



**Jacobs**

Challenging today.  
Reinventing tomorrow.

March 1, 2021 TAC Mtg

Agenda Item #8

# Sonoma Water Climate Adaptation Plan

TAC Briefing

March 1, 2021

# Sonoma Water Climate Adaptation Plan

- Sonoma County has experienced more “natural” system impacts than most regions in the past decade
- Climate variability and climate change will test the resiliency of systems in the region in the future
- *Sonoma Water’s Climate Adaptation Plan is a leading effort to improve understanding of climate change, identify and assess climate-related risks, and develop adaptation strategies to create more resilient systems*

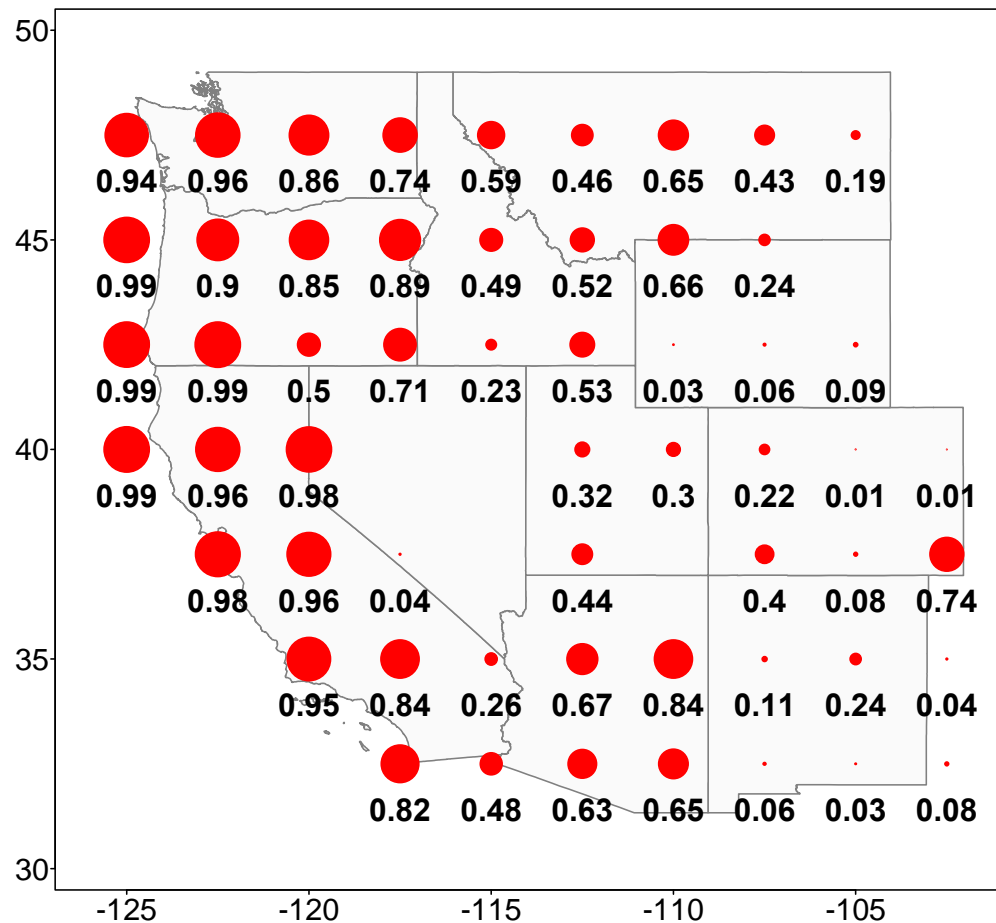


# Sonoma Water Leading Regional Climate Science and Understanding

- 15 years of innovative partnerships to advance climate science and understanding in the region
  - National Oceanographic and Atmospheric Administration (NOAA)
  - U.S. Geological Survey (USGS)
  - Lawrence Berkeley National Laboratories (LBNL)
  - Scripps Institution of Oceanography (SIO)
- Major climate drivers
  - Increasing temperatures
  - Extreme precipitation
  - Sea level rise
  - Flooding
  - Drought
  - Wildfire

# FLOODING – Atmospheric Rivers Drive Flood Damages

Proportion of Economic Losses Due to ARs



County	AR proportion of insured losses	Claims	Insured losses (\$m)	Total damages (\$b)	AR damages (\$b)
<b>Sonoma, CA</b>	<b>0.998</b>	<b>6650</b>	<b>172.0</b>	<b>5.2</b>	<b>5.2</b>

