Sustainable Water Resources Roundtable May 3-4, 2018

Sonoma County Water Agency, Westside Water Education Center

Restoration and Management for Sustainability

Proceedings

Contents

Day 1

Welcome Remarks and setting goals for the day: Robert Wilkinson & John Wells, SWRR Co-chairs; David Berry, SWRR Facilitator The co-chairs thanked the sponsors of the meeting: The California Department of Water Resources, The Sonoma County Water Agency, United Winegrowers, Lacrema Winery, and Truett Hurst Winery.

Water Roundtable Background, Activities, and History: John Wells SWRR Co-chair

John Wells opened his presentation with a summary of the mission and vision of SWRR. For the benefit of first time participants, he noted that SWRR is a national collaboration of federal, state, local, corporate, non-profit, and academic interests. It is a subgroup of the Federal Advisory Committee on Water Information. The roundtable has had over 1,000 participants at meetings in California, Colorado, Florida, Maryland; Michigan, Minnesota, New Hampshire, Louisiana, Virginia, and Washington, D.C.

SWRR sees the essential relationship of sustainability with water use to be one of maintaining system capacities to produce value over time. Environmental, social, and economic systems produce value

through flows of services, experiences, or goods that meet human and ecosystem needs over time. We achieve sustainability by maintaining capacity to meet present and future needs.

The SWRR Indicator Framework includes the main aspects and uses of water resources:

- Water availability
- Water quality
- Human uses and health
- Environmental health
- Infrastructure and institutions

Wells outlined the water sustainability activities and strategies of several government agencies:

US Army Water Security Observations

- Water management largely compliance-driven
- Less attention directed outward to sustainability of regionally shared water sources
- Long-term water projections currently not factored early into stationing decisions
- Chronic funding constraints means attention to Army-owned and Army-operated infrastructure tends to be reactive
- Long-term investment a challenge

Elements of the Army Strategy

- Assist host nations with water resources sustainability
- Assess the vulnerability of water and wastewater infrastructure to natural mishaps
- Match water quality to water use
- Anticipate long-term water requirements
- Influence long-term water management outside the fence line

EPA takes an overview of several aspects of water resources. They are advancing integrated water resource and watershed management approaches, models, and decision-making tools. EPA also assesses maps and predicts the integrity, resilience & restoration potential of the nation's waters and promotes science to support new or revised water quality criteria to protect human health and aquatic life

NOAA's challenges include addressing what climate we shall have tomorrow. The climatic and environmental stakes include:

- Increases in global sea and air temperatures
- Widespread melting of snow and ice
- Rising global sea levels

NOAA is working to improve models

- Observational & accuracy needs
  - -Global water & energy cycle research
  - -Global climate change research
  - -Water management, flood prediction & reservoir operation, agriculture & drought assessment
- Predictions at a finer scale
- Accuracy needs for regional problems
- Real-time data needs to augment operational networks

US DOE is working on the Energy-Water Nexus:

- Energy and water are interdependent
- Water scarcity, variability, and uncertainty becoming more prominent
  - –Leading to vulnerabilities in the U.S. energy system
- We cannot assume the future is like the past –Climate, technology, and decision-making
- Aging infrastructure brings fresh opportunities
- Expertise in technology, modeling, analysis & data –Can contribute to understanding issues & pursuing solutions

Wells also discussed the principle of shared responsibility. Because water does not respect political boundaries, its management requires shared consideration over time of the needs of people and ecosystems up and downstream and throughout the hydrologic cycle. He then said a few words about water sustainability in California as an introduction to several regional presentations to follow.

One-minute Round of Brief Self-introductions: David Berry It has proven useful for everyone to learn who is in the meeting to support contact and collaboration. This meeting was no exception and after the self-introductions, participants were able to make contact with potential collaborators during the day.

Welcome by Sonoma County Water Agency: Grant Davis, General Manager

Panel 1: Water Sustainability Outlook and Indicators: Moderator: Rich Juricich, DWR The session described water sustainability as a framework for water management and highlight how two regions are thinking about water sustainability

California Water Plan, Update 2018 Sustainability Outlook: Kamyar Guivetchi, CA DWR

Kamyar Guivetchi began by summarizing an update of the California Water Plan and acknowledging the role SWRR sustainability principles and indicators played in the work.

The key messages of the California Water Plan update are:

- Water challenges are threatening Californians well-being
- Update 2018 has a shared vision for California's water future
- Bold action will overcome critical (and systemic) challenges
- Sufficient and stable funding needed for sustainability

- California's values - a common aspiration for water sustainability
- The Way Forward – everyone has a role to play

Guivetchi said that California's Water Management is a tale of two extremes. Water challenges threaten the people and ecosystems of California through greater drought impacts such as unreliable water supplies. At the same time there is increasing flood risk. Other challenges include groundwater depletion and subsidence, degraded water quality, declining environmental conditions, aging infrastructure, and climate change impacts.

Systemic challenges are the root cause of individual problems. These systemic problems include Fragmented and uncoordinated decisions, initiatives and actions, inconsistent, inflexible, and conflicting regulations, insufficient capacity for data-driven decision-making, and insufficient and unstable funding.

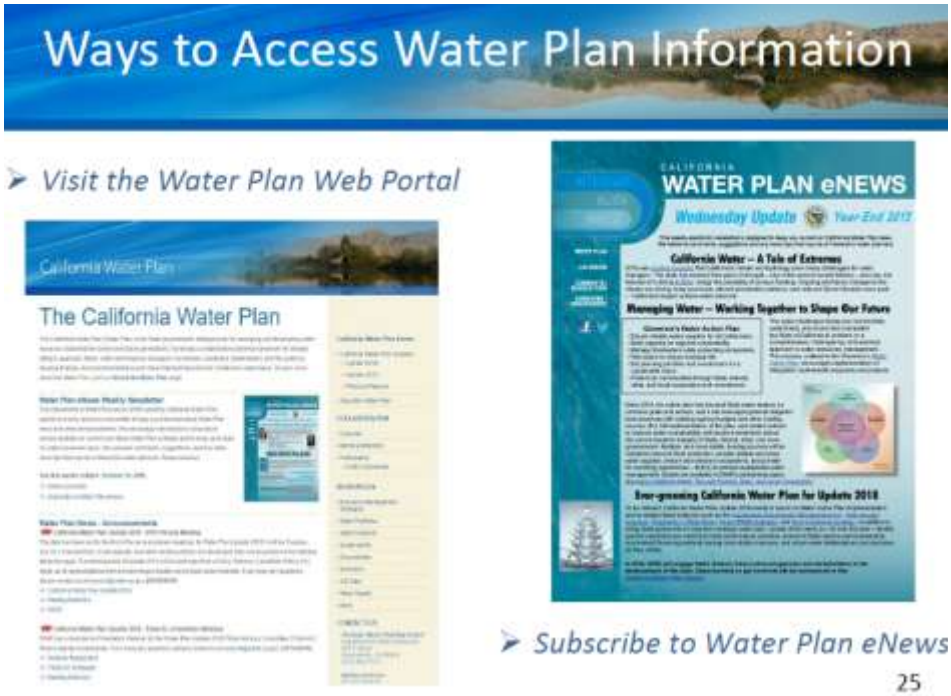
Our historical focus on water management has been reactive and oriented to individual projects. Reactive management is not sustainable. Today's water management system focuses on advocacies and actions. Sustainability requires taking a long view, shared intent and outcomes, agency alignment, balancing what Californians value, and investing time and commitment.

Guivetchi said the Update 2018 Shared Vision included:

- All Californians are protected from health and safety threats and emergencies.
- California's economy is healthy and all Californians have opportunities for economic prosperity.
- Ecosystems in the state are thriving.
- All Californians have opportunities for enriching experiences.

Sustainability requires shared intent and outcomes. The Update 2018 goals to overcome challenges:

1. New/Modernized Infrastructure and Restored Ecosystems
2. Improved Alignment of Decisions, Initiatives and Actions
3. Improved Regulatory Outcomes
4. Informed and Adaptive Decision-Making
5. Sufficient and Stable Funding



Sustainable Water Management (SWM) Profile: Mike Myatt, Water Foundation

Mike Myatt posed the question: "How do you measure sustainability?" As water supplies come under increased pressure, regions lack a uniform tool to assess sustainable water management. A goal of the Water Foundation's work has been to find or develop a tool to assess sustainable water management and inspire improvement at a regional scale.

The Water Foundation's tool for advancing long-term water supply resilience and water resource stewardship at a regional scale is known as the SWM Profile. It was developed in collaboration with many other organizations.

The SWM Profile Is Not…

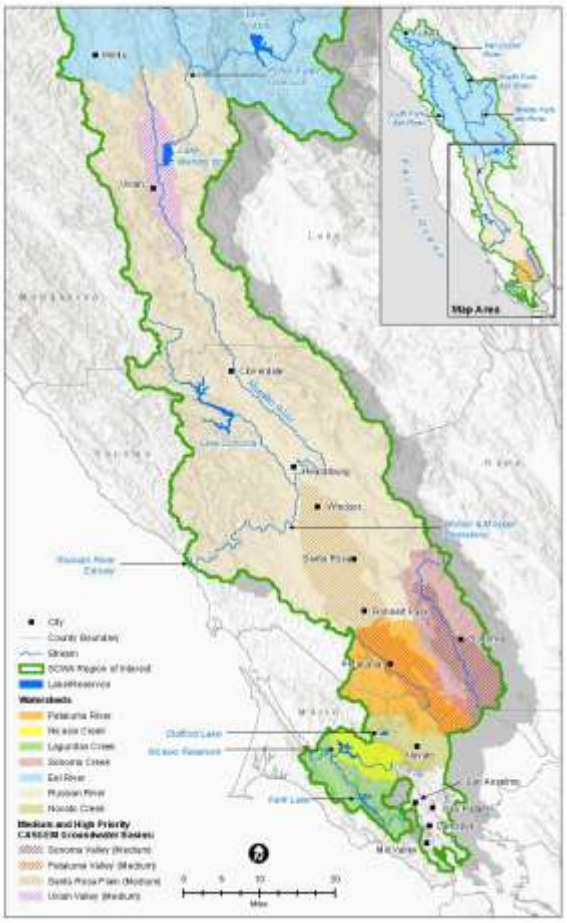
- Small-scale site-specific analysis
- Designed to be global or international tool
- Stakeholder-driven certification process
- All-encompassing sustainability analysis

Rather the SWM Profile is:

- Focused on sustainable water supply management
- Accessible to different audiences
- Flexible and scalable
- Voluntary
- Expert driven

Defining a region: A SWM Profile region is a "Region of Interest" with assessment boundaries that are flexible by stressor.

Sonoma County Region of Interest



Inland Empire Region of Interest

The SWM Profile themes are environment, supply, demand, and finance. The stressors on Environment are natural hazards, climate change, sensitive species, and watershed health. The stressors on supply are supply reliability, groundwater supply and source water quality. The stressors on demand are urban demand and agricultural demand and the stressors on finance are finance and investment.

SWM Profile V1.0 Framework

		Stress Level	Management Response			
Themes	Stressors	High/Moderate/Low	Initial Steps	Moderate Progress	Advanced Progress	Leading Practice
SUPPLY						
	1. Supply Reliability					
	2. Groundwater Supply					
	3. Source Water Quality					
	4. Natural Hazards					
	5. Climate Change					
DEMAND						
	6. Urban Demand					
	7. Agricultural Demand					
ENVIRONMENT						
	8. Sensitive Species					
	9. Watershed Health					
FINANCE						
	10. Finance and Investment					

SWM Profile Lessons Learned:

- Data availability limits indicator selection
- Defining assessment boundaries is challenging
- Thorough, independent analysis has value
- Providing context is critical
- More than just a snap shot: create a road map
- Context + Condition (Stress) + Action (MR)

Next Steps 2018:

- Pursue opportunities with California Water Plan pilots
- Collaborate with Russian River Watershed
- Support Santa Ana Watershed
- Finalize White Paper
- Pacific Institute Guidebook
- Outreach to promote lessons learned

Russian River, Sonoma County Example: Charles Gardiner, California Forward

Charles Gardiner asked the SWRR participants to imagine what it would be like if economic development and land use activities were designed to enhance natural resources. He said the Russian River Pilot was based on outside the box storytelling, sustainability, and recommendations.

Storytelling brings in many elements:

- Watershed
- Stakeholders
- Tribes
- Agencies
- North Coast
- Resource Partnership
- Russian River Pilot
- State of California
- Region
- Nations

Water Resources Sustainability draws upon:

- Sustainable Watershed Management Practices
- The California Water Plan
- Regulatory Innovation
- Cooperative Governance
- Tribal Culture and Knowledge

Gardiner spoke of a systems approach. What could we do if we could imagine ideal functions of the watershed if regulation, time, money, and jurisdiction were not problems? Can we identify real goals and objectives for the system? Current plans often list compliance strategies as goals and regulatory objectives have become the default goals.

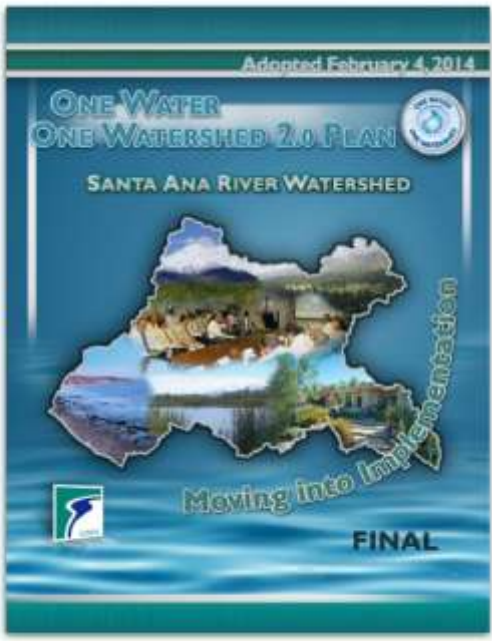
Gardiner outlined some A-Ha moments people had in the process:

- We don't have watershed-scale vision and goals.
- Innovations have happened within existing regulatory frames.
- We have studied a lot and know a lot; we need to synthesize past learning.
- The region has evolved understanding, collaboration, and coordination over the last 20 to 30 years; we are not there yet.
- We need shared understanding of the system and of where we are going.
- We know the outcomes we want; we need better alignment to get there.

