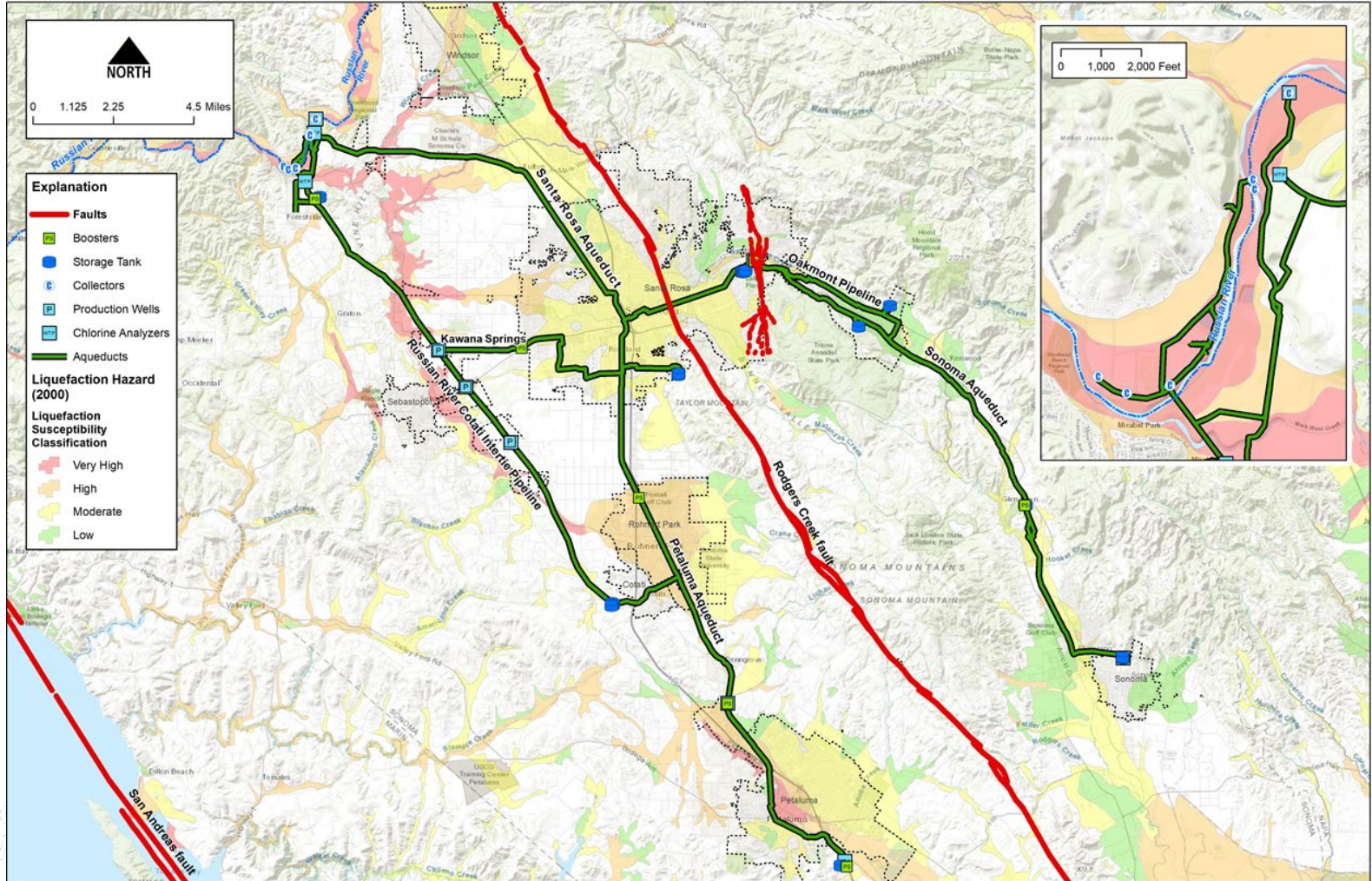
- Rodgers Creek Fault Crossing – **COMPLETE**
- Flow Measuring Devices – **IN PROGRESS**
- Isolation Vales – **COMPLETE**
- Russian River Crossing – **IN PROGRESS**
- Mark West Creek Crossing - **IN PROGRESS**
- Collectors 3 & 5 liquefaction mitigation - **IN PROGRESS**
- Collector 6 liquefaction mitigation - **IN PROGRESS**
- Emergency Groundwater Wells – **FUTURE**
- Santa Rosa Creek Crossing - **IN PROGRESS**
- River Diversion Structure liquefaction mitigation - **COMPLETE**





# Seismic Hazard Priorities

**Seismic vulnerabilities pose the **single greatest natural hazard risk** to Sonoma Water's production and transmission facilities**