T. Corringham, 2018

# WILDFIRES – North Coast is Highly Vulnerable to Wildfires

**Top 20 Largest California Wildfires**

	<i>FIRE NAME (CAUSE)</i>	<i>DATE</i>	<i>COUNTY</i>	<i>ACRES</i>	<i>STRUCTURES</i>	<i>DEATHS</i>
1	<b>AUGUST COMPLEX</b> <i>(Under Investigation)*</i>	August 2020	Mendocino, Humboldt, Trinity, Tehama, Glenn, Lake, & Colusa	1,032,649	935	1
2	<b>MENDOCINO COMPLEX</b> <i>(Under Investigation)</i>	July 2018	Colusa, Lake, Mendocino & Glenn	459,123	280	1
3	<b>SCU LIGHTNING COMPLEX</b> <i>(Under Investigation)*</i>	August 2020	Stanislaus, Santa Clara, Alameda, Contra Costa, & San Joaquin	396,624	222	0
4	<b>CREEK FIRE</b> <i>(Under Investigation) *</i>	September 2020	Fresno & Madera	377,693	853	0
5	<b>LNU LIGHTNING COMPLEX</b> <i>(Under Investigation)*</i>	August 2020	Sonoma, Lake, Napa, Yolo & Solano	363,220	1,491	6
6	<b>NORTH COMPLEX</b> <i>(Under Investigation)*</i>	August 2020	Butte, Plumas & Yuba	318,930	2,352	15
7	<b>THOMAS</b> <i>(Powerlines)</i>	December 2017	Ventura & Santa Barbara	281,893	1,063	2
8	<b>CEDAR</b> <i>(Human Related)</i>	October 2003	San Diego	273,246	2,820	15
9	<b>RUSH</b> <i>(Lightning)</i>	August 2012	Lassen	271,911 CA / 43,666 NV	0	0
10	<b>RIM</b> <i>(Human Related)</i>	August 2013	Tuolumne	257,314	112	0
11	<b>ZACA</b> <i>(Human Related)</i>	July 2007	Santa Barbara	240,207	1	0
12	<b>CARR</b> <i>(Human Related)</i>	July 2018	Shasta County & Trinity	229,651	1,614	8
13	<b>MATILJA</b> <i>(Undetermined)</i>	September 1932	Ventura	220,000	0	0
14	<b>WITCH</b> <i>(Powerlines)</i>	October 2007	San Diego	197,990	1,650	2
15	<b>KLAMATH THEATER COMPLEX</b> <i>(Lightning)</i>	June 2008	Siskiyou	192,038	0	2
16	<b>MARBLE CONE</b> <i>(Lightning)</i>	July 1977	Monterey	177,866	0	0
17	<b>LAGUNA</b> <i>(Powerlines)</i>	September 1970	San Diego	175,425	382	5
18	<b>SQF COMPLEX</b> <i>(Lightning)</i>	August 2020	Tulare	170,384	228	0
19	<b>BASIN COMPLEX</b> <i>(Lightning)</i>	June 2008	Monterey	162,818	58	0
20	<b>DAY FIRE</b> <i>(Human Related)</i>	September 2006	Ventura	162,702	11	0

There is no doubt that there were fires with significant acreage burned in years prior to 1932, but those records are less reliable, and this list is meant to give an overview of the large fires in more recent times.

This list does not include fire jurisdiction. These are the Top 20 regardless of whether they were state, federal, or local responsibility.

\*Numbers not final.



# Examples of Sonoma Water's On-Going Efforts on Adaptation

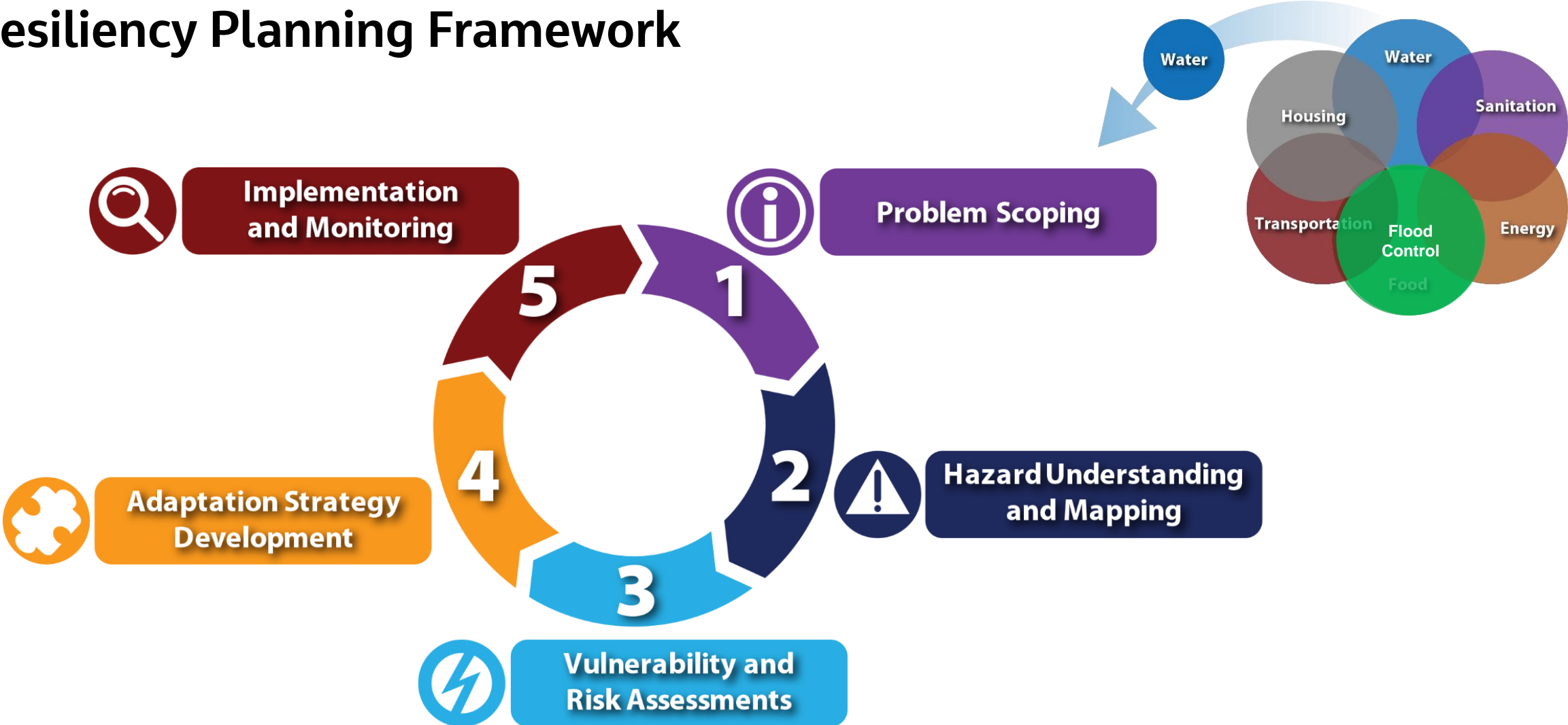
- Partnering with Center for Western Weather and Water Extremes (CW3E), USGS, and NOAA for Climate Science
- Forecast Informed Reservoir Operations (FIRO)
- Advanced Quantitative Precipitation Information (AQPI)
- Fire Camera Alert System (AlertWildfire)
- NOAA Habitat Blueprint Adaptive Management and Restoration
- Local Hazard Mitigation Plan (LHMP)
- Climate Adaptation Plan (CAP)
- Water Supply Resiliency Study
- Central Sonoma Watershed Project Vulnerability Assessment
- Sonoma OneRain Network