Gardiner proposed the following discussion questions:

- What system drivers shape and control the river system?
- What conditions do we want to achieve for the top-level drivers?
- Can problems with other related systems be addressed using the river system drivers?
- What are state of the practice approaches to align state and regional objectives?
- How can the State provide guidance and incentives most effectively?
- How does fire recovery affect watershed planning?
- What should we do next?

Santa Ana Watershed Example: Mike Antos, Santa Ana Watershed Project Authority



Mike Antos presented the Santa Ana Watershed "One Water, One Watershed" (OWOW) program. The steering committee is made up of county and municipal government members from Orange County, San Bernardino County, and Riverside County, from the Regional Water Quality Control Board, the Santa Ana Watershed Project, business leaders, and community advocates.

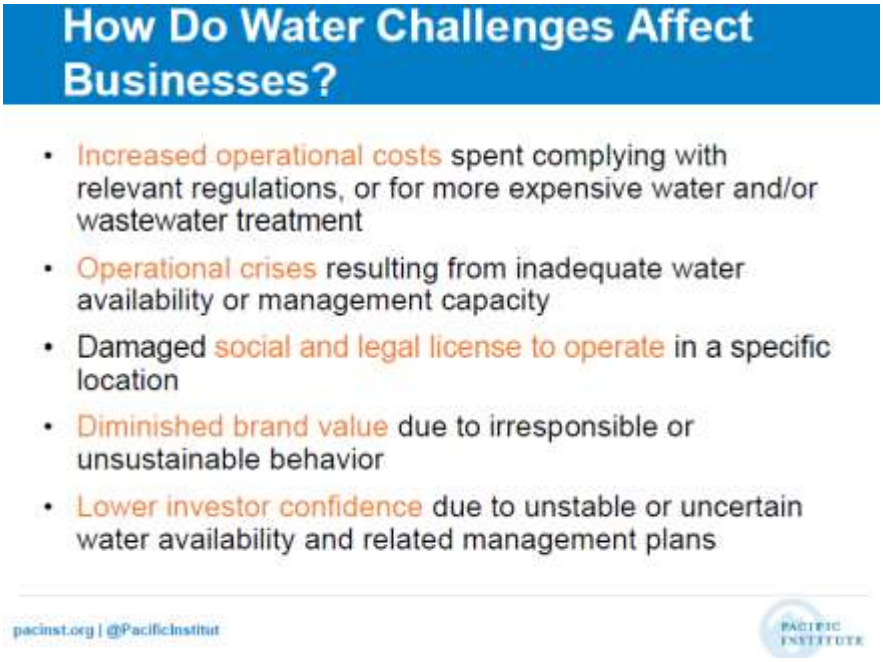
Draft OWOW Plan Goals and Indicators

1. Achieve resilient water resources through innovation and optimization.
    - Increased local supply
    - Attainment of outdoor budgets
2. Ensure high quality water for all people and the environment.
    - High quality groundwater
    - High quality surface water
3. Preserve and enhance recreational areas, open space, habitat, and natural hydrologic function.
    - Abundance of vegetated riparian corridor
    - Abundance of conserved open space
4. Engage with members of disadvantaged communities and associated supporting organizations to diminish environmental injustices and their impacts on the watershed.
    - Access to clean water
    - Community resiliency to climate change
5. Educate and build trust between people and organizations.
    - Effective collaborative actions
    - Watershed ethic
6. Improve data integration, tracking and reporting to strengthen decision-making.
    - Broaden access to data for decision-making
    - Streamlined data sharing and reporting

Business Engagement in the California Water Plan: Heather Cooley, Pacific Institute

Heather Cooley presented the Pacific Institute as a non-profit, 501(c)3, established in 1987 with the mission to create and advance solutions to the world's most pressing water challenges. The headquarters are in Oakland, California, with research staff in other parts of US, Brazil, and Australia.

Cooley spoke about the CEO Water Mandate. It has the objective to mobilize business leaders to address global water challenges through corporate water stewardship, in partnership with the United Nations, governments, civil society, and others. For water managers, engagement with the business community can help ensure buy-in from a key stakeholder group that will need to take action to realize policy objectives. For both parties, alignment on the indicators used to identify water challenges and track progress towards sustainability fosters collaboration, reduces fragmentation, ensures accountability, and increases awareness and political support, which in turn catalyzes investment.



The California Water Action Collaborative (CWAC) was founded in 2014, as a platform for collective action to improve water security in California. The strategic goals are aligned with California Water Action Plan and with the UN Sustainable Development Goals (SDGs). The Metrics Working Group is developing a standardize approach for measuring and communicating CWAC's impact and to help companies align measurement systems and core metrics, set meaningful targets, and prioritize actions and investments that address shared water challenges in the basins where they operate. In 2018, the project team will pilot test the methodology in basins around the world including the Santa Ana River watershed.

Cooley went on to summarize the planned outputs of the work:

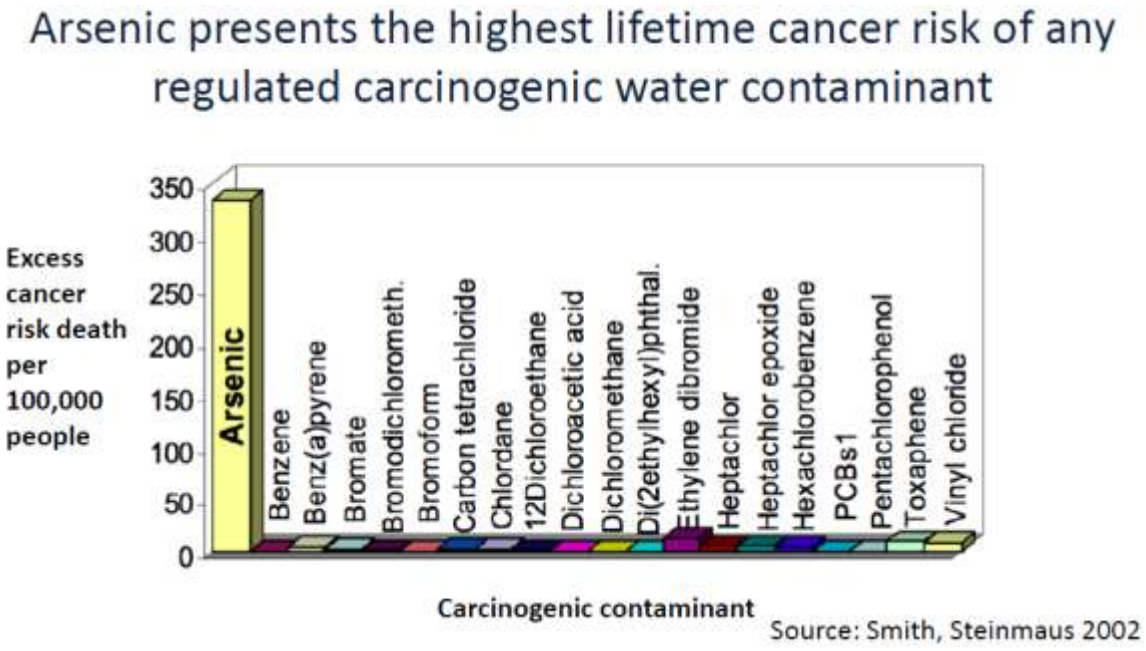
- Integration of business community insights into the California Water Plan Update 2018
- Development of a white paper that identifies the opportunities for and challenges with engaging the business community on watershed sustainability assessment systems.

Lunch Speaker: ElectroChemical Arsenic Remediation for Groundwater: Kate Boden, University of California, Berkeley

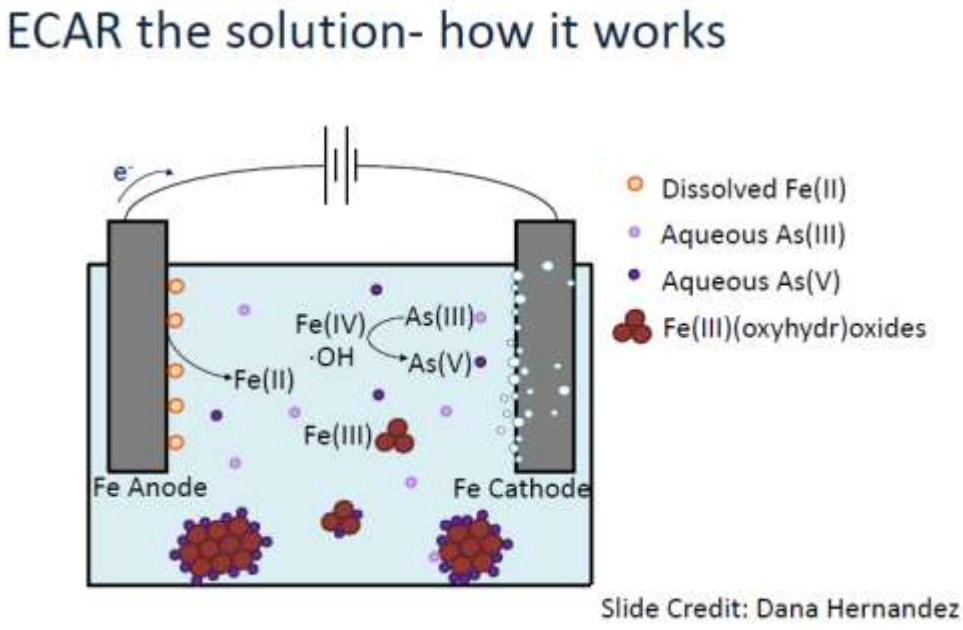
Kate Boden began by reminding SWRR participants of the severity of the arsenic problem in the U.S. ElectroChemical Arsenic Remediation (ECAR) is a novel solution. There is already a demonstration project in India.

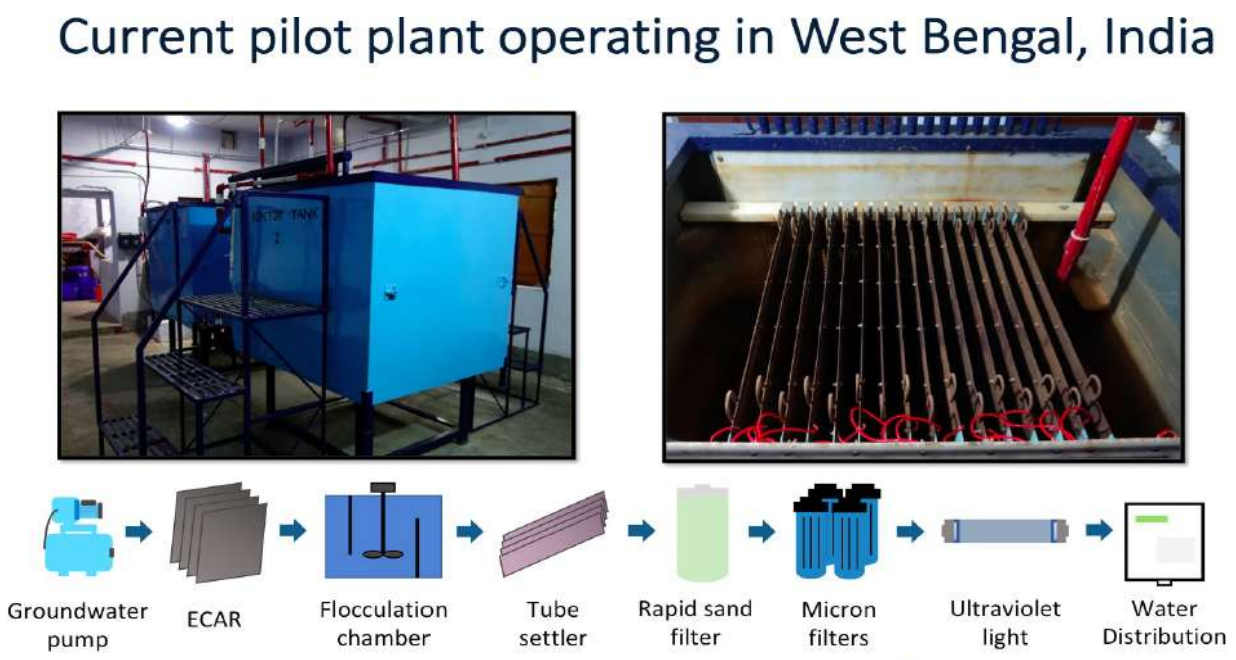
The Arsenic problem in the United States:

Private wells: An estimated 2.1 million people are exposed to Arsenic at levels above the EPA Maximum Contaminant Limit of 10 part per billion (ppb). Source: USGS 2017



Importance of regulation: Columbia University School of Public Health finds that compliance with EPA regulation has led to a decline of 17% in levels of urinary arsenic. Source: The Lancet Public Health





Extensive testing has shown that ECAR has consistently and successfully reduced the arsenic concentration at a school site in India from 250 ppb to less than 10 ppb since April 2016.