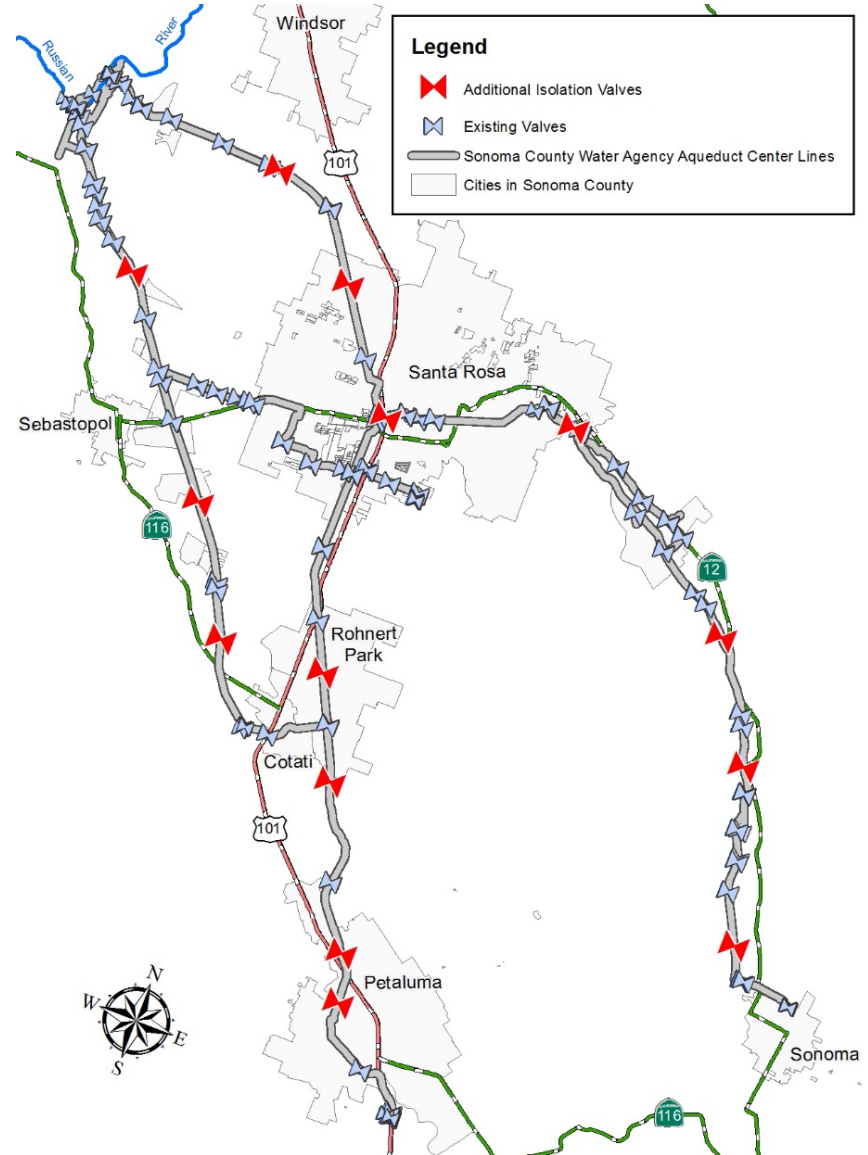


# Rodgers Creek Fault Crossing Project





# Isolation Valves Project



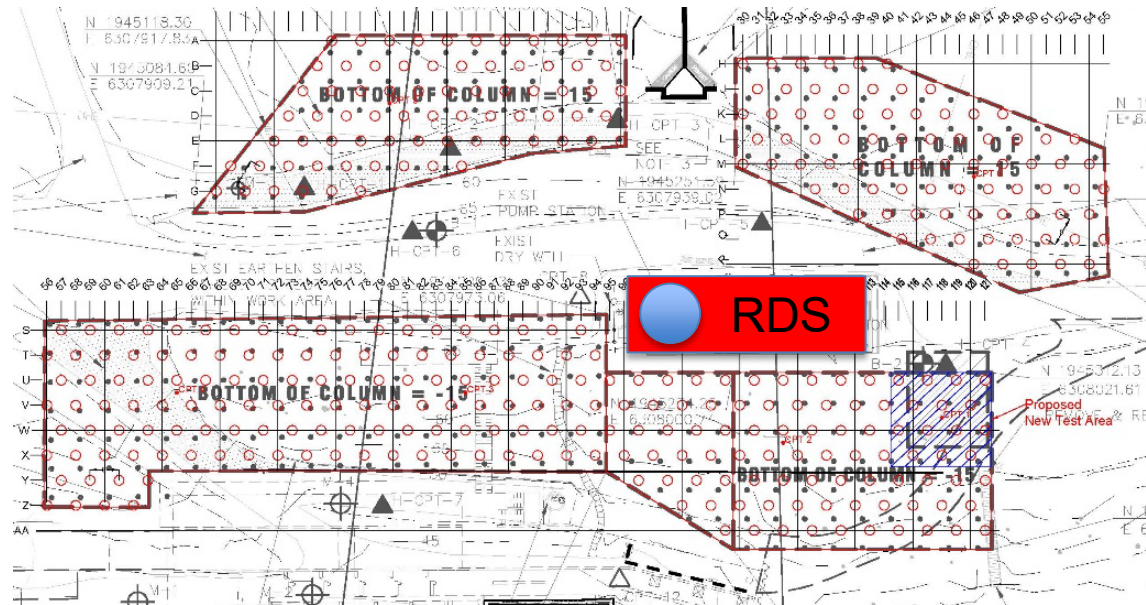
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# River Diversion Structure Project