# Sonoma Water's Climate Adaptation Plan

Guide Sonoma Water's assessment of climate risks to water supply, sanitation, and flood control infrastructure and operations, and to serve as a roadmap for developing, evaluating, and implementing adaptation strategies to improve the resilience of the Sonoma Water's systems



# Resiliency Planning Framework





# Projected Climatic and 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

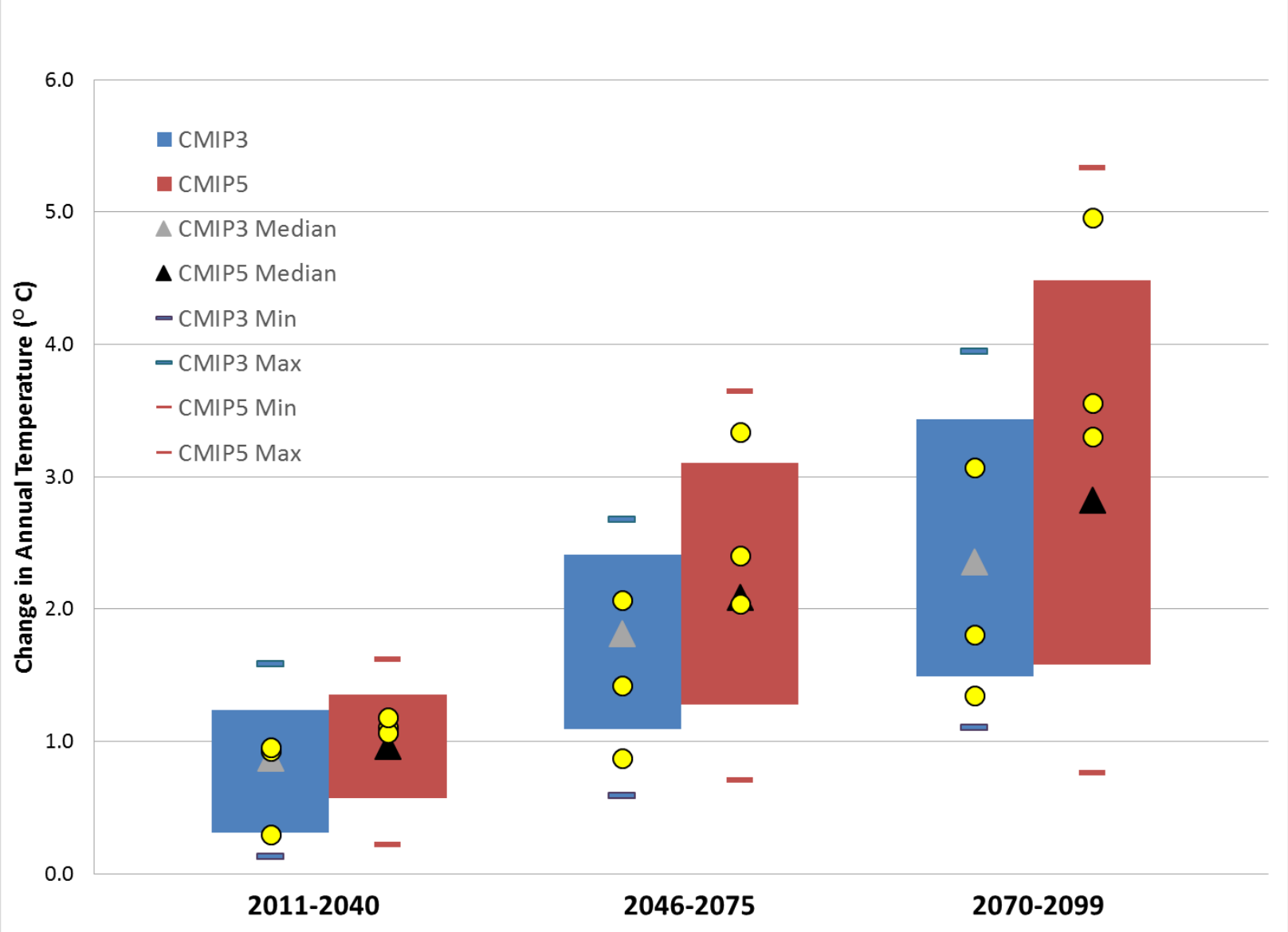
- More frequent and intense wildfires due to warmer temperatures and drier conditions
- Increase in probability of wildfires by 15-33%