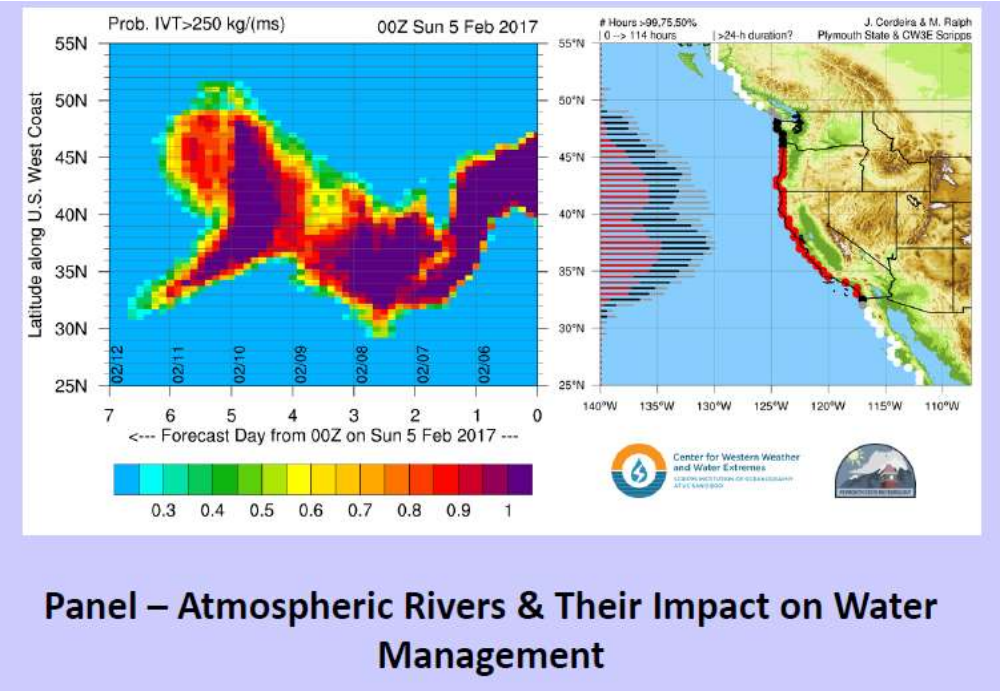
Future of ECAR

1. Next Generation
   –Increase output (sufficient for small water systems in the U.S.)
   –Shrink footprint
2. Demonstration plant in Allensworth, California

–Prove that ECAR is robust with different groundwater matrices and that it can be a cost competitive technology in the U.S. water market

Panel 2: Partnerships on Atmospheric Rivers, Drought, and Flood in the Russian River Watershed and Beyond: Moderator – Jeanine Jones, DWR

Session describes a partnership between Researchers, Federal Agencies, DWR, and Bay Area agencies to understand atmospheric rivers' impact on water management]



Studies of atmospheric rivers began with NOAA's HMT/EFREP… Hydrometeorology Test bed/DWR Enhanced Flood Response and Emergency Preparedness programs, a state-federal research observations partnership. Observing atmospheric rivers has led to forecast-informed reservoir operations (FIRO), advanced quantitative precipitation information (AQPI), and sub-seasonal to seasonal (S2S) forecasting.

State of California Investments in Observing and Understanding Atmospheric River Storms

- NOAA HMT/DWR EFREP (state share) -- $15M
- DWR AQPI grant to Bay Area water agencies -- $19M
- Calwater I & II field observing campaigns -- $5M
- Other research with University of California system & NASA -- $3.5M

Water Management Applications of Research Projects on Extreme Weather Events: Jay Jasperse, Sonoma County Water Agency

Jay Jasperse opened with an overview of his presentation:

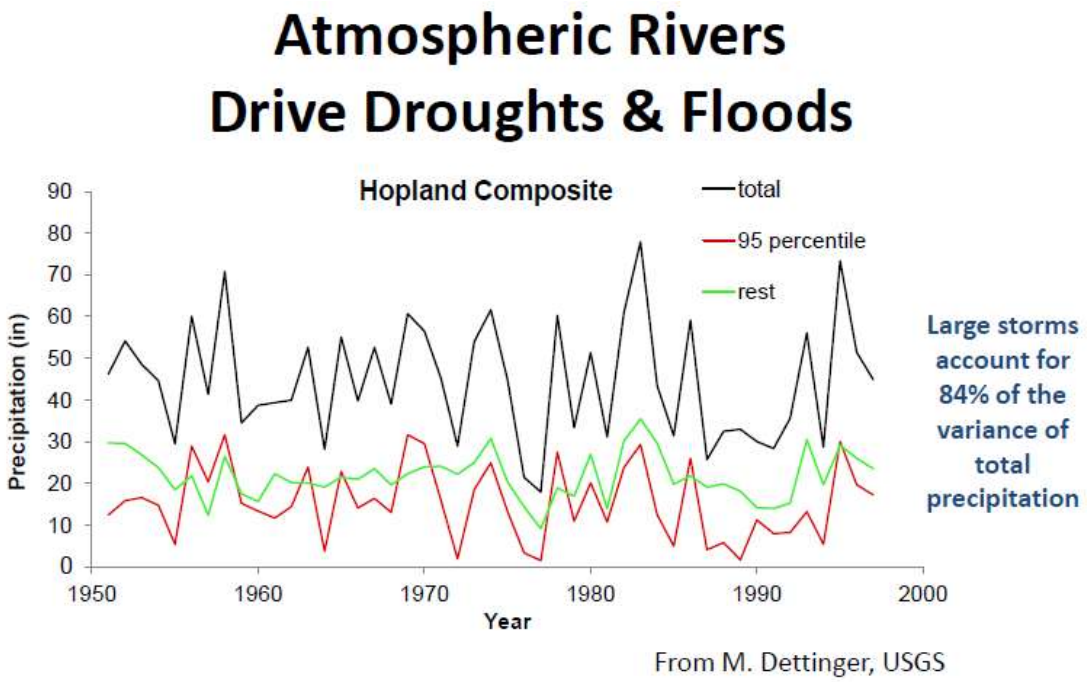
•Background – Regional Context in Sonoma County

•Why Atmospheric Rivers Are Important in Water Resource Management

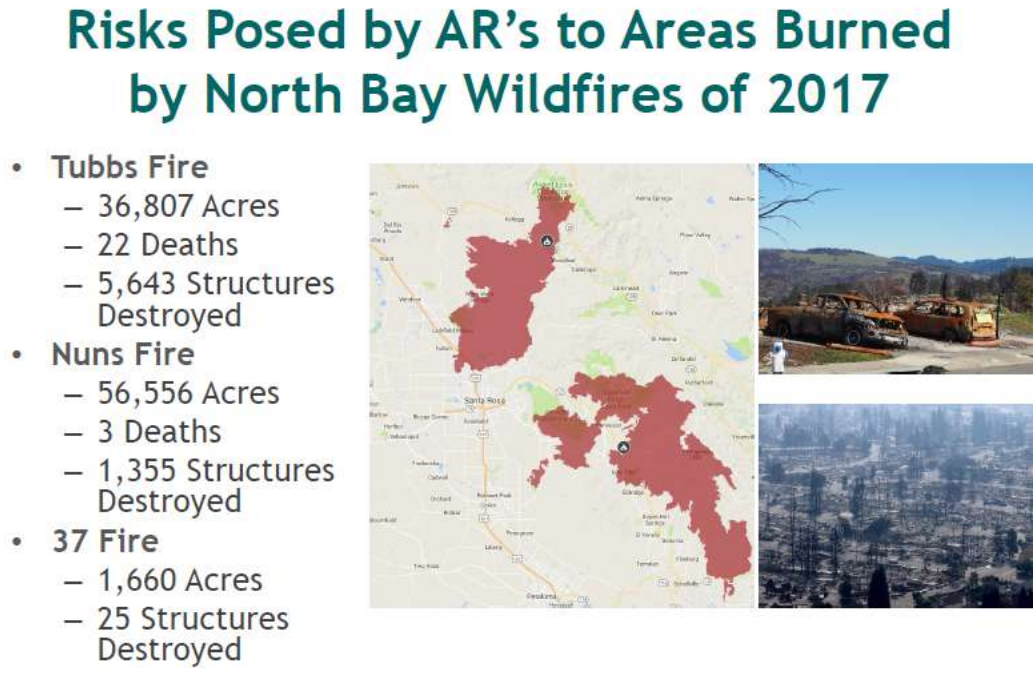
•Forecast Informed Reservoir Operations (FIRO)

•Wildfire Implications

Jasperse told the group that the Sonoma Co. Water Agency is a Special Act district that manages regional wholesale water supply, flood management, sanitation, and Russian River reservoirs multi-purpose facilities. The operations are dictated by storage levels relative to "rule curve." The agency must provide for water supply, flood management, and ecosystem, recreation and agricultural needs.



Jasperse gave some examples of the improvement of forecasting on water storage, water supply, flood management, and habitat, using data on atmospheric rivers. Given the high impact of floods in the areas recently burned, such improved forecasting is critical.

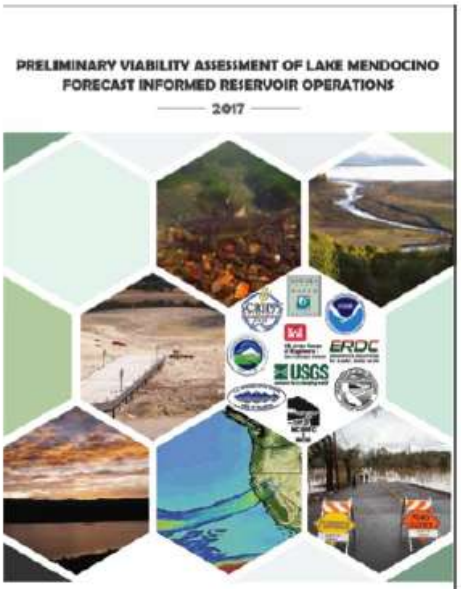


Lake Mendocino FIRO
Preliminary Viability Assessment - 2017

SCWA – Development and evaluation of a reservoir model that leverages streamflow forecast skill

USACE HEC – Evaluation of multiple reservoir management rule-sets/schemes in the HEC-WAT framework

Scripps CW3E – AR analysis, monitoring enhancements, and quantified forecast skill requirements



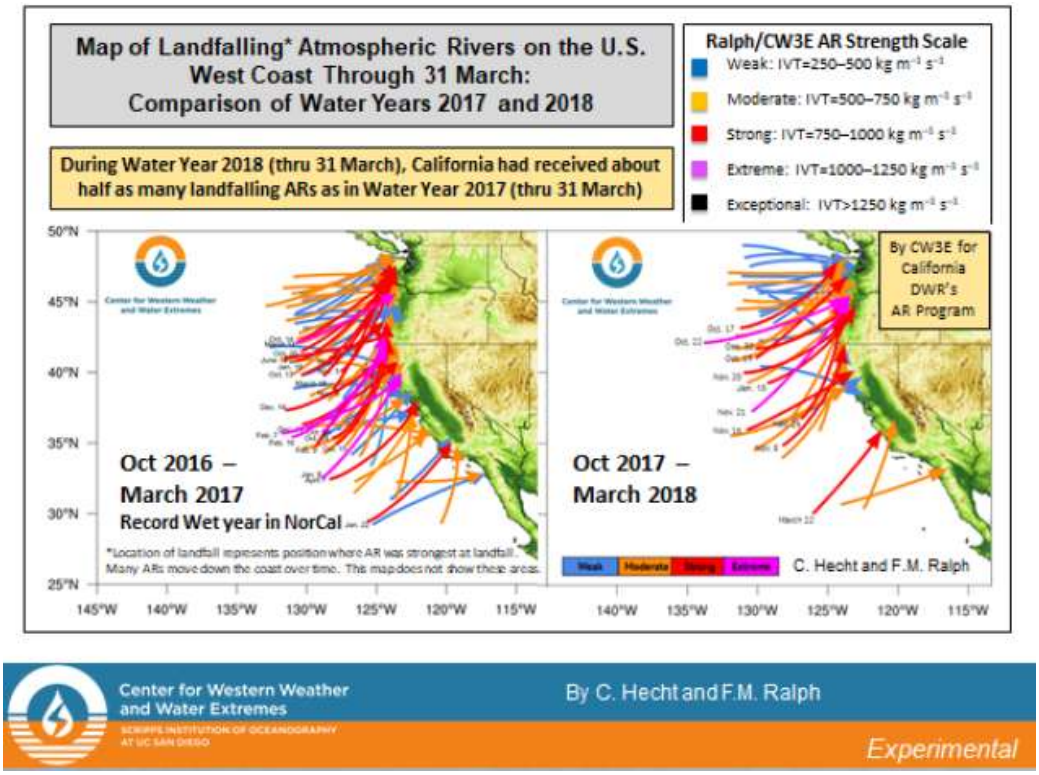
Jay Jasperse gave the following summary:

- Atmospheric Rivers: Our region's extreme weather events
- AR's produce almost 50% average annual rain in a few days
- ARs cause Russian River flashy hydrology: Droughts/Floods
- Water managers need to plan for AR events to ensure reliable operations and protect public safety
- FIRO shows promise in leveraging current (and future) forecasting skill & new technology to improve reservoir functionality in areas exhibiting variable precipitation
- ARs pose significant hazards in & below burned areas: Improved observational capacity and forecasting are essential to protect public safety and property

CDWR-NOAA Involvement with FIRO & AQPI Projects: Michael Anderson, California Department of Water Resources

Michael Anderson said that atmospheric rivers are a key component to California's water supply and flood risk. The character, size, number, and timing of atmospheric rivers play a key role in seasonal hydrologic outcomes for California. Improved observations and forecasting are key elements to improved decision support tools that can enable more options for water management in California. Forecast-informed reservoir operations (FIRO) and advanced quantitative precipitation information (AQPI) represent opportunities to explore operational implementation of research concepts to advance integrated water management capabilities in a collaborative environment.

California's topography affects our weather and climate and the Bay Area's complex topography offers unique challenges. California's Advanced Observing System for Atmospheric Rivers is providing valuable information.