## Ground Improvements to Reduce Liquefaction and Lateral Spread Risk

- 340 vibratory stone columns
- 36" diameter
- 50'-80' depth





# Hazard Mitigation Projects in Progress

- **River/Stream Crossing Projects**
  - Russian River/Mark West Creek
  - Santa Rosa Creek



- **Sonoma Booster Pump Station**
  - Seismic retrofit



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# Future Projects –Transmission System

## Planned Mitigation Projects

- Sonoma Aqueduct
- Oakmont Pipeline
- Petaluma Aqueduct
- Mirabel/Wohler
- Ralphine Tanks



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# FEMA Funding

## Pre-Disaster and Hazard Mitigation Funding To-Date:

- Rodgers Creek Fault Crossing - **\$2.3M**
- Isolation Valves - **\$1.9M**
- Russian River Crossing - **\$2.9M\***
- Mark West Creek Crossing - **\$2.8M\***
- Santa Rosa Creek Crossing - **\$3.0M**
- **Total - \$12.9M**



**FEMA**



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**Cal OES**  
GOVERNOR'S OFFICE  
OF EMERGENCY SERVICES



# Key Challenges

## Funding

- Availability and readiness

## Planning

- Site specific assessments
- Define mitigation solutions

## Resources

- Limited staff capacity

## Priority

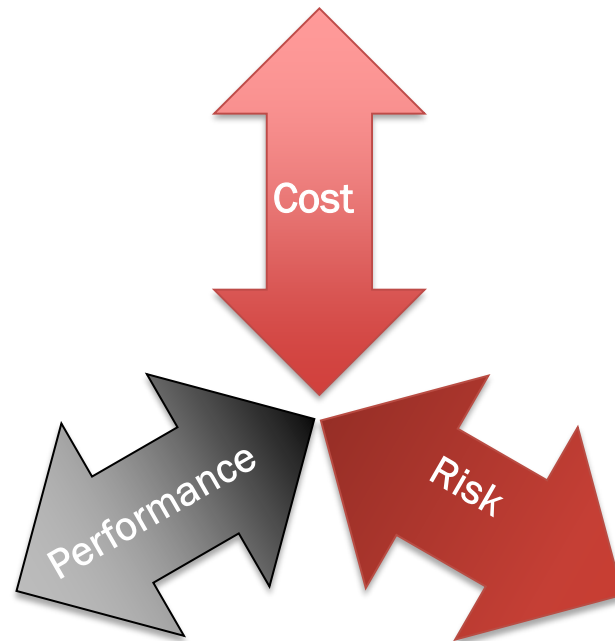
- Across core functions and enterprises
- Relative to other needs (regulatory, operational, etc.)