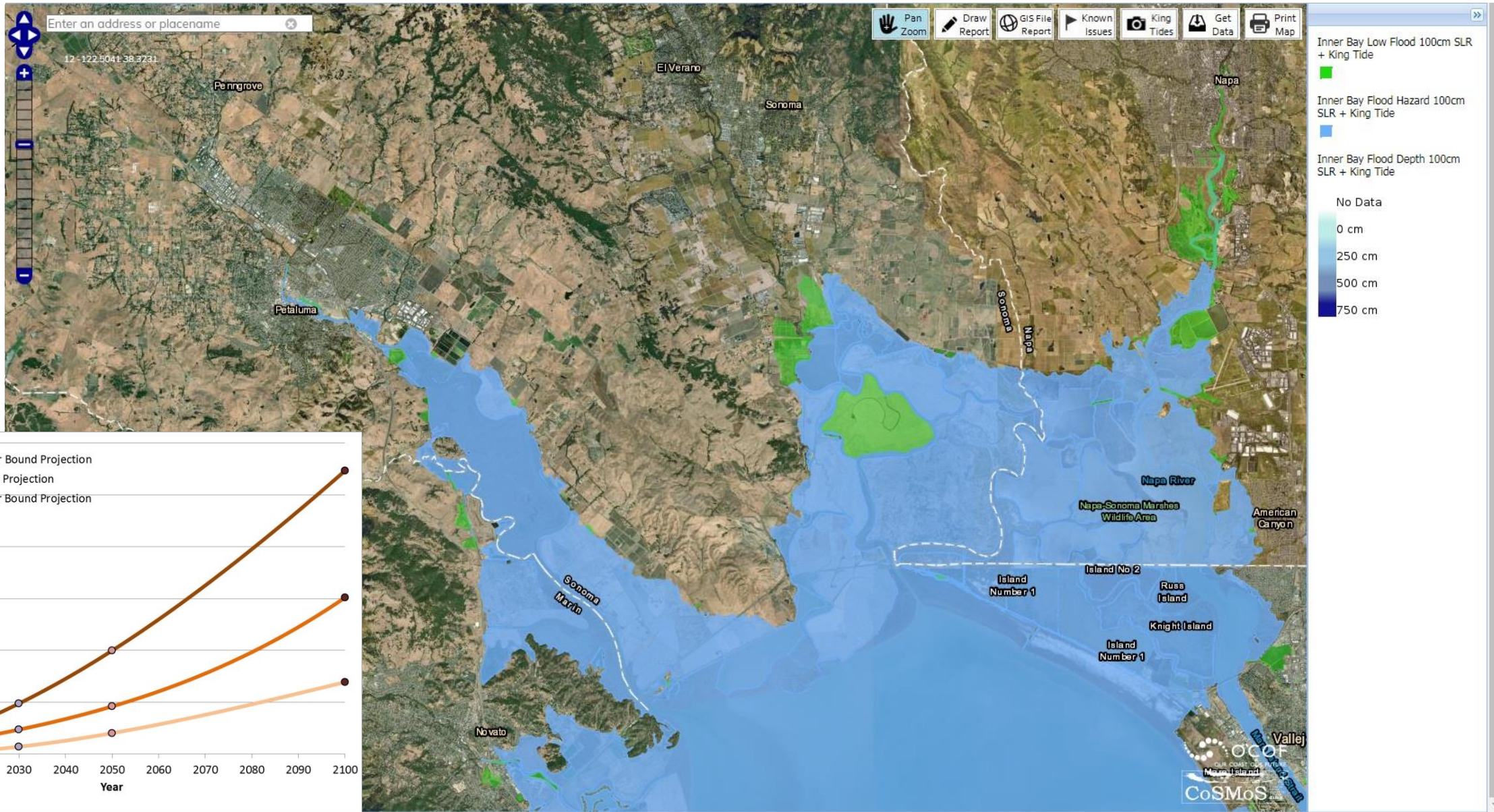
## River Flooding

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

# Projected Increases in Temperature

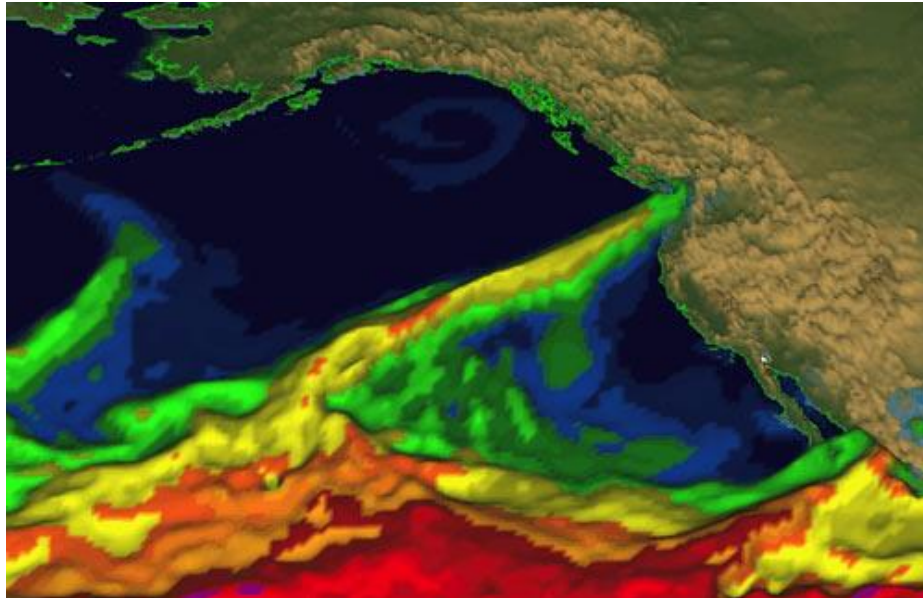


# Projected Sea Level Rise

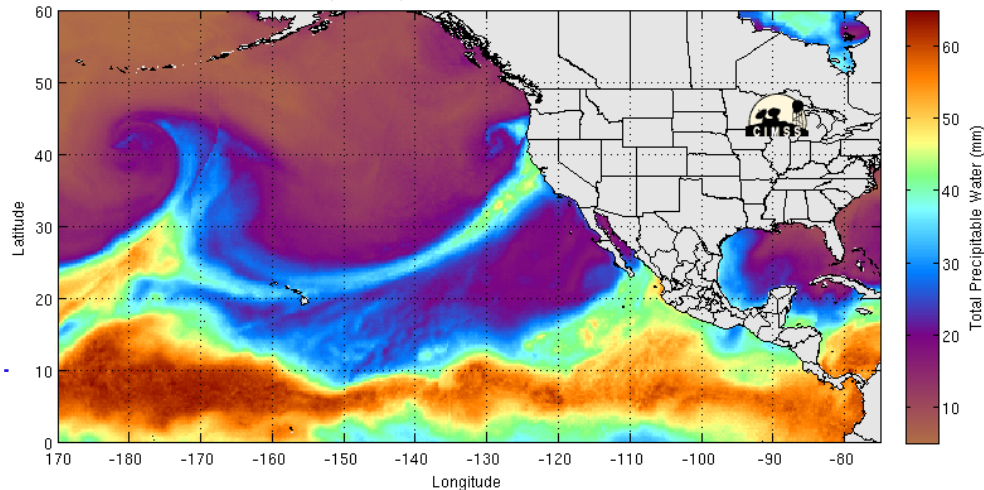


# Increasing Precipitation Extremes

Landfalling Atmospheric Rivers



Morphed composite: 2014-12-11 11:00:00 UTC



Mid Future Period (2046-2075)  