Anderson said using Forecasts and Advanced Observations to support reservoir operations improves supply reliability, stewardship, and flood management capabilities

Coastal Storm Modeling System (CoSMoS)

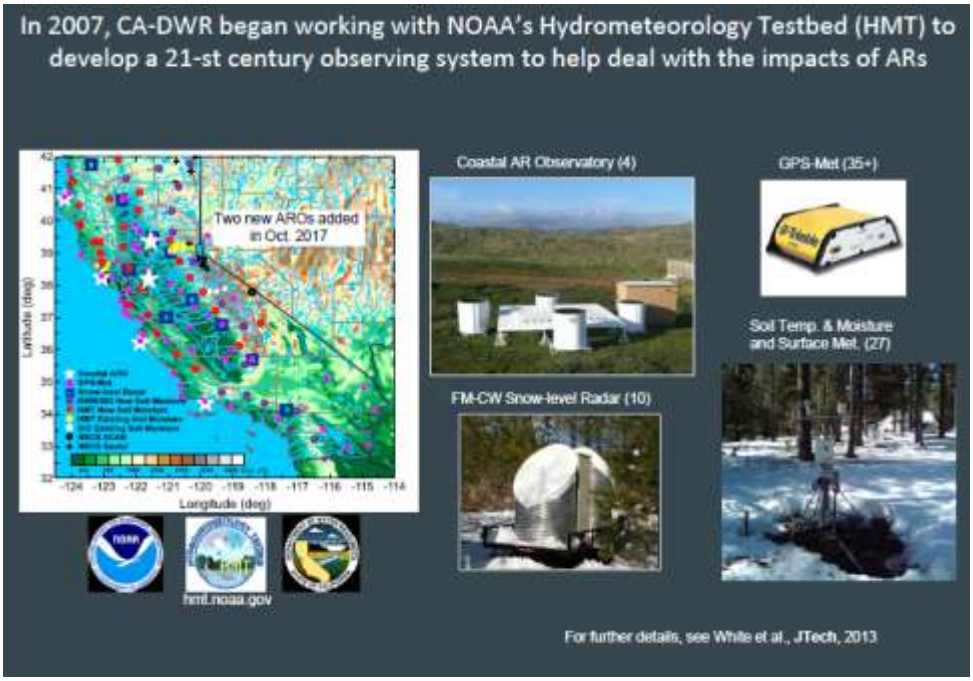
- Physics--based numerical modeling system for assessing coastal hazards due to climate change
- Predicts coastal hazards for the full range of sea level rise (0--2, 5 m) and storm possibilities (up to 100 year storm)
- Emphasis on directly supporting federal and state- supported climate change guidance
- New operational application for San Francisco Bay

The Bay Area is leading the way with successful alignment of local, state, and federal agencies in collaborative engagement for multiple benefits. The research community is engaged to bring the best science to integrated resource management for a warming world. The lessons learned in FIRO and AQPI can be transferred to other parts of California

NOAA-CDWR Enhanced Flood Response and Emergency Preparedness (EFREP):

Allen White, NOAA Earth System Research Laboratory

Allen White said NOAA has been working with CA-DWR since 2007 on CA-DWR's Enhanced Flood Response and Emergency Preparedness (EFREP) program. A major outcome of EFREP is a 21-st century observing system that has led to improved process understanding and better forecaster situational awareness for atmospheric rivers and their impacts. The California Department of Water Resources awarded NOAA and collaborative partners with funding for the Advanced Quantitative Precipitation Information (AQPI) project in 2015.

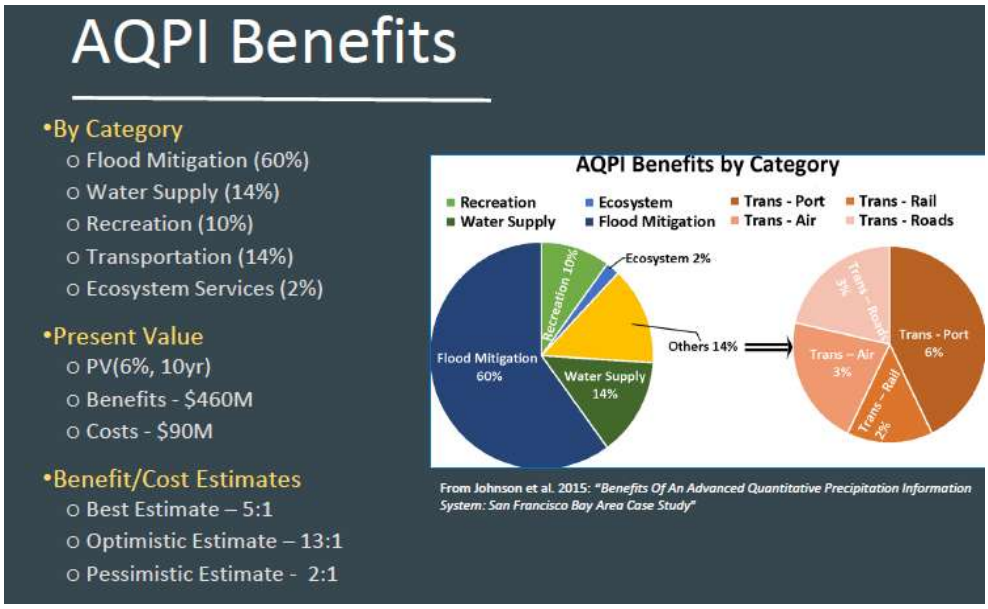


Data Dissemination

- Real-time and archived data and images from the statewide observing network are available to NWS forecasters and the public.
- Data are also sent to NWS Western Region in NWS specialized formats and some datasets are displayable in the AWIPS2 forecaster toolbox.

Advanced Quantitative Precipitation Information (AQPI) Overview

- Ultimate goal is to improve NOAA's ability to provide early warning through research, monitoring, and prediction of precipitation, streamflow, and storm surge
  - Integration of capabilities for many users
  - Benefits for waste water management, water supply, water quality, emergency management, transportation
- .Grant awarded by California Dept. Water Resources (Prop 84)
  - 4-year project, Sonoma County Water Agency is local sponsor
- .Project components
  - Radar and surface met deployments
  - Assimilation and analysis of observations
  - Precipitation, streamflow, and coastal storm surge predictions
  - ¦Integrate and disseminate observations and model forecasts (the AQPI System)
- .System to be owned and operated by consortium of CA Bay area water agencies



AQPI Project Team

- NOAA
  - Physical Sciences Division
  - Global Systems Division
- Cooperative Institute for Research in the Atmosphere (CIRA)
  - Colorado State University
- .USGS
  - Pacific Coastal and Marine Science Center
- Scripps Institution of Oceanography
  - enter for Western Weather and Water Extremes
- .Sonoma County Water Agency

AQPI Components

- Storm detection and tracking
  - Satellite-based AR detection + C-band radar
- Hi-res precipitation forecasting
  - Radar "nowcasts" + hi-res weather prediction models
- Watershed and coastal flood forecasting
  - SF Bay Integrated Flood Forecast Model
- Flood impacts
  - Critical infrastructure

Allen White summarized by saying that CA-DWR has a longstanding, successful collaboration with NOAA Research that has brought observations and new knowledge to bear on the state's water resource and flood protection issues. AQPI is a 4-year project started in Oct. 2017 that aims to improve monitoring and forecasting of precipitation and flooding in the SF Bay area. The benefits derived from AQPI significantly outweigh the costs and that success depends in large part on participation from state and local agencies.

Panel 3: Restoring People and Watersheds after Fires & Floods:

Moderator: Karen Gaffney, Sonoma County Agricultural Preservation & Open Space District [Session describes what state, regional, and local agencies are doing to recover from the 2017 fires]

Watershed Emergency Response Teams (WERT) and Post-Fire Watershed Restoration/Recovery: Drew Coe, CALFIRE

Drew Coe said the WERT Primary Goals are to

- Assist Communities
  A rapid evaluation of values-at-risk (VARs) subject to post-fire hazards, including:
  - Debris Flows
  - Flooding
  - Rock fall
- Life-safety-property focus

The flooding and landslides after a fire can be extremely dangerous.

Assessing soil burn severity

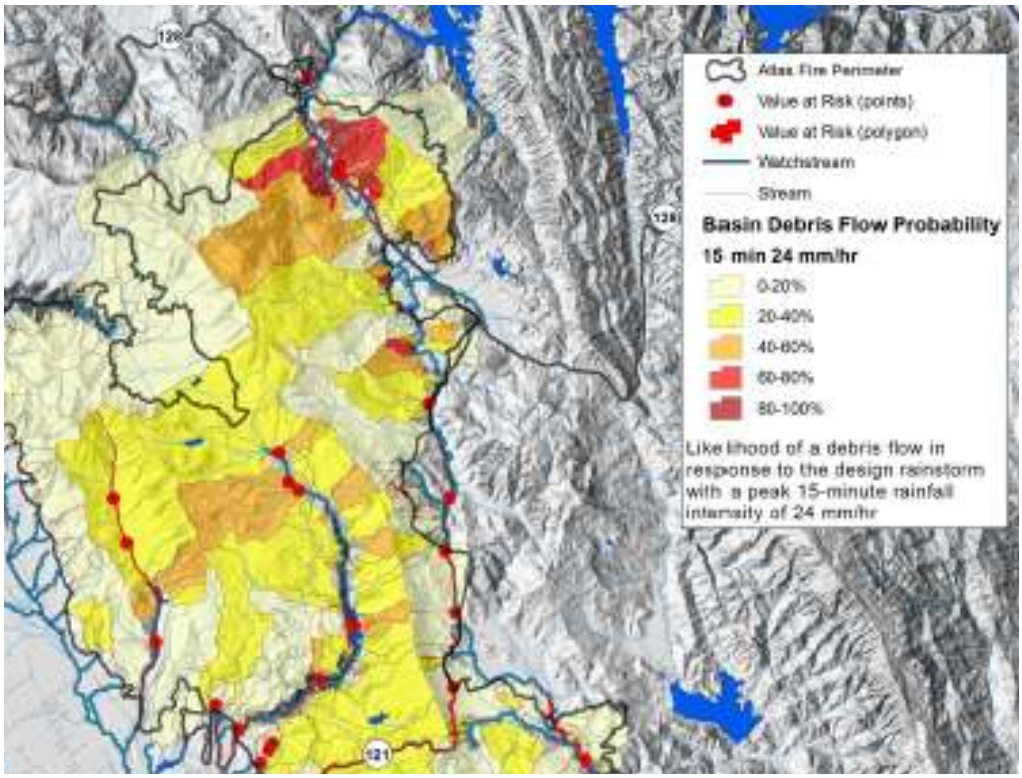
- Develop soil burn severity map for a spatially-distributed view of post-fire soil alteration
- Spatially explicit modeling and evaluation of post-fire debris flow potential, erosion rates, and peak flow
- Identification of values-at-risk (VARs) on non-federal land
- Hazard determination for VARs
- Preliminary/general recommendations to mitigate hazard(s)
- Communication to affected and/or responsible parties

The WERT process includes field evaluation performed by licensed professionals such as engineering geologists, civil engineers, and hydrologists. The relative hazard to life and property is determined by a combination of professional judgements based on geomorphic evidence, modeling, and spatial data (e.g., proximity to mapped flood inundation zones)

USGS Post-Fire Debris Flow model

Basin and segment probability

Volumetric debris yield



Using WERT Products to Identify Post-Fire Restoration Opportunities can provide spatially-explicit view of post-fire processes and hazards and allow local entities/stakeholders to focus efforts on values-at-risk most affected by post-fire watershed conditions

The Watershed Collaborative Shared Priorities for Watershed Resiliency: Karen Gaffney, Sonoma County Agricultural Preservation & Open Space District

Karen Gaffney spoke of a Sonoma County Board Request to engage watershed groups after the fires. On October 16, a group convened at the Sonoma Agricultural Preservation and Open Space District to build on County emergency response and the Watershed Emergency Response Team (WERT). The discussions were reported to the County Office of Recovery and Resiliency. The meeting included 175 people from over 65 organizations.

Watershed Collaborative Overall Priorities

- Support landowners and land managers in assessing and mitigating watershed impacts from the 2017 North Bay fires
- Increase community awareness and preparedness for living in fire-prone landscapes
- Evaluate the response of natural and working lands to the fires to inform recovery, vegetation management, and fire-preparedness efforts
- Identify and implement practices – including land conservation, fuel-load management – that maximize the resiliency of natural and working lands to climate change and future disasters
- Ensure long-term attention to community and ecosystem resiliency through policy, long-term funding, and established working groups
- Permanently protect a network of lands that support biological diversity through changing climate conditions and prevent development in high risk areas
- Prioritized Compilation/Not Consensus

Headwaters restoration and recovery in the Wine County Fire Zone:
Lisa Micheli, Pepperwood Foundation

Lisa Micheli said the Pepperwood Foundation Mission: is to apply advance science-based conservation science in the region and beyond. Through its new Dwight Center for Conservation Science 3200-acre reserve in Mayacamas, Pepperwood has partnered with the California Academy of Sciences.

Adaptive Management Planning Goals

- Create a living document to serve as a road map for current and future managers of Pepperwood's land, water, and wildlife (2016)
- Integrate indigenous perspectives into understanding the history of this land and planning for its future
- Demonstrate parcel-scale climate smart management using the Terrestrial Biodiversity and Climate Change Collaborative's (TBC3's) applied climate science tools
- Maintain ecosystem functions and habitat connectivity, while allowing for landscape characteristics and species composition to adjust in response to an increasingly variable climate

Pepperwood's preserve-wide management strategy

- Maintain Hydrologic Connectivity and Promote Drought Resilience
- Minimize soil compaction and extent of impervious surfaces
- Minimize soil erosion by avoiding concentrating flow around trails or roads and treating eroding roads and trails
- Minimize impacts to riparian vegetation Increase infiltration and soil moisture holding capacity by increasing soil carbon content and porosity through conservation grazing and native grass restoration
- Protect springs and perennial water sources
- Minimize vehicular soil compaction by prohibiting travel on wet roads or soils
- Conserve water from our wells and other infrastructure
- Minimize in-stream pollutants including nitrogen, bacteria, excess sediments, water temperature impacts

What is meaningful to evaluate in the field to improve our empirical understanding of fire impacts on local watersheds?