# Asset Management

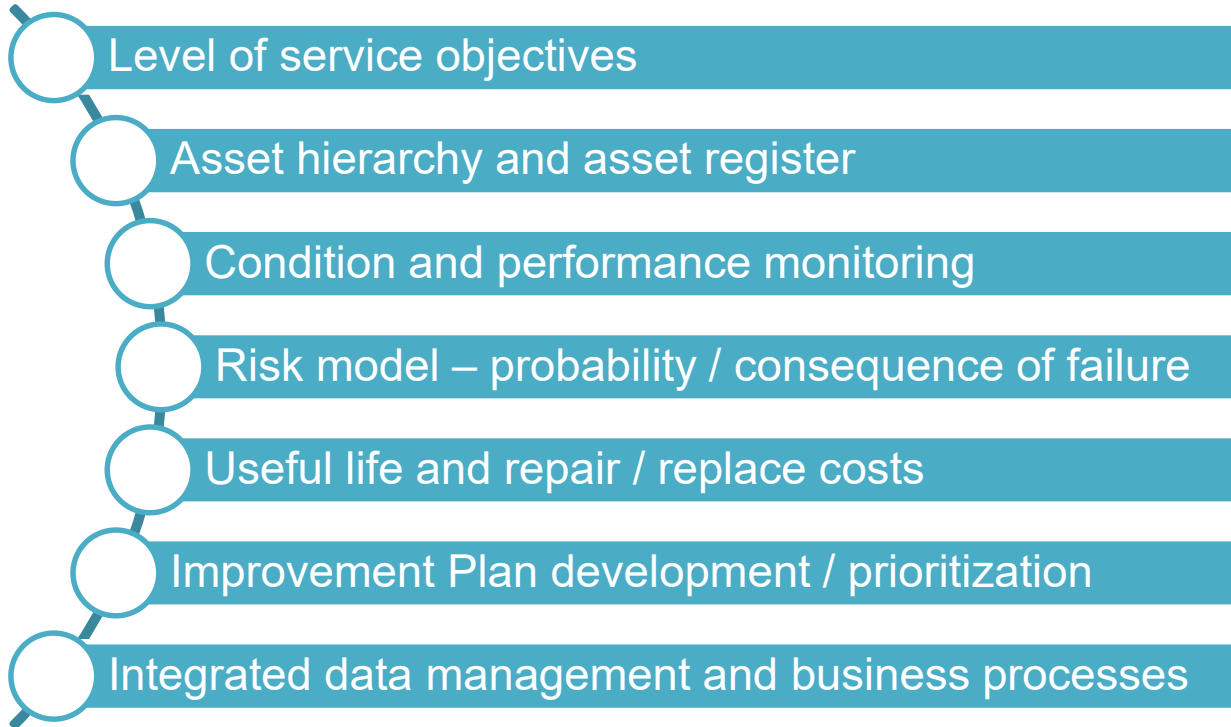
Kent Gylfe  
*Water Agency Principal Engineer*

## Asset Management

Development of a data driven decision-support system to provide a reliable level of service and improved cost efficiency while balancing level of operational risk



# Elements of an Asset Management Strategy



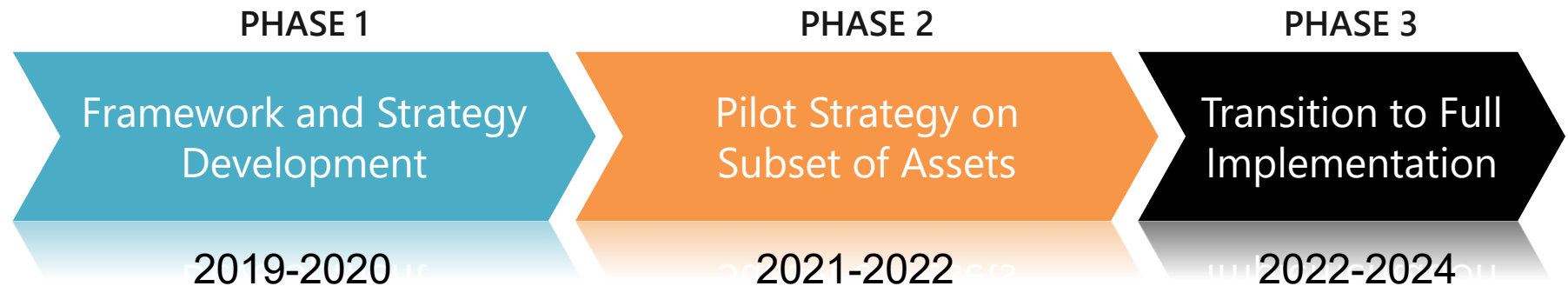
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# Development & Implementation Strategy

## Phased approach

- Phase 1 has been initiated
- Internal workgroups formed
- Consultant under contract
- Data collection and review underway
- Staff workshops commencing



# Planned Outcomes

- Improved reliability, efficiency, planning
- Better knowledge of system condition and performance
- Maximized asset life, reduced failure events
- Optimized resource allocation, cost efficiency
- Enhanced risk management
- Integrated data systems
- Data-driven support for rate-setting



# Summary

## How do we improve our Water Supply Resiliency?

- Prioritize partnerships & collaborations
- Invest in science/data
- Promote data-driven decision making
- Encourage innovation & proactive management
- Hire & retain skilled & innovative staff



# **Scientific Publications, Presentations and Awards by Sonoma Water Staff**

- **Over 60 peer-reviewed journal articles**
- **Research cited in numerous published books**
- **Co-authored several books**
- **Numerous conference and workshop presentations**
- **Staff have received multiple awards and recognition for research**





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Jay Jasperse, P.E.  
CHIEF ENGINEER  
[Jay.Jasperse@scwa.ca.gov](mailto:Jay.Jasperse@scwa.ca.gov)