Change in Extreme Precipitation

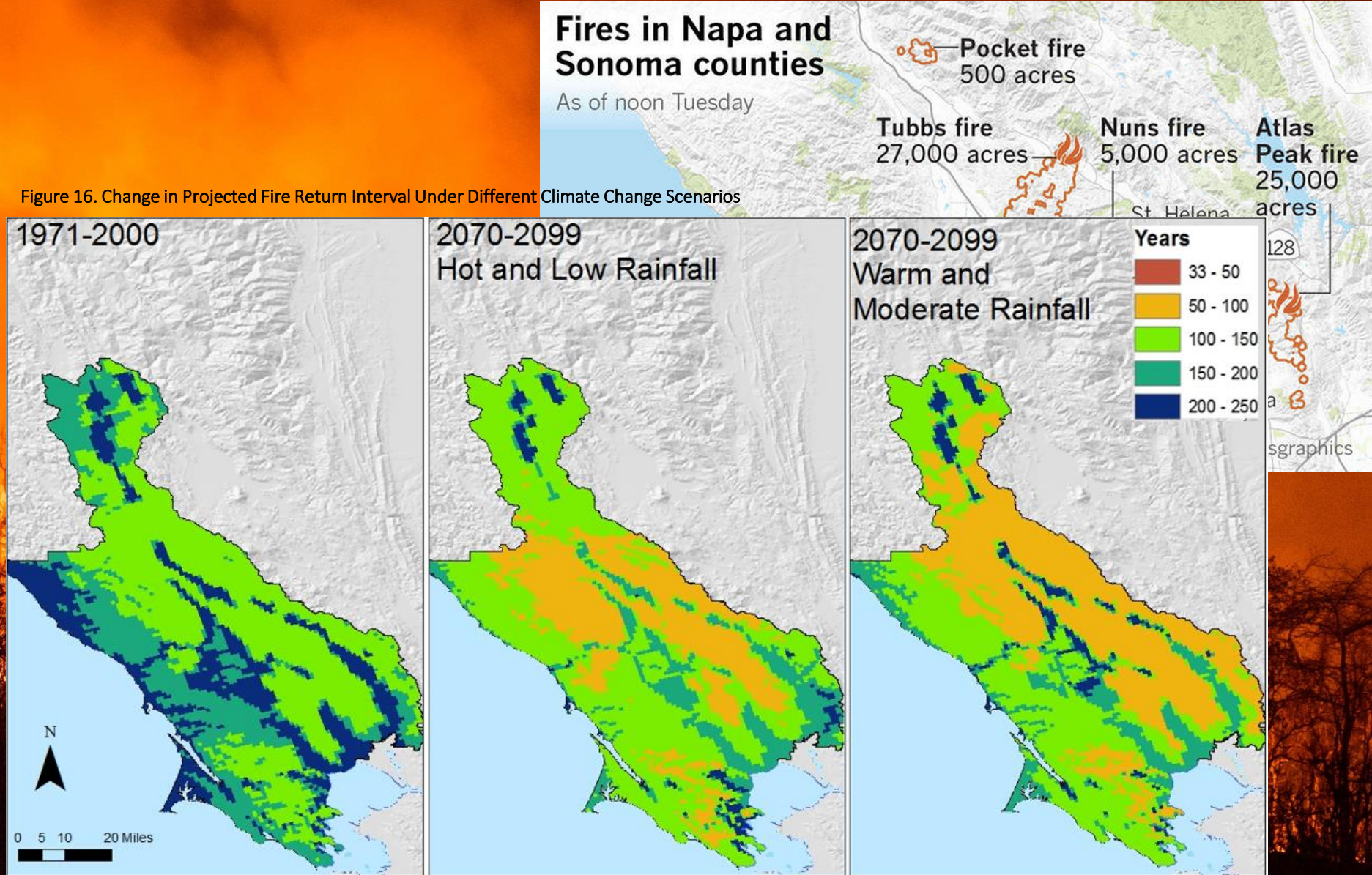
Return Period (Years)	Percentile				
	10th	33th	50th	66th	90th
1.11	-3.5%	1.9%	2.7%	10.9%	25.4%
1.25	-1.9%	3.6%	4.5%	12.7%	27.5%
2	0.5%	6.1%	7.0%	15.5%	30.6%
5	2.1%	7.9%	8.8%	17.4%	32.7%
10	2.8%	8.7%	9.5%	18.2%	33.7%
25	3.4%	9.3%	10.2%	18.9%	34.4%
50	3.8%	9.6%	10.5%	19.3%	34.9%
100	4.0%	9.9%	10.8%	19.6%	35.2%