The research undertaken by the Pepperwood Foundations includes capturing the complexity of rainfall distributions, stream depth, and soil moisture and assessing of patterns of increased aridity for ecological applications. In studies of pre-fire conditions, they look at the dynamics of groundwater in fractured bedrock systems, the variability of spring flows, the significance of fog to water balance, and the impact of their Conservation Grazing and Forest Management programs to hydrology.

Pepperwood studies include the questions:

- Did pre-fire treatments make any difference?
- What is meaningful to assess in the field?
- How are our watersheds projected to respond in terms of runoff and erosion?
- What is meaningful to evaluate in the field to improve our empirical understanding of fire impacts on local watersheds?
- How does fire affects soil characteristics: sealing and hydrophobicity?
- How do Northern California watersheds respond after wildfires?
- How severely did the 2017 Northern CA fires affect soil hydrologic properties?
- When do burned watersheds return to their reference runoff conditions? How does this vary with ecologic community/parent material?
- What are the rainfall thresholds for processes that transport sediment, and what are the expected hill slope sediment loads to streams?
- What does soil hydrologic recovery look like?
- How do soil macro-pores (cracking, etc) impact recovery?
- What will be the net effect on fuel loads and risk of future fire? Flood risks? Drought resilience?
- Can we inform extreme event-smart strategies for rebuilding our community?

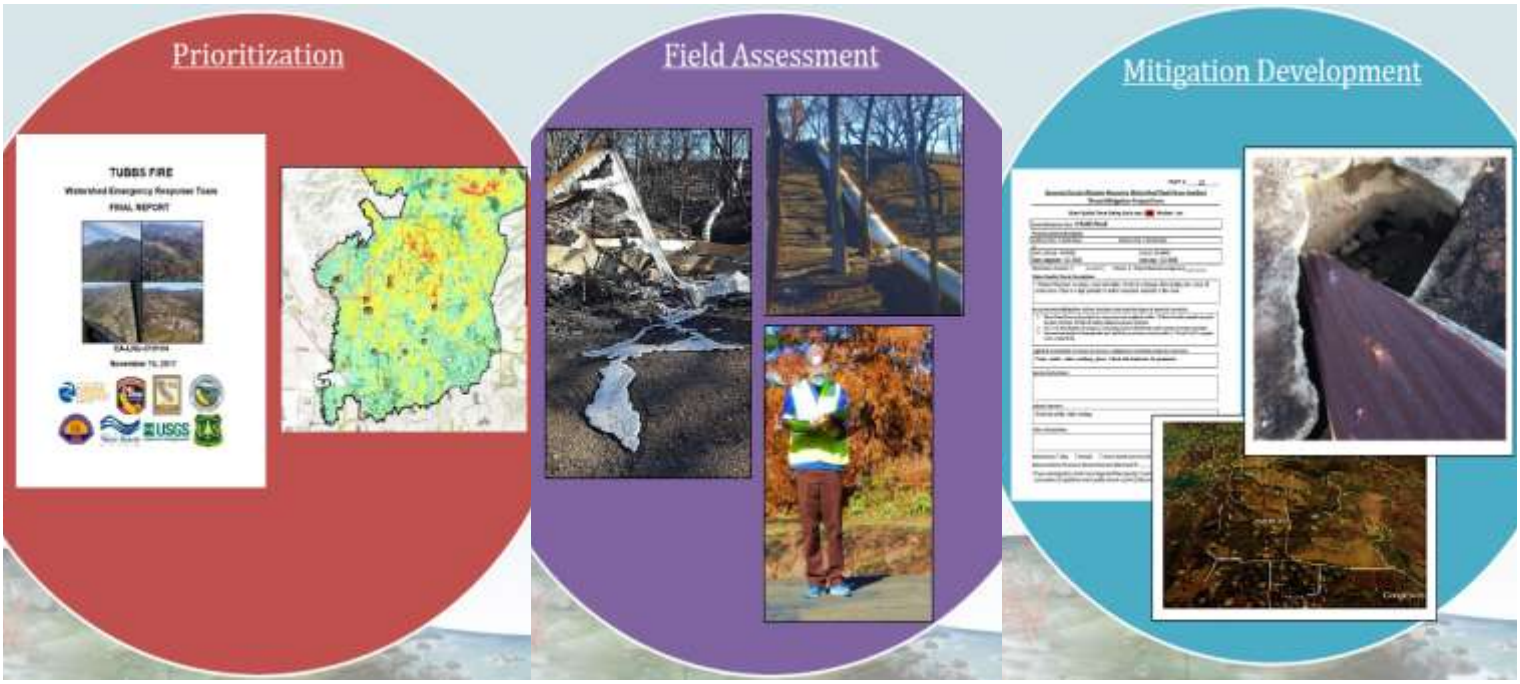
Responding to Water Quality Impacts: Mona Dougherty,
North Coast Regional Water Quality Control Board

Mona Dougherty reviewed the potential post-fire water quality impacts

- Aquatic habitat and sensitive aquatic life
- Drinking water supplies
- Fate and transport of debris

- ✓ Increased Sediment and Turbidity
- ✓ Elevated hardness, conductivity, and pH
- ✓ Total Organic Carbon
- ✓ Nutrients
- ✓ Metals
- ✓ PAHs
- ✓ Water Toxicity

The Emergency Services Act provides California Office of Emergency Services the authority to task state agencies to respond to local emergency needs. The task description calls for five teams of 2-3 personnel to do technical assessments to check for potential erosion and provide recommendations to minimize storm water pollutants.



Technical Specialists
•Cal FIRE Incident Command requested technical assistance
•Provided in the field guidance on the proper placement and configuration of erosion control
•Provided 2-3 teams per day

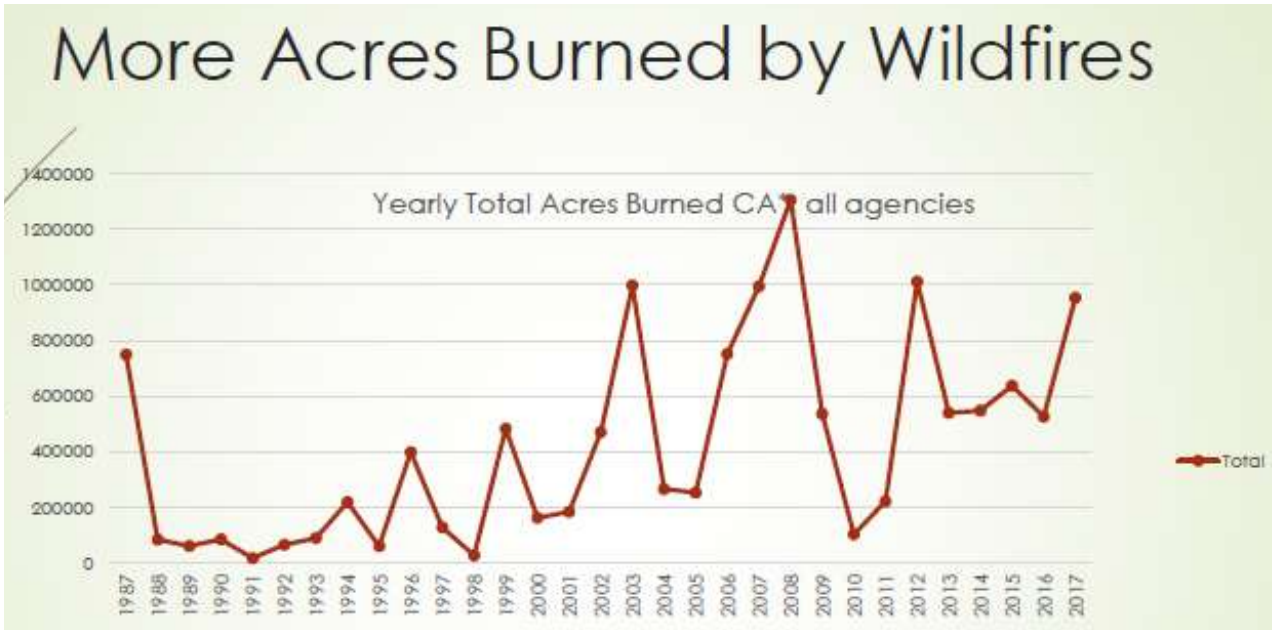
Coordination with City and County for Urban Areas

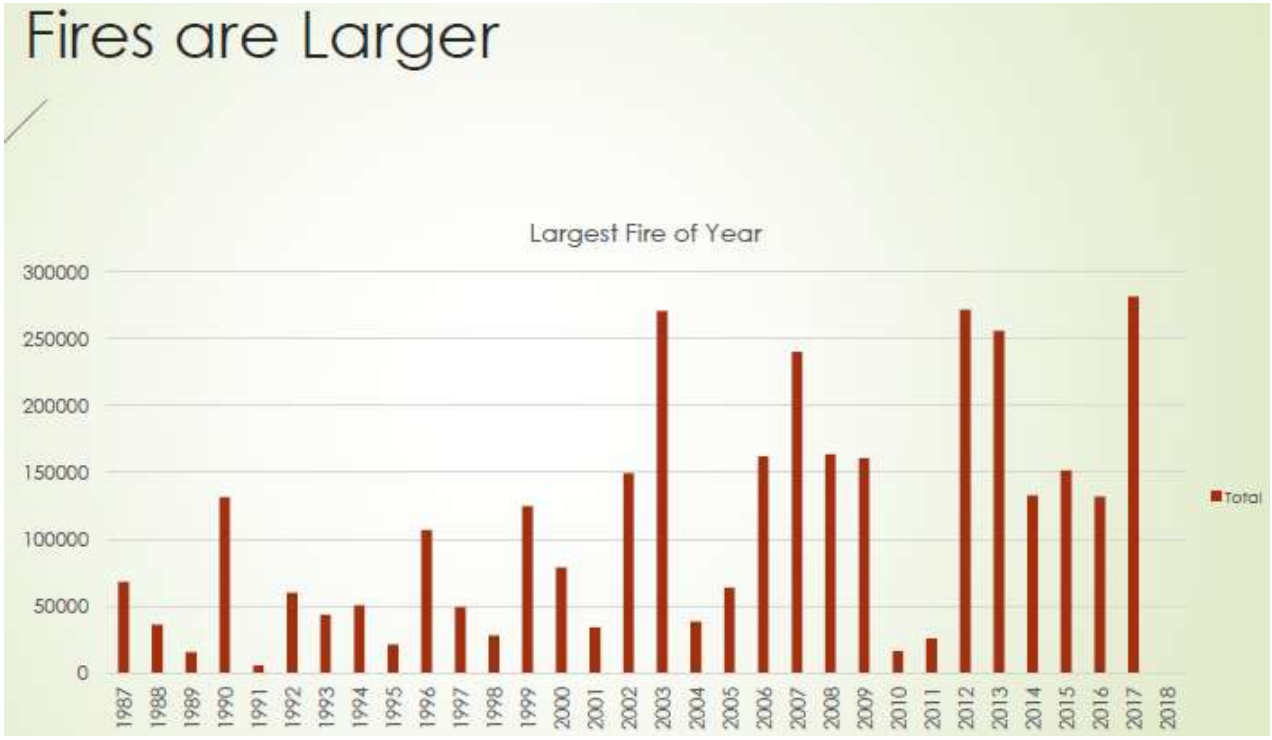
- Close coordination with City and County
    - City submits Early Action Plan
- Watershed Task Force Meetings
    - Most immediate threat: runoff from hardscape areas
- Directive letters for Compliance with Municipal Storm Water Permit

Dougherty said that near term monitoring and assessment has a focus on documenting water quality within burned areas during storm events particularly focus downstream of urban areas highly impacted by the fires. This helps detect acute hazardous discharges/toxicity and evaluate BMP effectiveness. Over the long-term, there is a collaborative process for assessing long-term impacts and identifying recovery actions. There are also increased sediment observations.

Wildfire, Watersheds, and Water Sustainability: Jeff TenPas, Burned Area Emergency Response, US Forest Service

Jeff TenPas said that there have been changes in fire regime and the watershed effects of fires. There is a longer, warmer fire season, larger fires and fires of greater severity, and these trends continue to go up.





TenPas said that changes in watershed impacts included l watersheds burned at higher severity, more frequent large scale erosion events, loss of soil, nutrients, water holding capacity, and soil productivity, debris flows, floods, more channel scour in higher order channels, less refugia for fish and riparian species, land more frequent disturbance.