# Increasing Fire Risk and Water Quality Impacts

## Fires in Napa and Sonoma counties

As of noon Tuesday

Figure 16. Change in Projected Fire Return Interval Under Different Climate Change Scenarios



# System-Wide Vulnerability Assessment

## Climate Threats



Temperature



Sea Level Rise



Precipitation



Drought



Wildfire



River Flooding

## Systems

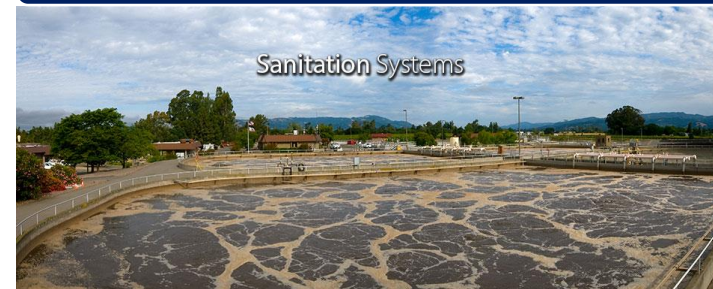
### Water Supply



### Flood Control



### Sanitation



# Vulnerability & Risk Assessment

$$\text{Vulnerability} = \text{Sensitivity} \times \text{Adaptive Capacity}$$

$$\text{Risk} = \text{Consequence} \times \text{Likelihood}$$

## Consequence





- System Function
- Social
- Governance
- Financial

## Likelihood

- Degree of confidence climate projections

		Sensitivity				
		Low = 1	Moderate/Low = 2	Moderate = 3	Moderate/High = 4	High = 5
Adaptive Capacity	Low = 1	L	M/L	H	H	H
	Moderate/Low = 2	L	M	M/H	H	H
	Moderate = 3	L	L	M	M	H
	Moderate/High = 4	L	L	L	M	M
	High = 5	L	L	L	L	M

		Consequence				
		Negligible = 1	Minor = 2	Moderate = 3	Major = 4	Severe = 5
Likelihood	Very Likely = 5	L	M	H	H	H
	Likely = 4	L	M	M	H	H
	Moderate = 3	L	L	M	M	H
	Unlikely = 2	L	L	L	M	M
	Very Unlikely = 1	L	L	L	L	M

-  Low Risk
-  Special Case
-  Moderate Risk
-  High Risk

# Major Vulnerabilities – Water Supply System

Facility/Asset	Temp	Sea Level Rise	Extreme Precip	River Flooding	Drought	Wildfire
Mirabel Diversion Facilities				H	M	H
Wohler Diversion Facilities				H	M	H
Wohler Chlorination and Corrosion Control			M/H	M/H		M/H
Mirabel Chlorination and Corrosion Control			L	L		L
River Road Chlorination			M/H	H		
Ely Booster			H			
Kawana Booster			M			
Upper Russian River Supply (Watershed and Lake Mendocino)	M				M	M
Lake Sonoma	M				M	M



# Adaptation Strategy Workshops - Generating Ideas to Address Vulnerabilities

- Focused Workshops with Agency Staff
  - Water Supply
  - Flood Management
  - Sanitation
- Addressed High/Moderate Vulnerable Areas
- Broad Collection of Ideas
  - Over 250 initial/concepts collected from workshops
  - Synthesis produced about 80 project concepts

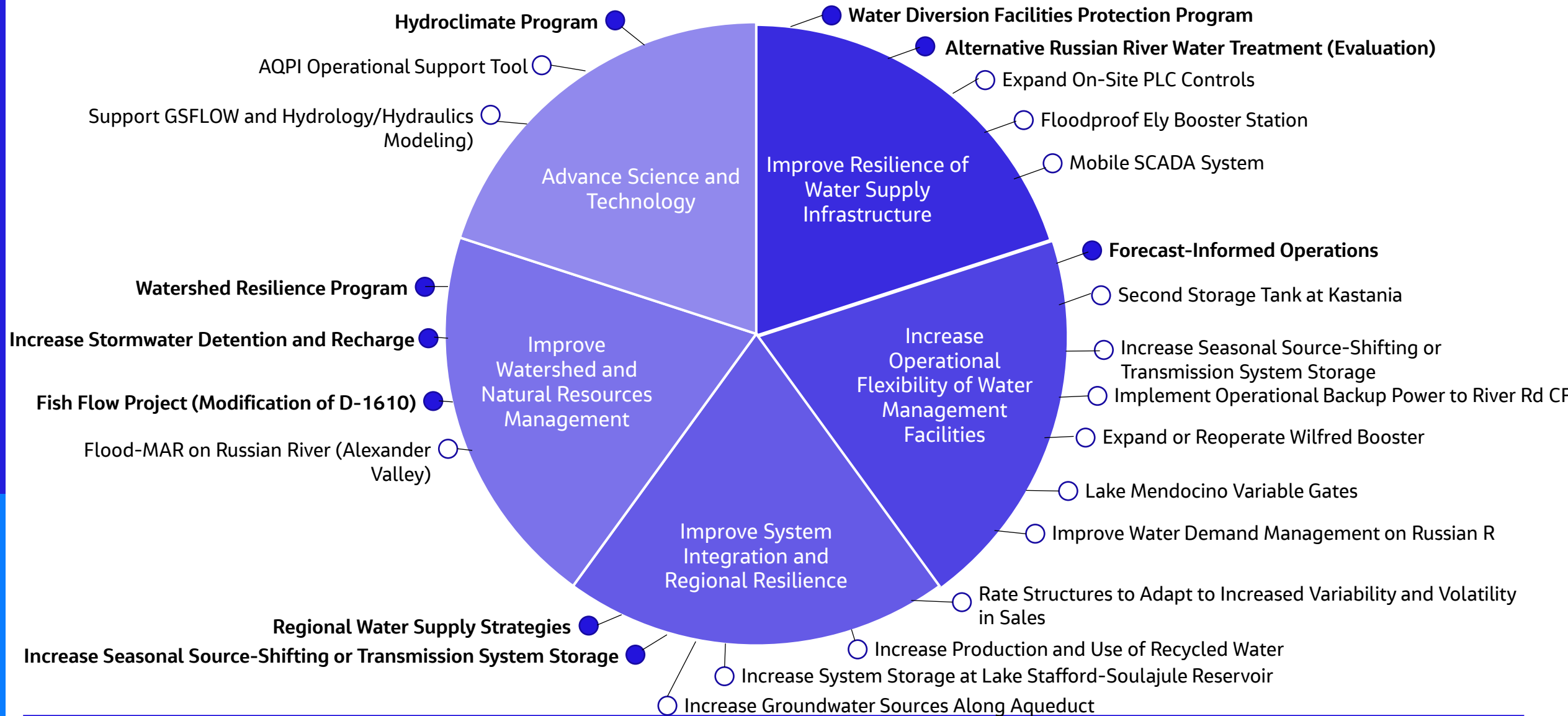


# Best Performing Projects form Basis for Portfolios

- **Anchor** project concept for each major action
  - Moves the needle on climate adaptation
  - Governed or substantially directed by Sonoma Water
  - Targeted funding sources
- **Supporting** concepts to help achieve action goals
  - Synergistic with anchor project
  - Diversity of concepts
    - Early, low regret concepts
    - Long-term, robust concepts
    - Long-term, contingent concepts?
  - Blended jurisdictions
    - Sonoma Water directed
    - Partnerships



# A Water Supply Portfolio to Achieve Adaptation Strategies



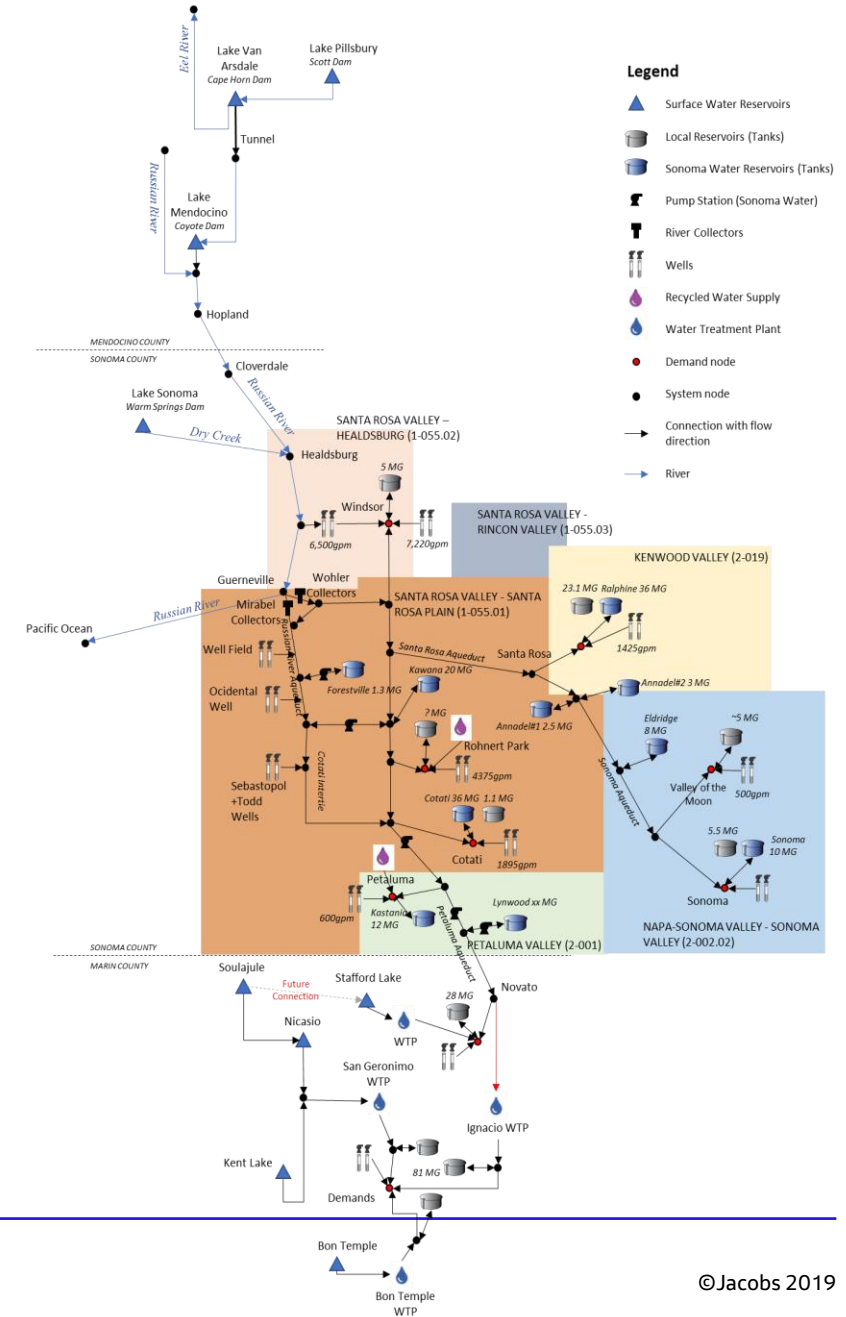
- Anchor Project/Program
- Supporting Project