US Forest Service Burned Area Emergency Response (BAER)

- Coordinated response with local, state, and federal agencies
    - Clarity on responsibilities
- Assessment of Values at Risk (VAR)
- USFS treatment of VAR on federal lands – the Forest Service expenditure authority is limited
- Treatments for watershed, roads and trails, endangered species, etc
- Many risks lie downstream

Post-Fire effects include reservoir sedimentation and shorter reservoir life, debris flow and flood damage to canals and water lines, temporary loss of water supply sources due to ash, wildfire disturbance adds to overall cumulative disturbance of fish and wildlife habitat, and there is less carbon sequestration

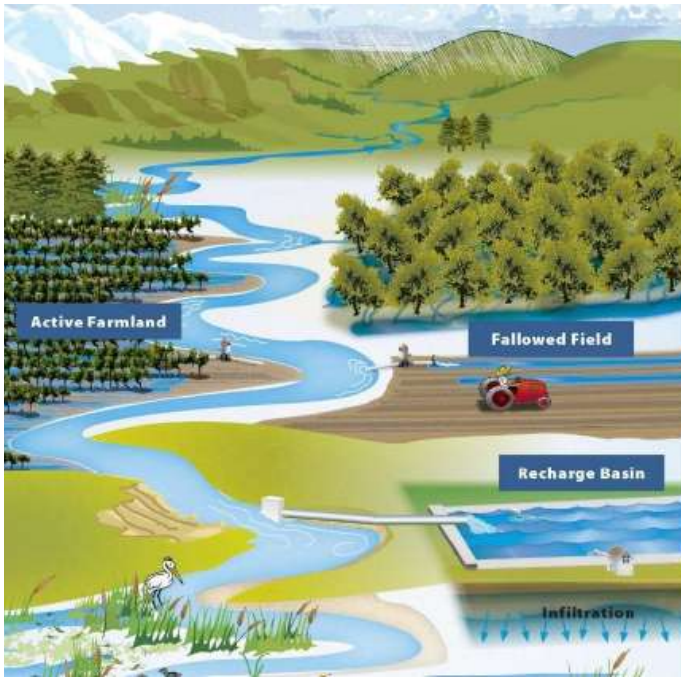
Adjourn: Reception at La Crema Winery

Day 2:

Panel 4: Partnerships on Sustainable Groundwater Management Moderator: Tim Parker [Session describes partnership between a number of agencies on sustainable groundwater for land subsidence, managed aquifer recharge, and groundwater management]

Flood Managed Aquifer Recharge: Philip Bachand, Bachand Associates

Philip Bachand outlined the Flood Managed Aquifer Recharge Concept and gave an example of a working on-farm recharge (OFR) demonstration project being conducted by NRCS, Terranova Ranch, Kings River Conservation District, UC Davis, and Bachand & Associates



Overlapping Technologies / Acronyms

- Recharge on Agricultural Lands – Primarily work has focuses on Central Valley
    - OFFCR – On Farm Flood Capture and Recharge
    - OFR – On Farm Recharge
    - AgMar – Agricultural Managed Aquifer Recharge
- Stormwater capture approaches – Work to date in Santa Cruz
- DSC-Mar – Distributed Stormwater Collection and Managed Aquifer Recharge
- Recharge on Working Landscapes: Agricultural, restored lands, etc…
    - FloodMAR – Flood Managed Aquifer Recharge

Examples of FloodMar and Related Studies:

- MAR, OFR and Groundwater Banking
    - UC Davis – Helen Dahlke, Thomas Harter, Graham Fogg et al.
- DSC (Distributed Stormwater Capture) – MAR:
    - UC Santa Cruz – Andrew Fisher et al
- Regional Tools and Integration / Climate Change / SGMA
    - Sustainable Conservation and Central Valley water districts
    - UC Water
    - NIFA San Joaquin Study – Bachand & Associates, Tetra Tech, UCM, UCD
    - GSAs
- OFR pilot projects and Groundwater / Surface Water Effects
- Sustainable Conservation, Bachand & Associates and collaborating farmers (e.g. hydrology, water quality, logistics, crop calendars, management practices, economics, agronomics)
    - Central Valley nut growers – pecans, walnuts, almonds
    - Santa Rosa Plain (e.g. Jackson Family Wines projects)
- FloodMAR guidelines, data gaps, integration in CA Water Plan
    - DWR and partners

Studied Topics
- •Hydrology
- •Agronomics
- •Logistics
- •Water Quality
- •Economics
- •Water Rights
- •CA Water System Reoperation

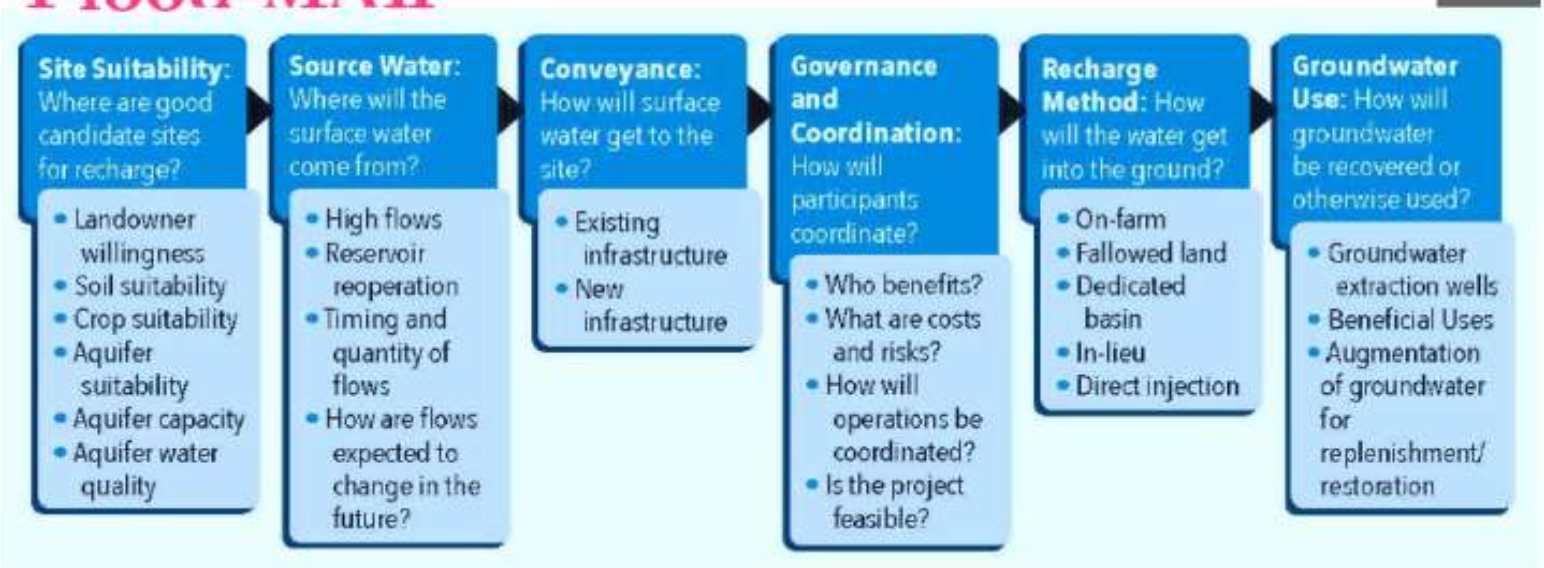
The McMullin Project:
Regional Scale Implementation at Significant Scale

The Key Players on the McMullin Project were:

- Technical / Private
  - Bachand & Associates – Technical Lead
  - Provost and Pritchard – Project Engineer, Permitting
  - Tetra Tech – CEQA, Groundwater Hydrology Lead
- Farmers and Local Agencies
  - Terranova Ranch – Agricultural Lead
  - Area Farmers
  - Kings River Conservation District – Phase 1 Project Manager, Phase 2 Partner
  - Raisin City Water District – Lead Partner, Phase 2, Funding Agency
  - McMullin GSA – Local GSA
  - James Irrigation District – Cooperator
  - District 1606 – Cooperator
  - Kings River Water Authority – Watermaster
- Non Profits
  - Sustainable Conservation – Outreach
- Federal and State
  - NRCS – Phase 2 funder, EQIP leader (Conservation)
  - DWR – Phase 1 funder (Flood Risk Reduction, Recharge)
  - CEQA – Army Corp, RWQCB, Caltrans, etc…
- Academic / Cooperative Extension
  - UC Davis – Soils management
  - UCCE – Nutrient Management

Factors for Implementing Flood-MAR

(DWR 2018, DRAFT)

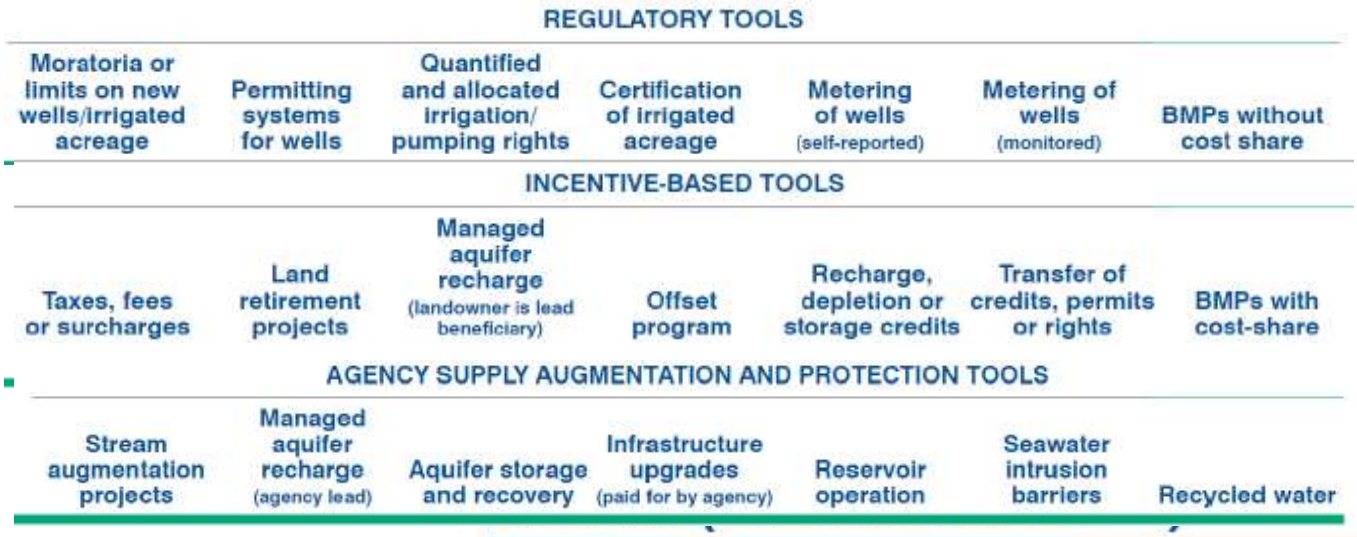


The Future of Groundwater in California: Lessons in Sustainable Management in the West: Christina Babbitt, Environmental Defense Fund

EDF'S Western Water Program as aimed at advancing sustainable groundwater management, planning for resilient ecosystems and communities, and creating healthy water trading programs.

Christina Babbitt said EDF is involved in nine groundwater case studies in the west, (in California they are at Kings Basin and the Orange County Water District. The studies reveal challenges that indicate that the Sustainable Groundwater Management Act (SGMA) has some undesirable results.

The tools used to address groundwater challenges can be regulatory, incentive-based, agency supply augmentation and protection, and education and outreach.



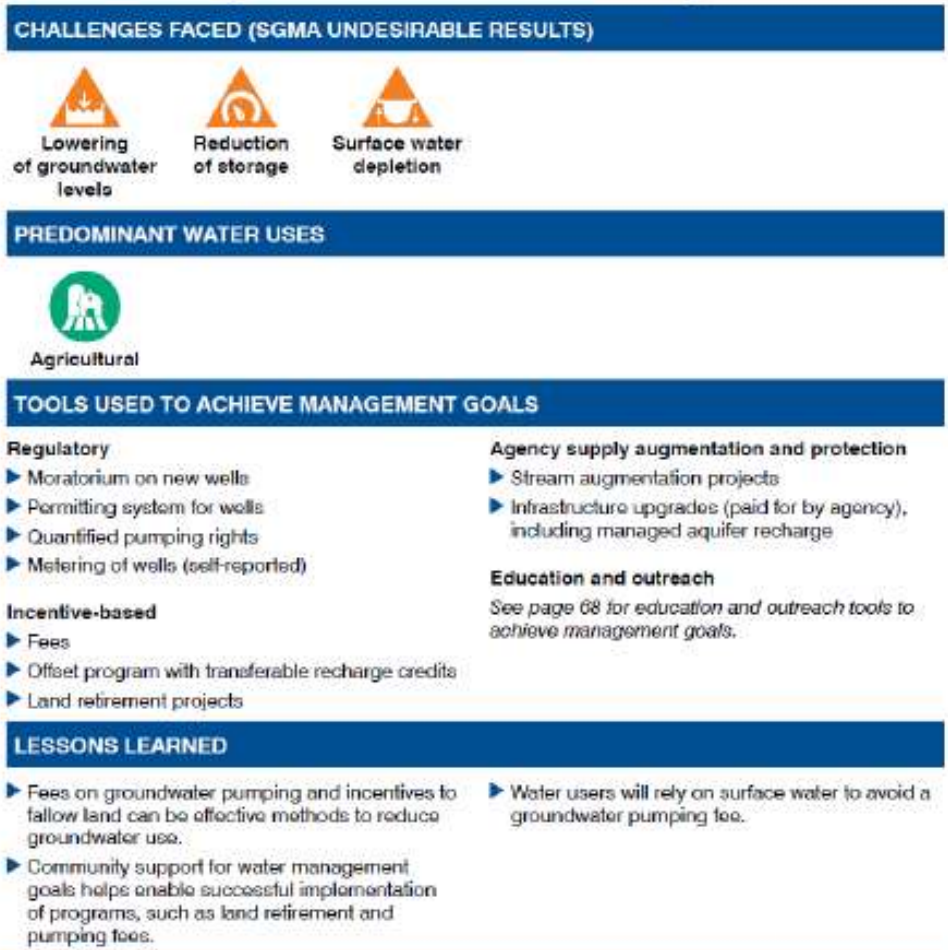
;

The lessons learned from the case studies

- Trust and Community Involvement
- Accurate Data
- A Portfolio of Approaches
- Assuring Performance
- Access to Adequate Funding

Report Link:

https://www.edf.org/ecosystems/future-groundwater-california



Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Melissa Rohde, The Nature Conservancy

Melissa Rohde said the mission of The Nature Conservancy is to conserve the lands and water on which all life depends. She defined groundwater-dependent ecosystems as ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface.