# Some Integrated Concepts

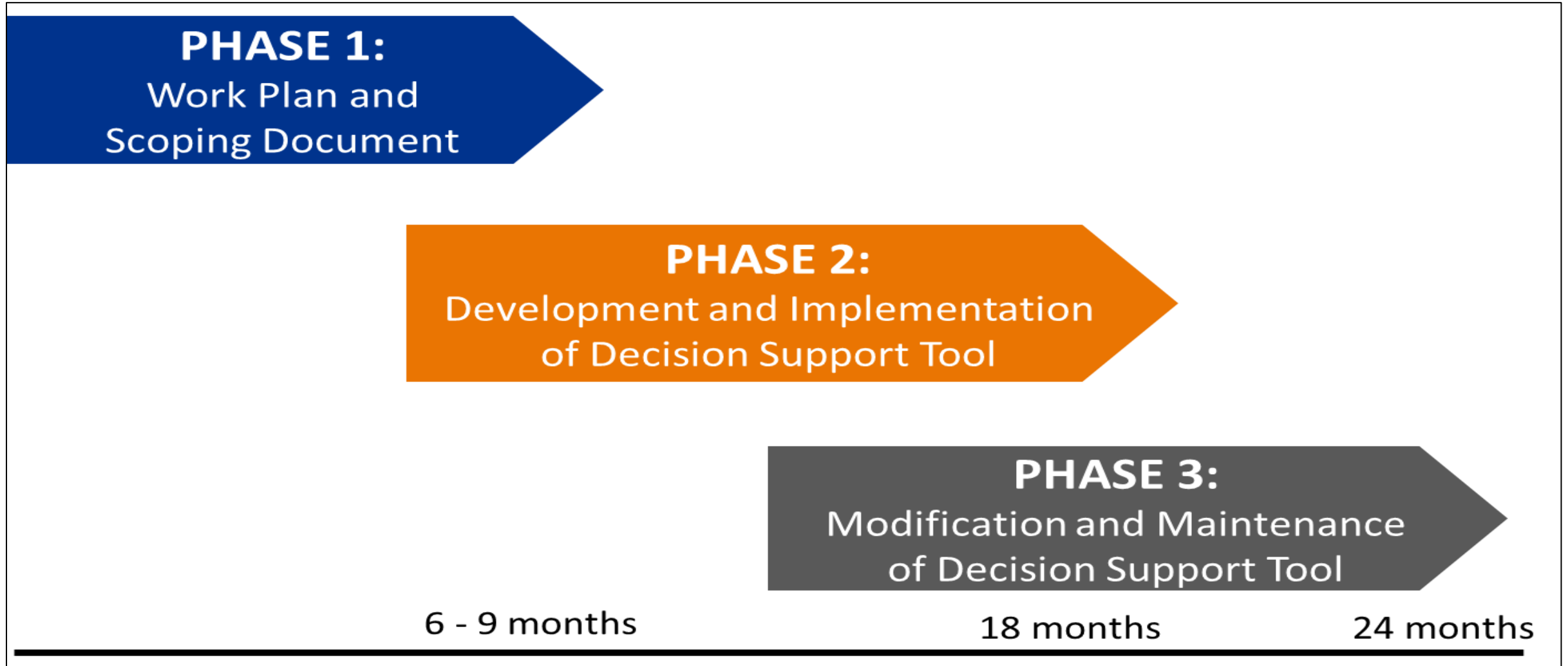
- **Watershed Resilience Program**
  - Integrate multiple concepts that focus on healthy headwaters, hydrologic and sediment management, and land and vegetation management for flood attenuation, water quality benefits during extreme hydrologic for wildfire events
- **Water Diversion Facilities Protection Program**
  - Merge multiple Wohler and Mirabel concepts that seek to protect infrastructure and access during flood and wildfire risks
- **Regional Water Supply Strategies**
  - Utilize Resiliency Study to develop integrated water supply strategies that develop seasonal, annual, or interannual storage program (gw bank, source-shifting, transmission storage, etc)
- **Regional Flood Management Strategy**
  - Initiate discussions with appropriate responsible local and regional agencies for coordinated approach to create a regional flood management strategy
- **Hydroclimate Program**
  - Integrate efforts of climate, weather, and hydrological measurement, data assimilation, prediction and modeling
- **Dynamic and Resilient SCADA**
  - Link various SCADA concepts together and identify opportunities to continue to build redundancy into master plan
- **Forecast-Informed Operations**
  - Consolidate Lake Mendocino, Lake Sonoma, and Flood Control structures FIRO efforts into a combined program
- **Integrated Sanitation Level Planning**
  - Develop holistic multi-district level planning

# Sonoma Water Resiliency Study

- Resiliency Study seeks to:
  - identify the key factors impacting regional water supply resiliency,
  - evaluate the current levels of resiliency,
  - develop a decision support framework model and process, and
  - identify promising opportunities for Sonoma Water and its retail customers to improve regional resilience in the future
- First of a kind look at the Integrated Regional System
  - Russian River & Potter Valley Project (Eel River)
  - Sonoma Water “backbone” system
  - 9 retail customer systems
  - 6 groundwater basins
  - local supplies and recycled water
  - multiple risk drivers
  - decision support model



# Resiliency Study Phase 2 Beginning .... through 2021-22



# Questions?

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