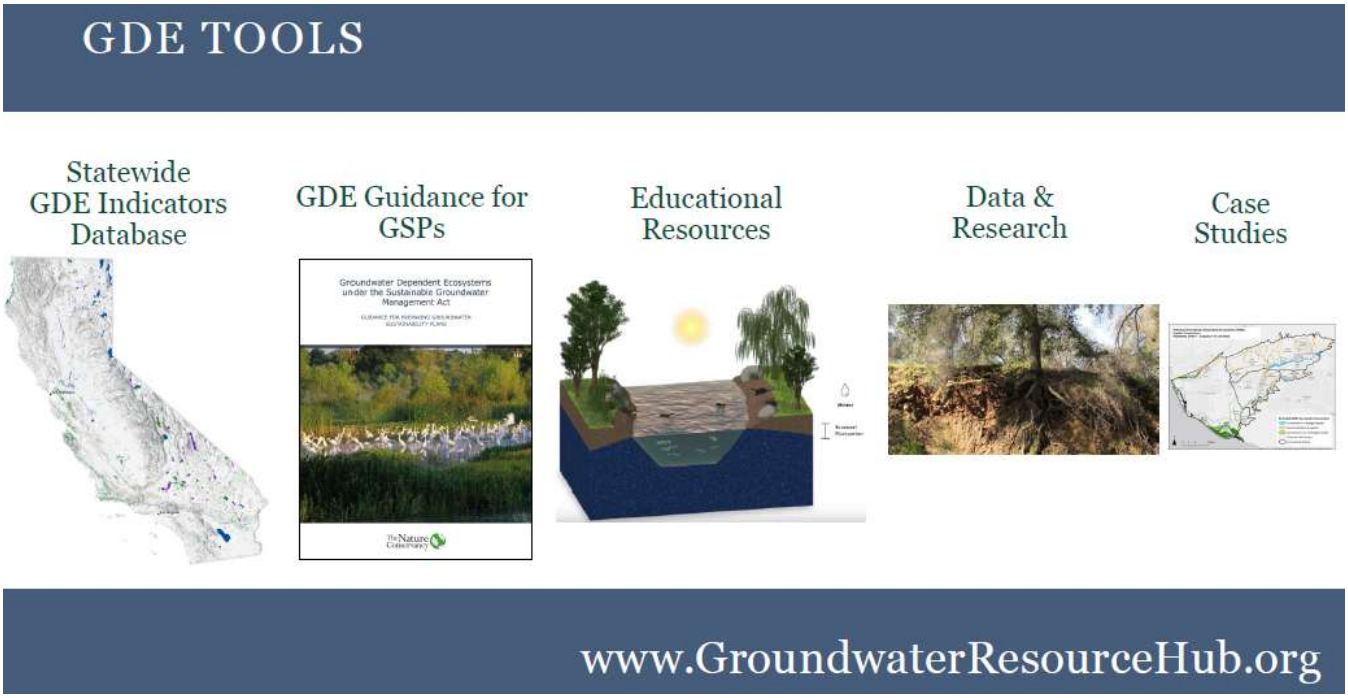
In some parts of California, less than 5% of Wetlands and less than 6% of habitat along rivers remain. In 50 years, nearly HALF of California native salmon, steelhead, and trout will be extinct.

Under the Sustainable Groundwater Management Act Groundwater Dependent Ecosystems (a beneficial use of groundwater) are a required element for Groundwater Sustainability Plans (GSPs). In the GSPs, the groundwater dependent ecosystems are identified and mapped, the potential effects due to groundwater conditions are described, and impacts due to groundwater conditions are monitored.

GDE GUIDANCE DOCUMENT

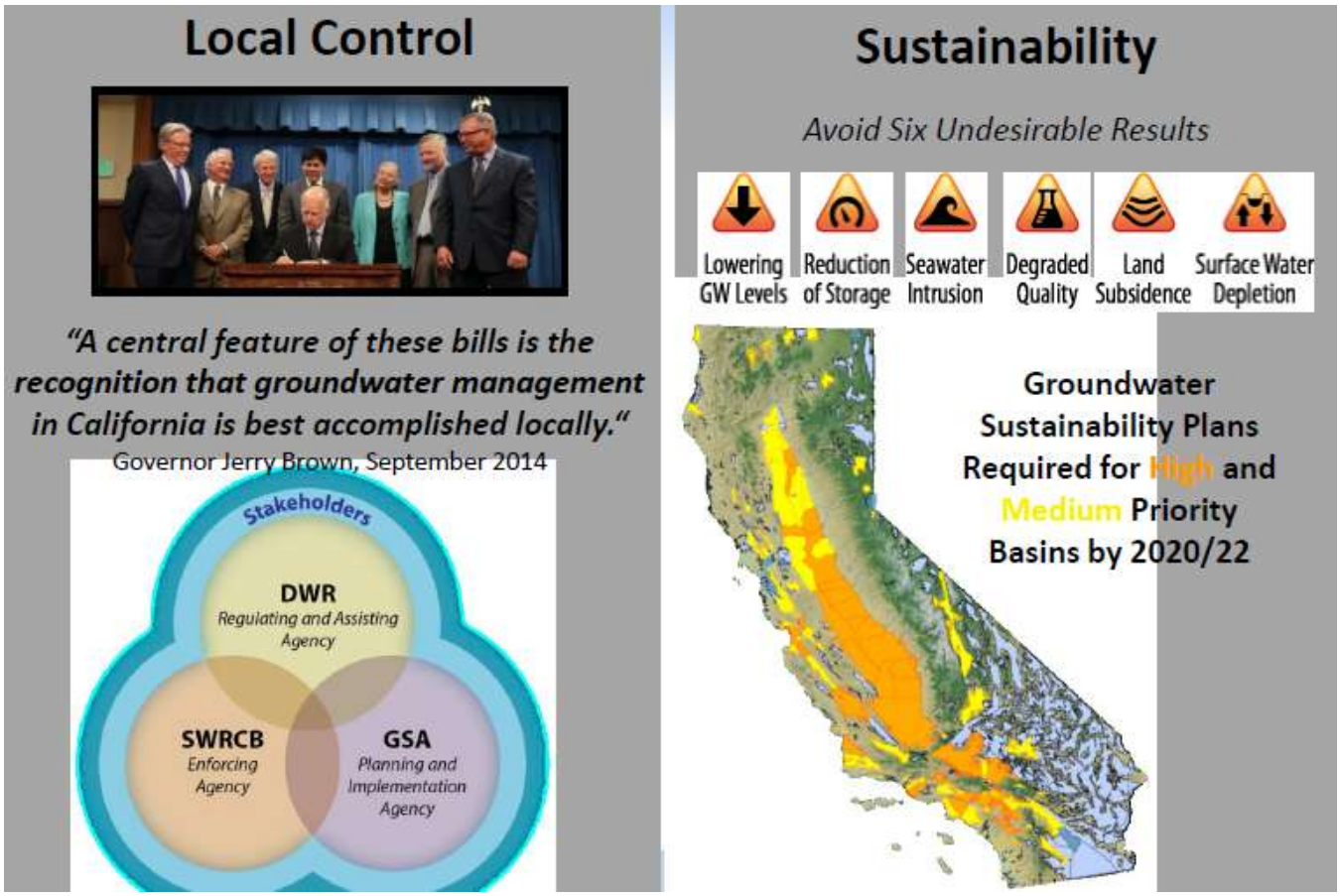
DESIGN PRINCIPLES:

1. Consistent with SGMA & GSP Regulations
2. Based on Best Available Science
3. Facilitate Local Control
4. Practical and Easy-To-Use



Groundwater Sustainable Management Criteria, Best Management Practices: Craig Altare, DWR

Craig Altare opened with a quick overview of the Sustainable Groundwater Management Act and sustainable management criteria.



Altare listed the undesirable results of unsustainable groundwater management practices:

- Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon….
- Significant and unreasonable reduction of groundwater storage
- Significant and unreasonable seawater intrusion
- Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies
- Significant and unreasonable land subsidence that substantially interferes with surface land uses
- Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water

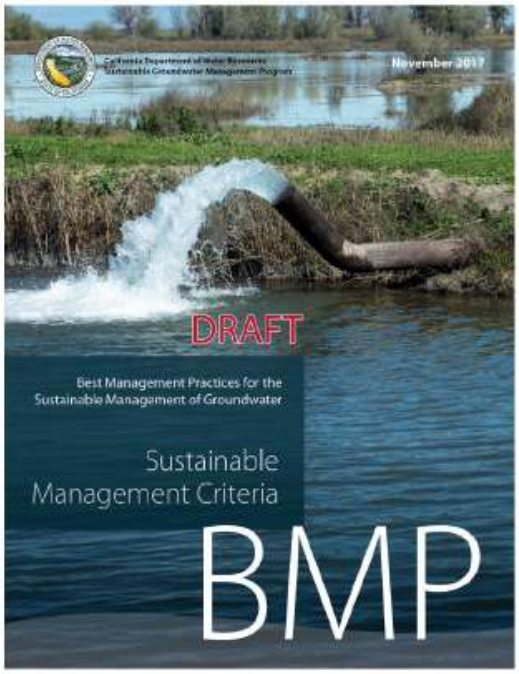
Groundwater Sustainability Plan Regulations contain requirements these nine items:

1. Introductory Provisions
2. Definitions
3. Technical and Reporting Standards
4. Procedures
5. Plan Contents
6. Department Evaluation and Assessment
7. Annual Reports and Periodic Evaluations by the Agency
8. Interagency Agreements
9. Alternatives

Sustainable Management Criteria BMP
Defining Sustainability

- SMC are the required, quantitative metrics that define sustainable management of a basin
- SMC are determined locally
- SMC support an outcome-driven process to achieving sustainability

- Sustainable Management Criteria
  - Sustainability Goal
  - Undesirable Results
  - Minimum Thresholds
  - Measurable Objectives
    - Interim Milestones



Plan Contents - Monitoring Networks

- Monitoring networks must include:
  - Monitoring objectives
  - Monitoring protocols
  - Data reporting requirements
- Must promote the collection of data of sufficient quantity, frequency, and distribution to characterize groundwater and related surface water conditions.
- Monitoring network must be able to evaluate changing conditions in the basin.

Plan Contents: Projects and Management Actions

- Realistic and sufficient projects and actions to achieve sustainability
- Developed to a level that demonstrates GSAs have the resources, knowledge, and stakeholder acceptance to implement them
- Known timeframe and general cost
- Projects do not need to be designed
- Supplemental plans and actions to address future uncertainties
- All projects and management actions do NOT have to be implemented just because they are listed in the GSP

Panel 5: Innovation, Technology, and Policy to Tap Multiple Benefits: Moderator: Robert Wilkinson, UC Santa Barbara and Martha Davis [Session describes new research and approaches to identifying and quantifying multiple benefits from integrated water management strategies]

Developing a Consistent Framework for Evaluating Multiple Benefits in Water Investments:

Sarah Diringer, Pacific Institute

Sarah Diringer told the participants that the project seeks to expand the usefulness, reach, and uptake of multiple benefit valuation by:

(1) Compiling social, economic, and environmental benefits of water management projects, and

(2) Developing a consistent framework and methodology to assess water management decisions

Project Goals and Outcomes

- State of Knowledge Report
- Framework and Methodology for Multi-Benefit Valuation
- Stakeholder Consensus Building
- Policy Mechanisms for Funding (and Co-Funding) Multi-Benefit Projects

Continuing Efforts and Outreach

- Advisory Group: Continue engaging to identify applications and advance the work
- State of Knowledge: Literature Review and Interviews
- Stakeholder Convening and Outreach: Integrating multi-benefit evaluation into decision-making; build consensus; opportunities for overcoming barriers.
    - Los Angeles, CA: June 19th
    - Minneapolis, MN: July 12th (following US Water Alliance, One Water Conference)
- Test Cases: Work closely with stakeholders to develop tools and resources for evaluating multiple benefits in water investments.

Sustainable Wine Growing and Wine Making: Allison Jordan, Wine Institute

Alison Jordan reported at the SWRR meeting that the Wine Institute has developed a sustainable business strategy for the wine industry. The California Code of Sustainable Wine Growing has 15 chapters covering 104 best practices with input from 140 vineyards.

|Sustainable business strategy
|Viticulture
|Soil Management
|Vineyard Water Management
|Pest Management
|Wine Quality
|Ecosystem Management
|Energy Efficiency
|Winery Water Conservation & Quality
|Material Handling
|Solid Waste Reduction & Management
|Environmentally Preferred Purchasing
|Human Resources
|Neighbors & Communities
|Air Quality

The participating vineyards practice a cycle of continuous improvement. They self-assess, interpret their performance, develop action plans, and implement change.

A third-party accredited auditor annually verifies that a vineyard or winery:

- Adopts sustainable practices based on Code
- Meets certification requirements including:
  - Meets prerequisite practices
  - Meets minimum score threshold
  - Measures & records performance metrics
  - Complies with crop protection material restrictions

WATER EFFICIENCY

100% developed comprehensive water management plans to optimize water use efficiency.

96% measured their water use using flow meters or other methods such as calculation based on duration.

88% used drip irrigation systems to deliver the optimum amount of water to each vine.

PEST MANAGEMENT

100% monitored for pests as part of an Integrated Pest Management program to prevent and manage pests responsibly.

100% explored low risk alternatives before applying pesticides and established buffer zones to protect sensitive areas.

86% used cultural practices, such as cover crops and leaf removal, to naturally manage pests and reduce the need for pesticides.

HEALTHY SOILS

100% allowed vegetation to grow in the vineyard, used cover crops and/or composted to improve soil health and structure.

90% used plant tissue analysis results to help make nutrient application decisions.

66% reduced or eliminated tillage to lower the rate of organic matter breakdown and improve soil structure.

ENERGY EFFICIENCY

88% reduced energy use through water pump improvements, which targeted the largest energy saving opportunity in the vineyard.

67% conducted an energy audit of the vineyard irrigation pump within the last five years.

56% tracked the fuel used and utilized practices and technologies to increase fuel efficiency.

Water Efficiency: Issues and Opportunities: Mary Ann Dickinson, Alliance for Water Efficiency

Mary Ann Dickinson listed some major issues and opportunities with regard to water efficiency:

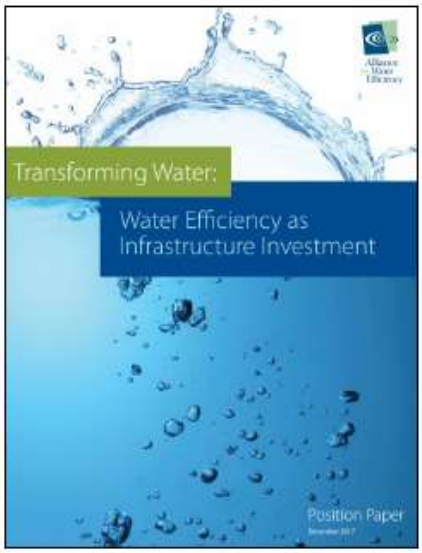
1. Water efficiency has multiple benefits
2. Water efficiency is cost effective but reduced water sales are helping rates rise
3. Water/Energy policy not connected
4. Water/Land Use not connected
5. Inconsistent public policy in general on water efficiency

Water Efficiency Benefits

- Drought: immediate savings during scarcity
- Planning: lessen gap between growing demand and dwindling water supply
- Environmental: provide base flows for streams and wetlands, sustainable GW
- Energy: reduce need for electricity with resulting reduction in greenhouse gases
- Economic: avoid higher expenses for supply or treatment
    - A quarter trillion dollars by the year 2020
    - Deferral of facilities will save millions

Transforming Water Report

- Evaluates the national economic benefit of water efficiency infrastructure investments
- Direct investment of $10 billion in water efficiency programs can boost U.S. GDP by $13 to $15 billion and boost employment by 120,000 to 260,000 jobs
- Could save between 6.5 and 10 trillion gallons of water, with resulting energy reductions



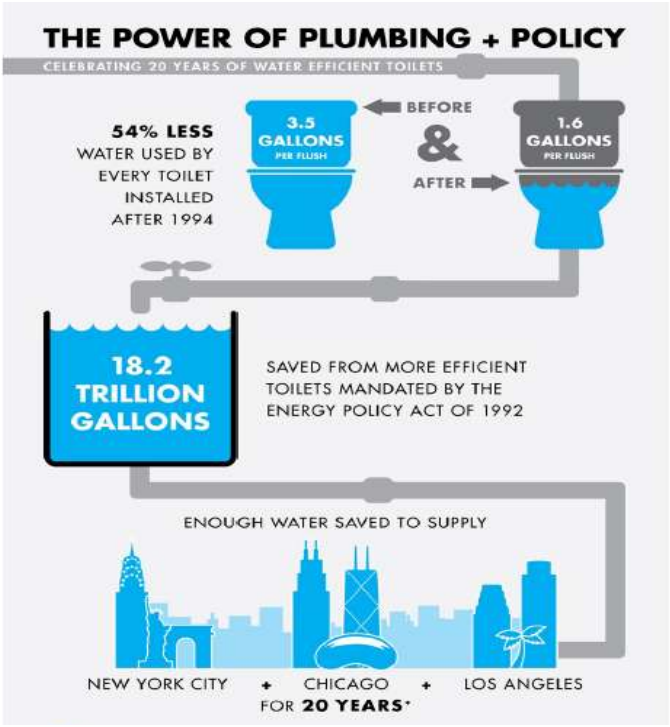
Dickinson said that there are significant energy savings from water conservation. Funding for the saved energy should go to water utilities -- not energy utilities -- if they funded it. The greenhouse gas reduction credit for the saved energy should also go to water utilities -- not energy utilities -- if they funded it.

Many cities are already challenged to meet customer demands for water. Growing population and economic growth will place even more pressure in arid and water-short areas. Water suppliers are reluctant to be involved in land use planning and customers are concerned about new development under restrictions.

Net Blue: Water-Neutral Growth

- National model template ordinance that can be tailored to create a customized water demand offset approach
- Worked with 7 partner cities across the country to develop approach
- Free Net Blue Toolkit

Investments in water efficiency are not federally tax-exempt. Income from water conservation rebates is federally taxable to the consumer, unlike energy efficiency rebates. Some states made conservation tax-exempt at the state level (e.g. California). Utility programs are affected by this since all rebate income totaling $600 or more in a calendar year must be declared in a 1099 at the end of the tax year. This is a problem because landscape transformation rebates (often known as "cash for grass" rebates) are popular, particularly in the arid West. Many individual consumers are now receiving much more than $600 a year and water utilities are realizing their federal tax obligations to mail 1099s to consumers. Consumer reaction has been very negative and this is a disincentive to customer participation in conservation programs.



Case Studies: One Water Solutions: Cynthia Koehler, Lindsay Rogers, WaterNow Alliance

Lindsay Rogers explained that the WaterNow Alliance is a network of local water leaders working to make sustainable, innovative, and affordable water solutions the new normal. The organization engages and educates leaders, advances policy solutions, and demonstrates success on the ground. They treat all water in communities – drinking water, storm water, wastewater – as part of a unified and integrated system.

There is great benefit in integrating green infrastructure to revitalize our communities. Many cities have combined sewer overflow challenges when storm water runoff overwhelms the sewer system. Lancaster, Pennsylvania has a 25-Year Plan to manage over 1,200 acres of impervious area. This will capture over 1 billion gallons of stormwater runoff over the long-term and save $2.8 million annually in energy, air quality, and climate related benefits and $660 thousand annually in reduced wastewater pumping and treatment.

Reclaimed water is also a key water conservation portfolio component. In Flagstaff, 50% of reclaimed water is used on golf courses, 8% is institutional use, 16% is industrial, 6% commercial use, and 6% municipal turf watering. One hundred percent of all wastewater generated is reused in the summer.

What was the motivator behind these projects? A serious problem needed to be solved:

- Regulatory requirements
- Water supply vulnerability
- Aging infrastructure

These cities chose OneWater, sustainable, multi-benefit solutions over traditional strategies.

What makes these One Water projects successful?

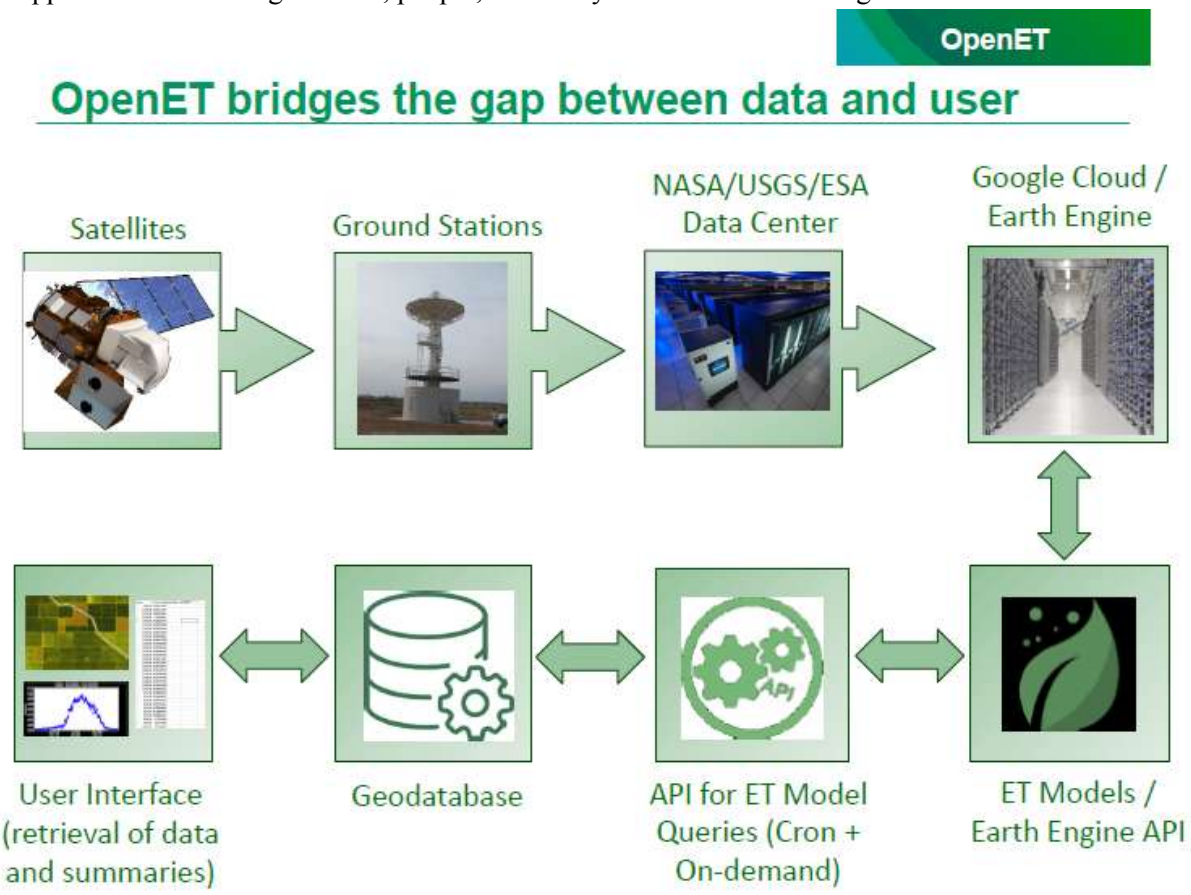
- Ability to break through silos
- Financing mechanisms for alternative infrastructure
- Availability of data to demonstrate cost-effectiveness
- Availability of data to demonstrate technical feasibility
- Willingness to establish sustainability objectives and targets
- Vision of local leaders to think outside of the box

Open Source ET data – Filling the Biggest Data Gap in Water Management: Robyn Grimm, EDF

Robyn Grimm said appropriate action is based on good data. Careful management requires careful measurement. Examples include urban conservation incentive programs and easement programs.

OpenET aims to provide open and easily accessible ET data for improved water management. Reliable and widely available ET data at the field scale can be used to:

1. Expand ET-based irrigation practices that maximize "crop per drop" and reduce costs for fertilizer and water.
2. Support trading programs that protect the financial viability of farms during droughts while insuring that water is also available for other beneficial uses.
3. Support other incentive programs that provide credit for water conservation efforts.
4. Develop more accurate water budgets and innovative management programs that ensure adequate supplies of water for agriculture, people, and ecosystems over the coming decades.



Program design consists of:

1. Project management, coordination, and outreach
2. Partnerships with Use Case Representatives and other stakeholders
3. Platform Development
4. Web Developer for User Interface

Water Data Integration through AB1755 - Michael Kiparsky, Wheeler Water Institute, Center for Law, Energy & the Environment, UC Berkeley School of Law

Michael Kiparsky said a lack of data and information has limited our ability to understand and manage our water resources. He summarized the work done at the Wheeler Institute, Berkeley School of Law on informing the implementation of California's Open and Transparent Water Data Act (AB1755) through research and engagement.

The report "Date for Water Decision Making" supports California's efforts to develop modern water data systems based on end users' needs. The report describes lessons learned from a process of stakeholder engagement focused on defining and clarifying uses of water data and how knowledge of these uses can inform the development of water data systems.

With better, more usable data informing water management, California's existing water resources could better meet urban, agricultural, ecological, and industrial needs. California's 2016 Open and Transparent Water Data Act (AB 1755) provides an important opportunity for improving the state of water data in California. The bill charges state agencies with integrating water and environmental data systems. However, the law itself does not ensure increased usability of data for decision making, which require a broader rethinking of data systems and the decision-making contexts in which they are embedded. This report makes the following recommendations:

1. To ensure relevance, an understanding of the way data is used in decision-making should guide the development of data systems.
2. A wide variety of data must be highly accessible and interoperable to serve many different contexts.
3. Data gaps and limitations take a variety of forms, including availability, accessibility, and usability, and will need to be filled in distinct ways.
4. For California water, an integrated data system will need to connect data from multiple independent sources, while keeping those independent systems as autonomous entities.
5. A water data system must address needs for data at multiple resolutions, and in multiple distinct forms and formats.
6. Ultimately, the goal is not only data provision; it is enabling the production of information (data that have been processed in such a way as to be useful).
7. Engagement between data system developers and end users is, ideally, an ongoing and iterative process.
8. Basing water data on principles of usability and stakeholder engagement requires robust cyber infrastructure, good governance, and stable funding.

Developing data and information in a useful and usable form requires not only resources; it requires substantial commitment to the processes of building relationships and working with stakeholders. The current momentum and collaborative efforts between agencies and stakeholders are encouraging progress towards actualizing data-driven decision making for California water.

Lynda Hopkins, Sonoma County Supervisor. Supervisor Hopkins welcomed the attendees to Sonoma County and described the importance of water to Sonoma County.

Lunch Speaker: Secretary Karen Ross, California Department of Food and Agriculture

Secretary Karen Ross began by addressing the students that had just filled the first row at the SWRR meeting. She said that the people working on sustainability were trying to hand the next generations a set of solutions for the world but that needed the help of young people. "We need your energy, your enthusiasm, your brain, and your willingness to tackle difficult challenges."

Secretary Ross summarized the importance of agriculture in California. The state's Mediterranean climate is one of five in the world and allows California to produce almonds, figs, avocadoes, artichokes and many other fruits and vegetables. The state produces a wider variety of agricultural products than any other state. California is the fourth largest wine producer in the world and supplies twenty per cent of all the milk that is produced in the United States.

Secretary Ross said we would like to pass this capability down through the generations. There are many challenges to agriculture in the state including those related to water resources and broad understanding of this makes is possible to have a conversation around sustainability with the farmers of California. They are showing a willingness to work together in a positive way on sustainability.

Secretary Ross thanked the participants in the Sustainable Water Resources Roundtable for convening a meeting on water topics in California.

Adjourn

Field Trip: Visit to site of Dry Creek stream restoration for habitat, and Truett Hurst Winery (a sustainable vineyard and winery).

Contact Information

SWRR Co-Chairs

Robert Wilkinson, Bren School of Environmental Science and Management, University of California, Santa Barbara, wilkinson@es.ucsb.edu

John Wells, 651-686-8615, John R. Wells and Associates, jrwells2411@gmail.com

SWRR Director

David Berry, 202-276-1081, davidberry@aol.com

Sustainable Water Resources Roundtable http://acwi.gov/swrr